

Out of Plato's Cave

**A Dream Journey of
Science, Philosophy, and Spirit,
Featuring Crashes of Memoir,
Dashes of Song and Rhyme,
Florid Stagings of Drama,
Wise Birds, Hungry Beasts, and
A Garnish of Rebellious Footnotery**

By Dana W. Paxson

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"In the days to come, ye will, verily, behold things of which ye have never heard before."

– Bahá'u'lláh

Out of Plato's Cave:
A Fantastic Journey
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PRAYER

O God, O Thou Who hast cast Thy splendour over the luminous realities of men, shedding upon them the resplendent lights of knowledge and guidance, and hast chosen them out of all created things for this supernal grace, and hast caused them to encompass all things, to understand their inmost essence, and to disclose their mysteries, bringing them forth out of darkness into the visible world! “He verily showeth His special mercy to whomsoever He will.”¹

O Lord, help Thou Thy loved ones to acquire knowledge and the sciences and arts, and to unravel the secrets that are treasured up in the inmost reality of all created beings. Make them to hear the hidden truths that are written and embedded in the heart of all that is. Make them to be ensigns of guidance amongst all creatures, and piercing rays of the mind shedding forth their light in this, the “first life”.² Make them to be leaders unto Thee, guides unto Thy path, runners urging men on to Thy Kingdom.

Thou verily art the Powerful, the Protector, the Potent, the Defender, the Mighty, the Most Generous.³

¹ Qur'án 3:67.

² Cf. Genesis 56:62.

³ From the Writings of ‘Abdu’l-Bahá, a Tablet translated from the Arabic.

PREFACE

This book's beginnings rooted themselves in a celebration: the bicentenary of the birth in 1817 in Tehrán, Persia, of Mírzá Ḥusayn-`Alí Núrí, titled Bahá'u'lláh, and the bicentenary of the birth in 1819 in Shiráz, Persia, of Siyyid `Ali Muhammad Shirāzi, titled The Báb. These two dates, observed in the Bahá'í calendar as adjacent days, mark what Bahá'ís – followers of Bahá'u'lláh – often term the Twin Holy Festivals or Twin Holy Birthdays, resonating with the celebration in every religion of the birth into this world of its unique Manifestation from God: Mawlid for Muslims, Christmas for Christians, Vesak for Buddhists, Janmashtami for Hindus, and many more.

The Báb is the Founder and Author of the Babí Faith and the Forerunner of Bahá'u'lláh. Bahá'u'lláh is the Founder and Author of the Bahá'í Faith. The present book concentrates on just one single principle among the many teachings poured forth in the copious Writings of Bahá'u'lláh and the Báb: the consistency of science and religion.

The first stage of the book was a brief essay on science and religion that got longer and deeper with every rewrite. In studying the theme, it became clear to me that in these past two hundred years we have witnessed the explosion of human knowledge as science has awakened us to realities we had never before known.

The result was a lengthy and rather academic discourse in book form. The work passed through many different realms of science and cognition, but finding readers willing to toil through the whole thing, footnotes and all, seemed unlikely.

Rewrite after rewrite followed. The motivating bicentenary observances came and went. I removed much material, but immediately added new material. By now the book had grown to great size, over 170,000 words. The removed portions became standalone pieces on their own. In a series of rewrites, I changed the whole presentation into a lively story narrative including many characters and memoir-like passages flashing views of the protagonist's personal life. The whole work is now an entertainment, a dream-narrative.

Through nested dreams and nightmares, the main thread is the journey of Will, the main character himself, accompanied and carried by the mysterious Jeddin and other stranger beings. In stages come the unraveling of meanings from the avatars of science and spirit Will encounters. Throughout, birds bringing wisdom to Will as he flies, falls, and wanders from one meeting to the next. Bits of verse and song bloom here and there along the way. Sometimes characters pop up with entertainments of their own.

Sources, patterns, and inspirations for this work range through Lewis Carroll's Alice, Attar's Conference of the Birds, William Langland's Piers Plowman, Guy Murchie's Seven Mysteries of Life, George Gamow's Mr. Tompkins, The Thousand and One Nights, Thomas Pynchon's Gravity's Rainbow, and innumerable scientific and religious sources. The Bibliography is long.

INTRODUCTION

So I must tell you a story. An entertainment, a survey, an exploration, a tease, a garden, a dance, a drama, a dream. Come with me. Free of the views of others, we'll explore some intimate workings of the reality that cradles us all.

Specifics of science and mathematics bloom here. They are speculative, sometimes wildly so, and often wrong. But getting things wrong is essential and unavoidable. Everything ever written fades into the past, and the science I wandered into in my enchanted vagabond's journey has since outstripped itself many times.

Notes throughout the telling of the story lead the inquisitive reader to a rich banquet of sources. On occasion, a note rebels and escapes into the text.

We fall and rise through life, over and over. We call this process 'learning'. We also envision life, anticipating, reflecting, acting – and we could easily feel that our envisioning can be called 'dreaming'. We also leap from scene to scene, theme to theme, mood to mood, style to style and we treat these abrupt transitions as flashes or snaps.

Here we do all three at once. Each stage of this book is marked by rises and falls, by dream after dream, by snap after snap. These markings run independently, like the features of a passing interior landscape.

Eleven dream-phases pass, in which many falls and rises happen, and snapshot flashes pop.

In DREAMS OF HELL AND RESCUE, we meet Will as he falls into the worlds of dream to meet his traveling companions Jeddin and Miriam. Moments of childhood memory rise in him. Jeddin ushers Will on a first kaleidoscopic flight across the world's great spans of vision and thought, and they dive, falling to a narrow Bridge leading out of all darkness. A troupe of performers joins them, and birds fly near to sing wisdom. The succession of flights and falls continues, dumping Will into a landfill where he meets Matt, faces despair, and gains rescue by the traveling troupe.

In DREAMS OF WILD MATHEMATICS, the troupe regales Will with songs leading into physics and mathematics. He tumbles through a nightmare aircraft disintegration into lessons from Maori and Finnish children on mathematical ideas and methods until he is slammed back into the troupe's wagon, where the singers unroll the key themes of the story: fractals, infinities, and incompleteness. He falls through the floorboards to Matt's unpleasant dump. A great flying creature picks him up, Jeddin returns, and they explore infinities. Another fall, and Matt welcomes Will to Hell.

In DREAMS OF LANGUAGE, Miriam enters Will's thoughts, hiding from Matt. They explore language and meaning. Matt detects Miriam's presence, dragging Will away and into the realm of demons, mocking the madneses of human language. The sweet melodies of the birds return, lifting Will out to meet Jeddin. They contemplate the perspectives of science and religion. Jeddin reveals his own virtual world and disappears. Will meets the maidens

of meaning and language, and then falls once more to the Bridge. He meets Hypatia, who shows him the sheer poetry of mathematics and language, and then a maiden returns to fill him with the wonder of the journey to meaning he is caught in. Another fall flashes him to a terrible scene of death.

In DREAMS OF INFINITE COMEDY, the maiden leaves, bringing Will into a dream scene at a hotel desk. He watches a story unfold as Alanna checks in at the Hilbert Hotel with its infinite number of rooms. The hotel staff take Alanna on a tour of very large numbers and the troubles of thinking about infinities, while Will, watching her from the Bridge, confronts wolves. Alanna and Will emerge onto a boulevard; they talk about the ways humans grasp infinities. She departs, and Will enters the Café de Philosophes on the boulevard, where Katrina serves him coffee and thoughts on human resistance to new understanding, and to reality itself. Winds rise into a storm, the café dissolves, and Will falls again.

In DREAMING, Jeddin finds Will. They revisit the journey so far, and then take wing again.

In DREAMS OF FRAGMENTATION, Will's senses, opened by what he has learned, buckle and weaken under the influx of reality, and Miriam takes him from Jeddin's side. She shows him how humanity makes better and better models of reality to ease reality's overload on us and help us anticipate events. They consider the unique and incomparable changes brought into reality from the Creator's greater world. Will, falling again, flashes to scenes of his first learnings about race in America.

In DREAMS OF INFINITY, Will falls into liquid literature, to meet an octopus showing him his own forgotten work – and the hope it holds. A sparrow brings him Miriam, who draws him up into flight. In the sky they discuss the value of models and games, and come down to meet Jane, a world-modeler and gamer. Remembering incompleteness, Will shows Jane that rule-changing is essential to better gaming and modeling of reality. He and Miriam fly again, marveling at the inaccessible depths of holy reality unfolding its evidences around them. They dance, and then Will falls into memory again.

In DREAMS AT THE EDGE, three figures from the troupe introduce to Will three minds working on the fringes of science and mathematics. He glimpses a limitless future, with religion inviting science to advance, and is hurled into a terrible fall that smashes him to pieces scattered in rubble. Matt appears, to mock him, but Will now sees into Matt's pain and despair, and offers him hope. They part, with Will sliding away to meet Jeddin and explore further the songs of the birds, especially those of the Nightingale. Now a black swan, taking them on wing, shows them the power of improbability; a seductive figure lays bare the visions of fractal scaling; and a frigatebird the twining of biology, metaphor, and meaning. The swan compresses time to carry them into and out of the heart of a supernova of comprehension. Will and Jeddin arrive in a field, find a road, and a guide leads them through a visionary city of the future. The dream fades.

In DREAMS OF TIME'S REACHES, the Nightingale awakens Will from a poem to sing to him of the tests of discernment. Will falls through memory to meet the Phoenix, who shows him

the vast scale of time now open before humanity, a cycle embracing many bestowals of knowledge into the physical world from beyond it. The Phoenix bears Will again into the supernova, as time shifts from ages to milliseconds, and the stellar explosion renders out the alphabet of nature's 92 elements in an instant, leading to billions of years of new evolution. Astride the Phoenix, Will meets a feminine presence who unfolds for him the alphabets of chemistry, genetics, astronomy, and human comprehension – and then disappears. The Phoenix offers Will the vision of the great timekeepings of the solar system, and how the renewals of religion now reach far into the future. A shrug, and Will is tumbled into falling again, first through memory, then through the Nightingale's melodies of praise.

In DREAM OF THE THERMO CASINO, Will lands on the grubby carpet of a gambling house to meet Max the proprietor. Will wants to leave, but Max explains the unbreakable laws of thermodynamics to him. Aided by the angelic maiden from his Phoenix ride, Will finds a loophole in the incompleteness of the casino with respect to the greater reality beyond it. Max, finding a little romantic partner, decides to escape his casino. Will is left in a cooling calm that heightens his awareness.

In AWAKENING UNENDING, Will listens to the strengthening birdsongs of the Nightingale as sensations of the Bridge gather around him. More birds circle him, singing of the challenging harmonies of the universe. Now memories open into the dream, and Will arrives in the vast spectrum of human variation, meeting Kupaa and Kuja, who reveal the meaning of a great puzzle of Will's childhood. They move Will into the vast library of loss, where the gifts of innumerable obliterated peoples finally ended. The two tell Will of the future in which such losses will no longer take place. Finding himself on the Bridge again with chaos and destruction building behind him, Will encounters Jeddin, and they are healed. Will takes wing above his Bridge, sees Matt not far from him in flight, and recognizes him for the first time. They fly toward the blazing light ahead, and others from Will's dream and life gather alongside them, soaring above the bridges as the Nightingale enchants them with glorious wisdom and delight.

OUT OF PLATO'S CAVE

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I. DREAMS OF HELL AND RESCUE

*The lover grips the mirror, staring in,
The mirror grips the lover falling through –
Caught within, the lover asks the mirror,
“If I am image now, then what are you?”*

Will sprawls belly-up on the wooden floor of a small office. His encrusted eyes won't open. His breath comes in ragged shudders, hampered by torn wisps of a thin plastic bag. He hears a series of rattling beats.

His hands pull away the bag, and he rubs his eyes open. Outside the office window, a sparrow hovers, batting at the glass, as it tries to find a nesting-place. Trying for a claw hold, the sparrow sidles on wing along the window. Will blinks and shakes his head, blinded, confused, amazed by the brilliance flooding into his awakened eyes.

With a flash of wings, the sparrow slips through the glass to perch on the office desk. Peering down at Will, it speaks.

“Flight! Do you want to come with me, Will? I'll sing everything to you.”

Will sits up with a grunt of pain, muttering. “I'm still here. But now I've got a talking bird.” He picks up shreds of the plastic, bunching them in one fist. “I guess that didn't work.”

“No,” the bird says. Its voice is light, childlike in pitch. “You're not done here.”

“I wanted to be.”

“Why?” The sparrow's voice sharpens. “So much love has carried you. You reject it all?”

“You're only a sparrow. And sparrows aren't singers.” Will stands with effort, seeing out into a sunny day, breezes shifting the heavy branches of a big tulip tree just outside. The office is in a home, a ranch house with a deep roof overhang. An empty computer screen sits black on the desk.

“Many birds will sing sweetly on our travels. And you've had a lot more time than your father did, haven't you?”

A jolt of memory grips Will.

It is 1954, on a hot July day. His father has a best high-school friend who takes big risks. He bought a failing company and turned it into the biggest hobby electronics company in the country. He and his wife love Will's family – they couldn't have children of their own, and they have taken Will and his sisters under their wings – in more ways than one.

Will's father and his friend are about to leave the local airport to fly to the Caribbean. His friend is buying a brand-new business plane, a twin-engine DeHavilland Dove. It has eleven passenger seats. Two pilots will help evaluate the aircraft before he buys it. Will's dad shows him through its luxurious passenger cabin. Will is eleven. He is impressed.

From the previous trip, art works, carvings, and calypso recordings from Haiti, Jamaica, and the Virgin Islands are all over Will's home. One of the carvings is a decorative serving tray with the mysterious-seeming word "Lechatibont" inscribed in it.

Will watches as the plane takes off and zooms overhead, its twin engines roaring. From somewhere in him, feelings overflow, and Will says words that will haunt him forever:

"Goodbye, Dad. Goodbye."

The bird in the office chitters, and Will shoves aside the slap of the memory. "I wanted to know everything I can. Knowing helped me. It made me feel safe. Now it doesn't." A thought surges up in Will. *I fell from a bridge...*

The little bird looks up sideways at him. "What do you care about? What do you want – some explanation, some grand "Theory of Everything"? Would that feel better? Ha!" The laugh is a loud chirp.

"Look, you're just a bird. What do you know about anything?"

"Yes, I'm just a bird, but you're talking with me. What do you think?" Its claws tipping off the edge of a stack of papers on the desk, the sparrow preens.

Will's words come slowly. "I loved drawing diagrams. Playing chess. Doing geometry. Learning science. Ham radio. Programming computers. That worked for a long time. Now I can't make sense of any of it. I can't even make sense of myself. And now, you."

"Come with me." The sparrow spreads its wings, turning its head aside, and it leaps off the desk, growing to stand as a tall, too-pale man, great wings furled behind him.

Will staggers back, grabbing for a chair. "What are you?"

"You'll see."

"Where are we going?"

"I'll show you what I can. We are taking a long flight across the great worlds." The winged man laughs. "There will be birds. Many birds."

"How do I... oh." A strong prickling grips Will's body, He is as light as air itself. Wings brush gently against the edge of the desk behind him. He looks down at himself. His weight of years has vanished. *I'm thin! This is the body I had when...* "Is this some dream? Am I dead?"

"What do you think? Does it matter?" The transformed man-bird's smile broadens into a grin, lit by his great dark eyes in a ghost-pale face violet-tinged, tight black coils of hair drawn back in a steel clasp, his garment a seeming feathery suit, his wings mighty behind his shoulders.

"Wait a minute." Will tests his wings, his chest muscles bulging outward, and the wings knock a cup full of pens off the desk. The man-bird laughs again.

Will asks, "Do you have a name?"

"Pick a name. Wait, no. Here's a clue for you."

In Will's mind a soft, gentle, male voice speaks. Its speaker seems familiar.

'... he shrugged the waters of the pool into wings and feathers like theirs, and they all bounded upward into black sky singing. His voice rose into an orchestra, storming above their tones, his words carrion-birds roiling in a whirlwind,

*"Illusion heaven, dream vapor,
Forget yourselves, surrender,
Hell forgetting, prison hope,
Beauty slaves, freedom chains..."*⁴

Will mutters, "What is this? I don't remember anything like this. No names, either."

His speech almost singsong, the man-bird says, "Just call me Jeddin. I'll call you Will. Will Plowman, maybe. Or Will Pilgrim." Jeddin laughs music.

"Jeddin? How... do I know you?"

Jeddin smiles. He reaches back with long fingers to preen a feather. "Fly! Throw away life and death, and start where you are now. You fell from a bridge, you wanted help, and here I am." His long brows a-tilt, he offers Will a hand.

"I fell from a bridge?" Will stares out the window. Clouds roll and darken, and the big spatulate leaves of the tulip tree spin and snap back in gusts. The seasons reel and scramble in him, time falls away. All his frustration, confusion, pain, and resistance crumble into dust. He speaks, and his words leak St. Elmo's faint electric fire. "All right. Show me."

Jeddin grips Will's hand. They spread wings and surge upward through ceiling and roof into a winter-ridden sky glowing with the low-hanging sun, wheeling on cold winds.

"Down there!" Jeddin cries out. Will's view zooms in. A man far below, in a rough shed swept with winter snow, taps out pulses of electricity on a fragile telegraph wire strung across great plains tormented by sheets of blowing snow.

"High up!" Jeddin points up far with a flash of wing. Will blinks, his vision leaping through space. A robot explorer crawls across Titan the moon of Saturn, tasting its banquet of novelty, chattering out its tales of discovery.

"Now in deep!" Jeddin calls out, banking and circling with Will into a tighter and tighter microscopic vortex. Tangles of electrons throb in a skein of altered DNA in a sleeping woman's fetus, folding a protein vital for the sake of life.

⁴ from the author's novel *Descending Road*, Chapter 33, scene titled "Van Illustrations by Daumier"

Jeddin draws Will to flash outward. Their flickering flight straightens and steadies. "All this is new to humankind. Two centuries ago, none of it was known."

Will shudders. "I'm seeing past, present, and future all at once. Everywhere at once! How is this happening to me?"

"Reality! You are barely immersed in it! This is just a taste! This 'now' – what you and I sail through, into atoms and out to stars – is a moving instant in time, a blade's edge of space."

They soar in dark sky, in thin bitter air, far over the highest twilight clouds. Faint stars tease Will's night vision. "How?"

Jeddin taps Will's wingtip with his own. "You've already written this yourself, so why do you wonder at it? You called this 'innerspace'."

"I don't remember!" *Innerspace*. Will hears the word inwardly from the same soft, male voice, familiar but still beyond his reach.

"Inside you, time is knotted. Remembering means tracing the knots back and forth, jumping from one trace to another. In this moment, you're young! We're traveling in time! You haven't yet found the knot in time when you adopted the word 'innerspace'."

Will follows Jeddin as they dive deep to level their flight through faint cold mists. *Innerspace? A greater world inside me?*

Jeddin laughs. "Isaac Newton wrote, *'I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.'*"⁵

Jeddin pauses, gliding level. "The mystic says that the ocean is contained in the pebble." A small brown bird swoops near them, singing gloriously past. Words bloom from its song.

*"How resplendent the luminaries of knowledge that shine in an atom, and how vast the oceans of wisdom that surge within a drop!"*⁶

The bird's music flares up in Will, unlike anything he has ever heard or felt, a melody of such power and meaning that time itself stops in full flight. He gasps.

Wings glistening sapphire and emerald, they dive. Will follows Jeddin down over a shining river snaking among jagged mountains. Now an oriole spins near and vanishes, its notes ringing old and familiar language.

⁵ Sir David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton* (1855) (Volume II. Ch. 27).

⁶ From Bahá'u'lláh, *The Kitáb-i-Íqán*

“Where were you when I laid the earth's foundation? Tell me, if you understand. Who marked off its dimensions? Surely you know! Who stretched a measuring line across it?”⁷

Will's mind seizes on the words in the melody, swerving off into filigreed details. “But there are no straight lines here for a measuring line! Land is all wrinkled and folded and twisted. A straight line across these mountains and rivers can't tell us how far we would have to walk. At least we can fly straight up here.”

Jeddin smiles. He peels away. “Yes! But now you humans learn how to measure and explore these impossible tangles.” They land beside a mountain stream. Salmon swarm past, some poking their heads to the surface to stare at them. A few seem to shape words with their mouths.

“But numbers and computation don't work in the tangles,” Will says.

“Reality won't listen to our objections. Watch out!” He jostles Will and they leap upward, a bear's claws swiping away a few gold feathers from Will's left wing. They climb to hover as the bear bends back to its pursuit of salmon.

“Good thing we have more dimensions of movement than the bears have,” Will gasps.

Jeddin laughs. “That bear seemed to have quite a reach.” He flips a vector sign with his fingers,⁸ wiggles his thumb, waves it away, laughs, and cocks his head. “You love details, yes? Did you know that you can treat dimensions fractionally?”

“What?” These ideas penetrate Will like charms or spells.

“Not now. I'm teasing. We have many rivers of meaning to explore. Come!” Jeddin races upward and away, despite a fierce and mounting headwind. Will chases him.

*The hawk soars, clutching the seeker in her claws,
Talons gripping his head.
Talons stabbing his heart;
In agony he cries, “Why?” and the hawk laughs,
“Why not? I am only your sleepless imagination.”*

Jeddin and Will streak far over mountains, valleys, plains, lakes, and forests, the faint scrawls of roads wandering, stitching here and there. Deep pits and dark mounds of refuse and filth scar and infect tormented lands sliding below. Fetid vapors, smokes and flames rise where gases and trees burn. Lakes, rivers, seas, ponds cry clashing colors of stench and poison.

Will sees everything at once. Dark factory buildings spew sludges and stinks, livestock cram into their digestive slaughters to become packaged meals, workers crowd in to mix

⁷ Job 38:5

⁸ The gesture with index finger and thumb at right angles, with the other fingers curled, showing the orientation of 3D coordinate axes (right-hand rule).

livestock virus into humanity's grotesque panoply of ills, filths bubbling abundant, blighted, fecund into groundwaters and streams.

His wings weaken, he shudders in despair. "What can ever clean all this, or heal it?"

Jeddin says, "Your human past still clutches you. Greed devours you, war defecates you, disease lives on you, famine follows you, death celebrates it all." He glances back at Will and slants away and down, his pinions flashing in the high sun. "Come!"

They land on a broad, scorched heap of wreckage: parts of a crashed plane, a straggle of harnessed wiring dumped away from some dead factory, a broken pale-blue wall-panel of a collapsed motor home. A rusted steel crucifix peers in pain from a tangle of chicory, beside a faded and torn photo of soldiers grinning out of muddy slurry. Will shakes his head.

Jeddin pokes a foot at half-withered weeds. "Religion. Science. Look at all this."

"What does religion or science have to do with any of this?" Will says.

Jeddin says, "You humans want peace and wisdom, but you make war and madness. You choose very badly."

Will says, "We're stuck." He lowers his head, closes his eyes. "I'm stuck."

Jeddin bends to sniff a blue chicory blossom. "You called me here. Are you asking for help?"

"I called you here? No, I was just..." Will stops before he tells out his despair. *I was just thinking of how to end it all.*

Jeddin turns to Will, takes both his arms, and holds his gaze. Jeddin's eyes are wide and steady. "Trust me. I heard you call. I heard the way you hunger for faith and reason. You want both, But what would you throw away? What would you keep?"

The words surge out of Will. "I'd get rid of the trappings. The rituals, dogmas, costumes, contentions, and rankings. We can't see ourselves as equal human beings." A beetle crawls across the photo. Will's right wing itches briefly, and a glistening feather falls away.

"Suppose you did? You live in a vast reality, always learning more of it. Don't you all need that?" Jeddin gestures at the wreckage. "What truths have you buried under the garbage? Are all of you so afraid of truth? Listen!"

A melody of Nightingale birdsong rises around them, utterly sweet, liquid, pure as light:

*"Fire and paradise both bow down and prostrate themselves before God. That which is worthy of His Essence is to worship Him for His sake, without fear of fire, or hope of paradise."*⁹

⁹ The Báb, *Selections from the Writings of the Báb*, from Excerpts from the Persian Bayán, VII, 19.

Will staggers back as the brief song winds through him. "How... what makes such meaning come from a bird singing? The Nightingale again? What is happening? These notes write language and meaning in me! Beyond words! I don't understand!"

Jeddin smiles. "Get used to it. These songs don't fit in ordinary language, even though the words appear in you. The words are the surface, the music is the first layer of many. You explore the layers and forms and movements of the meanings. An endless journey!"

"But they're words, with meanings. Why not accept them as we see them? Is 'paradise' what you mean when you say 'truth'? We stand in the fire already – that seems clear enough."

"It's only a beginning. It might help to turn your thinking inside out, and make yourself the moving bird circling around the constant truth of inner meaning."

"So when I hear the birds singing, I can fly around their truths and advance my understanding?"

"Especially since now you yourself can fly." Jeddin spreads his wings again and rises on tiptoe. "Ready for our next flight?"

"No! Not yet! Do we have to leave so many questions unanswered?"

Jeddin laughs, and his sheath of feathers flickers light. "Can you face the prospect of not worshipping some God of your own conceiving? How about embracing what is absolutely-unknown to anyone?"

Will reaches out and his hand clasps Jeddin's. A shudder runs through him. "This dream, this hallucination, makes no sense to me. It's unreal! All these words, these images, these flights, belong in my real life, not in this ... whatever it is. Why are we here? These words are playing with me, getting dressed up and putting on a show."

Jeddin laughs again, raising their hands together. Their wings unfurl great gusts of air. "That's called 'meaning'! Come on!"

Chained in the Cave

They fly wingtip to wingtip. Soft mist moving in fitful drafts, falls, rises, fades, thickens as they penetrate it. Another great bird rises just ahead on broad dark wings gleaming red and green, violet and blue, notes of song swirling from it into letters and words in some fleeting harmony. Will tilts toward this glorious creature, but Jeddin whispers "No! It's not time yet. We are about to escape from the cave."

"Cave? What cave? We are flying free!"

"No, we are not. This is innerspace."

"So what is outside it?"

Our surroundings soften and fade. The great bird evaporates, its song leaving bare scraps of light shimmering behind. Jeddin smiles.

Will's eyes widen. "Are we in some fantasy, movie plot, some mystical trip? Is this all it is?"

"If that's true," Jeddin asks, "why do you humans hunt for truth in your stern and complex physics of the universe?¹⁰ The vastness and mystery of the world just deepens (and darkens¹¹) as you explore it further. Why do you do this? And why do you dream? Look!" Jeddin disappears.

Will's wings and the sky have dissolved away. His arms and legs are chained to the floor, as the wall before him dances with shadow life.

One shadow forms Jeddin. He steps out of the wall, his wings intact and radiant. "Your physical world has hidden dimensions. More importantly, you have hidden human potential, even if history tells you otherwise." His eyes light up. "Put these two insights together, and an infinite future blooms."

Will shakes his chains. "How are you free and I'm not? I'm dreaming! How can I find and read reality? Why can't I wake up?"

"Reading reality is dangerous," Jeddin says. His fingers touch the chain at Will's wrist. "To read your reality with greater consciousness awakens you even more. So then you can read deeper."

Will's mind sinks its teeth into the details. "All right. I'll dream outside this cave dream. Are there extra dimensions? Do they hold unknown intelligences awaiting us? Maybe an alien civilization sends us instructions for spacefaring?¹² Would this connect science with some greater reality?" He shakes his chains.

"Look at what you humans do with ideas like that," Jeddin says. "You build these huge arrays of antennas to listen to... what? Alien radio commentators? Interstellar disk jockeys? Do you know what those antennas remind me of? Your cargo cults of the Pacific, building runways for the gods." He giggles.

"What?"

"A cargo cult. It's a human belief system about contact with an advanced civilization. It produces signs created to attract benefit from that civilization. Aren't you humans just out looking for goodies?"

"No! The antennas are scientific! They're not just some mock-up. They work!"

¹⁰ Lisa Randall, *Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions* (Harper Perennial, 2006) – The idea of additional dimensions "rolled up" at tiny scales is currently under study as a means of explaining the weakness of gravitation as compared to the other fundamental fields identified in nature.

¹¹ Brian Greene, *The Fabric of the Cosmos: Space, Time, and the Texture of Reality* (Vintage Books, 2005), p. 294, "A Prediction of Darkness" – outlines the process by which astrophysicists revealed the preponderance of so-called "dark matter" and "dark energy" in our universe.

¹² Carl Sagan, *Contact* (Pocket Books 1997)

Jeddin nods, with a slight smile. "But to the cargo cultists, their runways and planes weren't mock-ups – they were signaling devices to summon goods and technologies from the gods. And for the cultists, they actually worked! Planes showed up with goodies!"

Will recalls an image from the film "Contact": the gigantic, triply-rotating device through which the heroine is dropped to commune with alien worlds. "Your view of humanity's science is not very flattering."

Jeddin laughs. "So you think advanced alien science would fall within the range of your scientific comprehension today? You think that they'd communicate in linear or graphic language using a modulated radio signal or light beam? What haven't you learned yet?"

Will tries to stand, but his bonds clank, making him stagger. "I don't know."

"That's only part of the story, too," Jeddin says. His hands dissolve the manacles at Will's wrists.

"Hey! Why didn't you do that when you showed up?"

Jeddin ignores the question. "Doesn't your greater reality embrace other aspects of human experience, like dreams¹³, visions, meditative states, prayer, and even some kinds of hallucination?"

"Like this dream I'm in? But there's no science to that. It's personal, it's subjective."

"So what? You expand the sensitivity and penetration of your scientific toolset, all the time." Jeddin gestures, and the remaining bonds fade into mist. Will stands up, rubbing the marks left by the chains. Jeddin goes on, "You push the boundaries of science outward. The surprises reality unfolds for you are unending, staggering, and unpredictable."

¹³ J. W. Dunne, *An Experiment with Time (Studies in Consciousness)* (Hampton Roads 2001) – This work explores the use of dreams in precognition.

He takes Will by both shoulders, locking eyes. "It doesn't matter how you name or classify it all. It's all about getting your knowledge and wisdom from some non-human source."

Will's right wrist oozes blood from a sharp edge of its chain. He smears it away. "Well? What is that source? Nature? An alien intelligence? God? A hidden state of one's consciousness?"

Jeddin shakes his head. "Given the limits of your human awareness, it can't fit some easy category. It is clearly not from another human being. It's information coming from some superior source via some conduit to all of you."

Dancing, manycolored lights catch Will's eye, casting his shadows on the wall. The scent of roses touches him, faint birdsong whisper and he mutters to himself, "We read our reality. Who or what wrote it?"

"It's time to fly again," says Jeddin. "Hang on!" He grabs Will's head between his hands and squeezes.

Will's eyes fill with light, light, light, in so many tones and tints and shades and overpowering reaches of wave-coded signal that he staggers, blinded by the inrush, Jeddin's hands now steadying him.

"Now you see with eyes that span the electromagnetic spectrum. The heat of very-long-wave radio signals. The bitter gleams of gamma rays. More than 50 octaves on the instruments of the cosmos."

"I can't! It's too much!" Will's knees buckle and sag.

Jeddin catches him up. "Here – let's dial it way down in volume. Your everyday vision falls within just one octave of this range. Now look around!"

The walls of the cave melt away, and reality sings light to Will from everywhere.

"To the cosmic rays, the gamma rays, the radio waves, your cave is nothing but vapor," Jeddin says. "Humans have grown new senses now. And this isn't everything, either. Listen!" He massages Will's ears.

An orchestra of vibrations floods into Will: the deep speech of elephants and whales from the ground and sea, the tremors of the earth itself as its crust and mantle tumble and grind, the pierce of insect and bat ultrasonics, thin tickles and sprays of neutrinos, the phonon songs of crystal and metal vibration, the explosive dances of stellar nurseries, and even the shivers of spacetime itself in the collapse and merge of a pair of black holes.

Will staggers again and leans on Jeddin. "I'm lost in it all."

"Oh, it goes much farther. You can see in your minds with eyes that encompass all the kinds of spaces and times you can *imagine* – far, far beyond the shadow projections on the walls

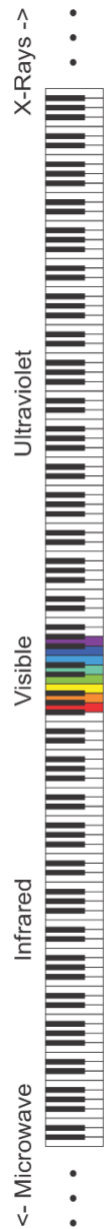


Figure 1 - EM piano

of that Plato's Cave.¹⁴ And far beyond just the things you can sense physically. Now we fly again."

"No! Please, no more! Let me stop and think!"

"Easy now! This will feel better!"

They drift free, up and out into a sky rich with stars and suns, intensely dynamic, explosive, growing, alive. Shadows recede and resolve. Desire surges in Will, a hunger for this greater reality, this universal truth, unknown, wild.

They race together, up and out and into overwhelming beauty, plunging toward unexplored terrain, dissolving into a mighty flow of possibility and harmony. Will's head spins.¹⁵

Jeddin says, "What you see of science here applies just as well in the 'now' of religion. He whistles a few quick notes far up in the vast spectrum, and a thrush wheels toward them.

The thrush, open-throated, scribes the air above, and as with the Nightingale earlier, words and meanings bloom out of the rapid outpouring of notes, the singing of a fast-fleeting feather-quill pen composing and improvising language all at once. Without words, it's an efflorescence of perfections:

"The one discerns and articulates the values unfolding progressively through Divine revelation; the other is the instrumentality through which the human mind explores and is able to exert its influence ever more precisely over the phenomenal world. The one defines goals that serve the evolutionary process; the other assists in their attainment. Together, they constitute the dual knowledge system impelling the advance of civilization."¹⁶

Will stares. "The one? The other? What does this mean?"

Jeddin nods, saying, "The 'one' here is the essence of religion. The 'other' refers to science."

"How do you know this?"

Jeddin smiles. "Your answers are coming as you fly and fall and fly again."

Escaping Plato

Will's senses reel at the onrushing meanings. The thrush spirals away and up. "Now," says Jeddin, "See where you have been." A great city appears below, sprawling out across a green hillscape, its buildings ranging from low concentrations and clusters veined by alleyways to tall, many-storied edifices, spired and shining, gathered tightly to rise in the potent light.

¹⁴ See Yuri I. Manin, *Isolated Systems*, in Manin, *Mathematics as Metaphor*, p. 116. (Manin 2007)

¹⁵ See David Bohm, from *On Creativity*, published as an essay in the journal "Leonardo", Vol. 1, No. 2, Apr. 1968, from p. 138, (Bohm 1968)..

¹⁶ The Universal House of Justice, from *One Common Faith* (2005), at <http://www.bahai.org/library/other-literature/official-statements-commentaries/one-common-faith/>

"Here's the long home of human thought. For thousands of years these structures have grown in their places. Some have fallen away, some have been overbuilt, many have burned or disintegrated, but the rest have been your only home. You are the creatures of your making and your immersions in the world. It's a world resting on a chthonic, deep-subconscious pattern of your ways of thinking and remembering, a set of organizing principles rivering back through all the long reach of time. What do you see?"

Will's eyes scan as they glide without effort. Streets, façades, roofs, signs, in brick, adobe, glass, stone, steel, wood, paint, and much more fill his vision, teeming with life at every scale. It all seems disordered, chaotic, but it's all ways and buildings, floors, walls, and roofs. "Yes. This is what my thinking seems to be like. Are we living in a metaphor here?"

Jeddin laughs. They land in a busy streetside market. "If you really want to see," he says, "Take off your spectacles."

"What do you mean?" Two men in short jackets and skullcaps argue over a tray filled with glittering stones, the sunlight spraying color over passing shoppers in thin shirts and pants, reds and greens, purples and golds, threads of bright blue all weaving senses with musical language and gesture, fleeting aromas of strange herbs, tones of song and string and reed, speech of many cadences and accents.

"You wear spectacles grafted on your eyes at birth by your world's strengths and limitations. Your task now is to see what they show you – and what they keep from your vision."

"I don't understand." Market vendors are calling, conversing, buying, selling, making change. No one notices their wings, and here and there Will sees others moving through the crowd.

"You draw knowledge through two enduring, fundamental ideas: classification and hierarchy. It all happens deep inside you. It's like the air you breathe." Jeddin turns away to make faces at some many-toned children, capers a dance around them, all of them laughing.

Will stares, fascinated, at a table where a little fierce-faced figurine walks, its eyes malachites. It turns and lurches a few steps, pauses, turns again.. It follows a square path. A figurine? A toy? He glances at other things nearby – clusters of cheap jewelry and a rack of bright scarves. The noise of the marketplace is chaotic, but this small, animated thing entrances him.

The vendor sidles up to him. "Hey there. Like my little robot? His name is Frankie. I can give you a special deal."

"Robot? It's just a figurine, isn't it? A toy?"

The vendor mutters in Will's ear, "It might be. But it's more than that. It's special. Watch this. FRANKIE!"

The little figure halts in mid-step and says, "Yes, effendi?"

"Play a game of chess with our guest here."

The figurine unfolds a little metal chessboard from its midriff, places all the pieces with speed and precision, and tilts its head back to look expectantly at Will. It grates, "You have the first move." Its malachite eyes roll a little.

Will loves chess, and he loses the game with embarrassing speed. The vendor names a price far beyond Will's ability to pay.

Jeddin rejoins him "Having fun? I see that chess is not your game of choice." He smirks just a little.

"What is that thing? Toy? Figurine? Robot? Chess automaton? What else does it do?"

Jeddin laughs, his dark eyes gleaming. "Distinguish! Classify! Make pigeonholes! Create taxonomies: domain, kingdom, phylum, class, order, family, genus, species. You do it with languages too. Whole cities and states of meaning. But what if little Frankie there were alive? Maybe he speaks many languages?"

Gabble surrounds them, speech from many places. Will says, "Alive? No! Yes! I don't know. Wait. You said 'languages'. What's the big deal? We define separate languages, and measure their similarities and differences. We trace their relationships. But is it really that simple?"

Jeddin shakes his head. "No, it isn't! Your world is bewildering, diverse and richly entangled. Entangled! So you cope by defining boundaries and sorting things accordingly. You filter your interactions. You build large social constructs and fire up their dynamics: military commands, corporate hierarchies, church structures and titles, and governmental bureaucracies. And market stalls." He ticks three fingers as he says, "You are born into, imprinted with, and carefully taught the process of all this patterning."

"So?"

"Your patterns imprison you! Your instilled patterning is deeply grooved into your brains' neurons and connections. This happens via multiple feedback loops in your genetics, your epigenetics, your behaviors, and your symbolic operations of speech and writing."

"This is a lot of words. Explain it all to me."

"Patience! You're not ready for all the details yet."

"So? It's all natural, isn't it? Patterns, you said. Then you rattled off this list of features..."

"These features tune your brain wiring. So you detect and perform classification, dichotomy, and similar Aristotelian practices of cognition, and hierarchy. Unconsciously! So

you can't simply read a book, say, and alter your wired-in comprehension of it through your will power alone."¹⁷

"Why not? Could we give natural selective advantage to new ways of reading our reality and responding to that reading? Can't we change the patterns we use?"

"Yes, but only with great effort. Some of you already live in other patterns, but your traditional Western ways of thinking have dulled your awareness of them. Here!" Jeddin sketches in the air, and a quivering graphic appears before them. "What do you see?"

"It's a tree, I think, branches, trunk, and roots. And... some dots – for bark, maybe?"

"Anything else?"

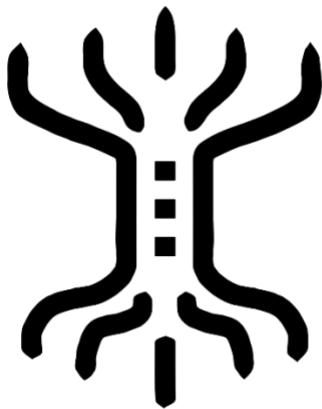


Figure 2- A tree pattern

Will's thoughts come out in words, slowly. "If experiences are mostly discrete and stepwise, they'll make strongly-bounded patterns in the Aristotelian way. You're saying that's what we are wired for. But what if they're mostly continuous and flow from one to another?" Will pauses. *Maybe... ah.* "Where do the roots and branches connect to other trees, or the sky, or the earth? And what if I see it as a river flowing upward through a narrow outlet between boulders squeezing it from either side? Oh – now I see two clasps, one on top, one underneath..."

Jeddin smiles. "Very good! A river, a clasp but not what it is clasping. Any other ideas?"

"Is this a letter? An icon? A symbol?"

"Why not all of these things at once?"

"That would be nonsense! Like a pile of junk!" A pain strikes through Will's left forearm. A darkening gouge appears there. He shakes his arm – it's tingling, and strokes his fingers over the wound.

It is 1951. Will's great benefactor, his father's best friend, is both rich and childless. Today Will is opening for the first time his benefactor's mighty gift: the latest edition of the Encyclopedia Britannica. Here before him in fine print on its expansive pages lies the vastness of human knowledge of every kind. Will's hungry eyes, greedy for exploration of everything, roam and devour: mathematics, astronomy, manufacturing, language, geography, medicine, culture, art, religion, history, politics, biography, and much more.

¹⁷ See the book *Evolution in Four Dimensions* (Jablonka and Lamb 2014) for a potent, detailed, and well-researched explanation of this topic – a topic far too sweeping, impactful, and dynamic to be explored here.

Will cannot read the future in the encyclopedia. He cannot know that he will keep it in his possession for almost forty years, and that it will come to an ignominious end in a mold-filled basement, made virtually useless by his own frenzied leap into the astonishing flood of the Information Age.

He cannot know that the future will soon expose the encyclopedia's failures of perspective, the unchallenged classism, nationalism, and racism of its sources and authors. When he will reach eighteen years of age, truth will shake him awake.

He looks up, startled, as a young woman passes close by him. She pauses to look straight in his eyes, and her hand is over his fingers. She looks down at the gouge-mark, taps his hand gently, and both the gouge and the pain from it vanish. Will is caught in her gaze. Her eyes are crystal-black pools of the bazaar's many lights, flashing and glowing. Her little smile graces him.

Her face is a rich, dark gold, her hair woven back in rows and dotted with red, silver, and copper beading. She says softly, "My name is Miriam. We'll meet further along." And she is gone in the crowd.

Will turns to Jeddin, who is looking off over the passing crowd. Jeddin shakes his head, drops of light flying away like sweat, oblivious to the encounter. "A pile of junk?" He chuckles. "It's junk only if you see with eyes that force a category on the thing you see. After all, a letter by itself is one thing, but for greater meaning, you connect it with other letters to make syllables, words, and more."

"But it's still a letter by itself. A separate thing. And words are separate things too. Phrases, sentences, verses – all separated things..."

"Only when you don't assign them meanings. When you connect them, graft them, compose them together, you instill meaning in them. It's the connections, the bonds, the flow of coalescence that brings life to the marks and sounds we make."¹⁸

A fond memory surfaces for Will like a trout in the stream. Sneaking spools of thread out of his mother's sewing-box, he proceeds to turn his bedroom into a three-dimensional web of multicolored threads back and forth, up and down, in and out, wall to wall. *Graphs and connections.*

Jeddin goes on. "You love hierarchies. Lists and trees. The branching structures that make orderly sequences and rankings. The smallest branch to the single trunk. The lowliest brick to the mighty building. The logic of your long-established mathematics and sciences. Your human societies rank their members in the same way, from the child to the chieftain, from the janitor to the chief executive."

"So?"

¹⁸ See the Excursions essay **The Divine Grammar of Algebra** for a challenging exploration.

"This scheme is powerful and simple. It has served civilized humanity well for thousands of years. But it's no longer enough. Complexity overwhelms your world now. Your old ways have become sadly inadequate by themselves for this flowing, emergent realm – you're living in a newly-organic tier of reality."

"An 'organic tier of reality'? What does that mean?"

"Before, you studied biological systems analytically, anatomically, feature by feature, system by system. But look at how your DNA has bits of viruses and prions in it. They're not part of you, but they are! DNA has all kinds of segments still being unraveled, with multifarious effects on your lives not yet understood. It turns out that one segment of codons has many unanticipated applications."

"I don't know anything about that. Are you going to explain?"

"No. Not yet. You're not ready. Oh, and by the way, is a virus a living thing?" Jeddin grabs Will's wounded arm. He lifts and pulls them both up to face the tree pattern he sketched.

"I don't really know. I thought so."

First Fall

"It's time to dive away from these questions," Jeddin says, grabbing Will and leaping with him into an opening hidden under a market awning. They are falling in dark emptiness. Below them the tree pattern reappears, remote. They plunge toward it as it twists to horizontal, stretching to become a long, narrow bridge rising ahead of them over a bottomless abyss of shadow.

Will's mind spins in darkness. It is 1948. Will reads eagerly through aircraft recognition magazines his father hoards from his Navy days.



Figure 3 - Tree to Bridge

Flight amazes Will. Instead of dodging about in two dimensions on foot and in tanks and ships, pilots use the layered expanse of three dimensions to move and fight. A wild freedom of snap rolls, chandelles, Immelman turns, barrel rolls, pitchbacks, and much more grabs Will's imagination. In the magazines, death is a thing on paper: a picture of a detonation, a few words of who lost and who won. Death is unimportant.

Will and his sister explore the woods and fields near their house. Behind a hedgerow they discover a mysterious tangle of fabric and wood and metal. When Will tells his father about it, he looks it over, and says, "This looks like the wreckage of an old glider. I wonder what it's doing here."

Will wonders how something that flew in the sky ended up in that pile of junk in a field.

Time blinks. Jeddin and Will alight at the middle of the bridge, with no rail or handhold on either side, nothing above but black sky.

Teetering on the Bridge

Will stumbles, giddiness pulling at him. "What is this?" The stony surface under his bird-clawed feet, shiny in patches here and there, glows in a tracery too fine to see clearly.

A high sweet voice calls from far ahead. "Come!" The bridge span ahead tightens to a very narrow width. Will's wings are now gone. Jeddin, behind him, whispers, "Careful!" Will freezes, his claws scratching and slipping across the hard surface.

A moment, and the Nightingale appears ahead, hovering, to sing:

"Take thou good heed that ye may all, under the leadership of Him Who is the Source of Divine Guidance, be enabled to direct thy steps aright upon the Bridge, which is sharper than the sword and finer than a hair..."¹⁹

"Come!" the voice ahead calls.

Will can't move. *How can I keep my footing? Why am I here? What is this bridge about? Who is she, the one who calls to me?* He turns to ask Jeddin, but no one is there. He stares ahead into the far-off light, trying to find the caller. The birdsong lingers.

"Sharper than a sword and finer than a hair..." Not encouraging.

Vague and distant rumblings come from behind and below.

"Come on!" the high voice, feminine, more urgent now, says again. A moment ago Will's feet were claws, gripping the edges of this slick footing over darkness. Now he's fully human again, no wings, no claws, bare toes on an unsure edge, teetering slightly in some shifting touches of breeze, alone. Below him, the darkness roils, a flash or a rumble rising here and there, the smell of hot metal rising around him.

Frozen on the thin bridge, he looks back along its downward slope through smoke and steam. On the edge of the gulf at the bridge's foot, two monstrous beasts wrestle and roar. One a grind of shine and steel, edge and point and armor, the other a smear of slime and tendon, bone and filth and web, they grapple, stabbing, spitting, biting, slashing, hammering, vomiting their toxic innards at each other.

They stop. Their limbs and bodies shudder, merge, and unfold into a single living tower of violence. Fanged mouths open wide with blasts that shake Will's footing far out here, and the beasts uncoil many-tentacled limbs to destroy and ruin everything around them.

I can't go back. Will turns toward light again. Now from behind him faint cries, screams, moans, calls for help, thread themselves through brief moments in the monstrous noise, in

¹⁹ The Báb, *Selections from the Writings of the Báb*, Excerpts from the Persian Bayán, VII, 2. This is the bridge of the Sirát, also known in Islam as the Straight Path, passing above the fires of Hell to take the faithful to Paradise.

voices of children, women and men, young and old, high and low, multitudes. Words, phrasings, snatches of meaning, here and there a tatter of sound of one voice Will finds almost familiar. Roars mount to overwhelm everything.

Devastation. Will's eyes overload him, visions pouring in, screens and windows and suns of energy. Forests burn, seas fill with filth. Cities rot. Farms and fields fade to dust. Debris sinks in mountains of sewage. Swarms of refugees, locusts of displacement and upheaval, all blanket desolate lands in hunger.

Will staggers back. *I can't stay. If I stay, I will die here.*

He swerves from the thunder and clamor. The bridge ahead, thinning now to the breadth of his foot, shines and dances with reflected light from faraway pale mist, figures moving deep in its clouds. He takes one short, slow step. Debris and projectiles from the advancing battles behind him whip past. He freezes again.

The high voice is gone, lost in the din from behind. *This bridge can't be real, and neither can Jeddin be real.* But is this a dream or not? *No wonder I can't move.*

Trying to generate courage, Will whispers a few words of a prayer.

It is 1946, and Will's mother is putting him to bed, teaching him to say

*Now I lay me down to sleep,
I pray the Lord my soul to keep.
If I should die before I wake,
I pray the Lord my soul to take.*

What does it mean? he asks himself. It seems to him that there is some good, safe place to be, but not here.

Hearing the Melody of Infinity

A tiny speck of dust gleams at Will's toe as he inches forward on the bridge. He nudges the speck to the edge of the span. In a heartbeat it balloons to fill the space around him, a dimly-lit room with a small square cabinet facing him. On top of the cabinet a chessboard stands, set for a new game. The white pieces are on his side of the board. The chaos of the bridge is gone.

Will recalls the little figurine from the market. "Frankie?" Nothing happens. The board waits. Will reaches out and advances the king's pawn two squares.

A mechanical arm unfolds on the far side of the board to advance the queen's bishop's pawn two squares: the Sicilian Defense. Will plays, and loses the game, fast. Again.

Will studies the cabinet. A small button on one side invites pressing, and a panel opens to a mass of gears, levers, shafts, and ratchets. Further exploration is blocked in the tangle of machinery. Will starts to close the panel, and an eye peers out at him and winks. "Miss me?" A familiar voice.

"Jeddin?"

Two more panels flip open, and Jeddin unfolds himself from the far side of the cabinet, wings and all.

"You play chess?"²⁰

Jeddin chuckles and unfurls his wings once again in this sudden bubble-room around them.

"You know about Deep Blue, the IBM chessplaying software and hardware system, the one that beat all human players? Does anyone know how it arrives at any given move it makes in a game? Can it explain to you what it decides to do?"

"No – at least not yet. Wait. Am I still on that bridge?"

Jeddin ignores the question. "It all looked like magic until I popped out, didn't it?"

"Yes!"

"And now it's all explained, right?"

"Well..."

"Welcome to the homunculus problem!"

"What's that?"

"A homunculus is a little entity hidden inside a system doing the unexplained, unpredictable things, the way I was doing them with you. When the system is the human mind, you even say in colloquial terms, 'the devil made me do it.' You make it sound as if the devil is in all of you."

"That would explain all the chaos I saw."

"But it doesn't explain anything. That's why the use of a hidden system is forbidden in quantum physics, because it pushes the essential questions of physics to another layer that is not understood. Doing this is called the 'homunculus problem'. In any case, it's like a cop-out."

Jeddin waves a wing. The cabinet disappears, the room disappears, and they are on the bridge span again, balancing, the dark abyss below on either side, the chaos behind Will, the light ahead. "You can't just bury your understanding by putting it off all the time. Sooner or later, you're back on this bridge."

"Okay. How do we move ahead here?"

²⁰ For a time in the 18th century a chessplaying machine called "the Mechanical Turk" toured the world, amazing onlookers and opponents with its ability to play a very strong game of chess. Lo and behold, it was finally revealed to be not a mechanical Turk but a live (and very-smart) chessplaying midget carefully concealed inside a boxed-in tangle of clockwork gears and shafts: a human homunculus.

"What do you see behind you?"

"War and destruction."

"And ahead of you?"

"Peace and light."

"And where are you right now?"

"Balancing and praying I don't fall off. This bridge keeps getting thinner and thinner."

"So to go forward, you need to balance better and better."

"That would be good. Hey, why do you have wings right now, and I don't?"

"Sometimes you're the bird, and sometimes you're not. It's all up to you." And with that, Jeddin disappears completely.

Behind Will, a shoulder-high wolf, its jaws bloodied, sets foot on the bridge. From one side of its jaw a long strand of skin dangles. The wolf's eyes reflect gold light coming back from ahead of Will. Its stare fixes on him. Again cries come through the beast-din from behind it, among them that naggingly-familiar voice, its tone pleading.

It's all up to you. Jeddin's words reverberate. *What else is here? What am I missing?* Will slides one foot ahead, balancing – there is no room for both feet side by side. The wolf, some distance back, slips a foot off the bridge, loses balance and tumbles away into darkness. A fading howl, and then nothing. Another wolf steps onto the bridge. Behind that one a pack waits, coming hungry one by one from the seething chaos. Their voices grate at him.

If this bridge is reality, isn't there a bigger world containing it? The bird at the window... Will fumbled for the memory.

Everything changes. Life is dynamics. Will ducks, wobbling, almost falling off, as a volley of arrows, bullets, and spears flies past him out of the darkness behind. His cracks of insight and memory claw at the dark flows enveloping him.

A tiny golden Warbler flutters across Will's vision, perches on his left shoulder, and begins an enchantment of song. Will's eyes close, time falls away, and the notes weave past, present, and future in melody that resolves into surprising, elegant lyrics:

*"Know then, with regard to the mathematical sciences, that it was only in this distinguished age, this great century, that their scope was widened, their unresolved difficulties solved, their rules systematized, and their diversity realized."*²¹

²¹ 'Abdu'l-Bahá, *Tablet of the Universe (Lawh-i-Aflákiyyih)*, in *Makátib-i 'Abdu'l-Bahá*, Volume 1, pages 13-32 1997.

Will hesitates at a singing phrase. *'This great century'? A clue to the pattern I'm looking for, maybe?* The Warbler sings on:

*"The discoveries made by earlier philosophers and the views they held were not established upon a firm basis or a sound foundation for they wished to confine the worlds of God within the smallest compass and narrowest limit and were quite unable to conceive what lay beyond; even claiming that there was neither void nor matter, but merely nothingness. This view is at variance with and contrary to all the divine truths and heavenly secrets."*²²

Will's eyes are still closed. He moves his toes forward slightly, timidly, to grip the edge of the bridge floor. The Warbler spreads its wings and bursts into a melodic theme of breathtaking beauty. He freezes in place to hear it:

"Indeed, if thou dost compare the ideal world to the human world and apply spiritual principles to physical matters thou wilt discover that this view is flimsier than a spider's web, because, just as the luminous spiritual worlds are sanctified above computation or limitation, so too are the physical worlds in this vast immensity of space."

The wolves hesitate, silent now. Will doesn't breathe. The Warbler's trills bloom even more meaning.

*"This is a secret of which God hath apprised His servants through His grace and mercy in order to demonstrate the idleness of the fancies of those who disbelieve in God, and to expose the baselessness of the arguments of those who are wandering blindly in their heedlessness, that the edifice they have built out of their vain imaginings may crumble and their profitless pursuits be discredited and fall into disrepute."*²³

Will breathes again. He says softly, "Warbler, beautiful singer, please, sing to me, how do I go forward?"

His eyes open again. The blaze of illumination ahead of him now sings in a bouquet of harmonies. The Warbler rises to soar off and into that light, its liquid notes trailing out behind it in a dance of meaning fading from Will's mind, softening and muffling the now-recurring animal chaos.

The scream of a small child, piercing between crashes and howls, tosses Will into 1944. Two muscular Navy orderlies pin him down, hard, as a doctor approaches with instruments.

He shakes time away, again free on the bridge, impulsively staggering toward the darkness, away from the light, but tears himself away in fear, turning around. He moves toward the light. A glass surface stops him. Beyond it is a small tiled room – a bathroom? A young

²² Ibid.

²³ Ibid.

woman steps in front of him. Terrified, he looks wildly back at darkness and forward at her, and pushes and fumbles against the glass, trying to push on and through it into the bathroom. "Help!" he calls out to her. She recoils, racing out and slamming the door. The room and the pane – the window or mirror – disappear, and Will lurches, fighting to regain his footing on the bridge toward the light ahead.

"Miss me?" Jeddin's voice from behind startles him, and Will loses his balance. Jeddin's hand grips Will's shoulder; he laughs. "Good! No bullet holes or arrow wounds. Let's fly again!" And to Will's great relief, his own wings sprout and lift him alongside Jeddin, far up off the bridge, to soar through the fading of chaos and cries.

Will draws a deep breath. "Free at last! Thank you!"

Jeddin says, "You're not free at all. You humans generate and perpetuate this nightmare. You think you know! Now you twiddle the human genome to suit yourselves and your whims. You swap a single codon in your DNA for another, and the resulting being may sink, soar, or lie inert in the realms of human possibility."²⁴ He draws up to Will, hovering. "Can you really do science in violation of human integrity, sovereignty, and station?" He gestures below to the turmoil's noise.

"But..."

"You created atomic weapons without hesitation, once you knew how to do it. Then you used them on each other. Don't you understand the human consequences?"

"Well..."

"These choices break natural and divine law! They attack the stability, well-being, and advancement of humanity and your world. Your science and your religion can be utterly intimate, can serve your great human organism, can feed and nurture your continued and unending development, maturation, and wisdom as a human family. Right now, in this critical flow of time, they are often at war with your very existence."

Will objects. "But I'm not part of that! We're not all making war."

"Yes, you are. You can't seem to respect useful distinctions and connections. You use religion to make war. You use war to enforce religion. You reduce science to weaponization. You reduce religion to meaningless babble."

Jeddin looks, waits, as images come slowly to Will, who says, "Maybe our distinctions can't draw nice neat simple lines? Could they have a tangled character to them?"

Jeddin cocks an eyebrow. "Explain that."

²⁴ Take a look at *A Crack in Creation*, a book by Jennifer A. Doudna and Samuel H. Sternberg, for a sense of the dangerous power of DNA editing.

Will's thoughts come, fractal, knotted, intertwining, themselves tangled. "Our boundaries between ideas and things keep convoluting themselves. They're **alive**: changing, moving, developing, morphing. We can't freeze boundaries in place. When we try, maybe we're damaging and destroying what we need most."

"So?"

"We need to embrace the living processes of an always-changing world. After all, we now have countermeasures coming against global disease much faster than we thought possible."

Jeddin smiles. "Not bad!" he exclaims. "You seem to get the idea, or the pattern of ideas you need. Now get to work again! Back you go!"

And Will is on the bridge again alone, chaos advancing. The darkness is cold. A chill wind gusts across his path, interrupted by toxic blasts of smoke and heat stabbing from behind him.

The Warbler returns, hovering just in front of him, singing in melodies now more familiar:

"There is no contradiction between true religion and science. When a religion is opposed to science it becomes mere superstition: that which is contrary to knowledge is ignorance.

"How can a man believe to be a fact that which science has proved to be impossible? If he believes in spite of his reason, it is rather ignorant superstition than faith. The true principles of all religions are in conformity with the teachings of science."²⁵

The chaos urges Will to take two tiny steps further over the darkness below. He resists the urge to listen and look back.

"Hello again!"

"Would you STOP doing that!!" Will shouts, and Jeddin, laughing, catches him as he teeters and flails on the bridge.

Will glares at him. "What about those 'violations of God's laws of physics' that are in fact perfectly obedient to laws of physics of which we are as yet ignorant? They look like acts of gods, miracles, tricks of tricksters like you."

²⁵ 'Abdu'l-Bahá, *Paris Talks*, 44 – this particular presentation, delivered by 'Abdu'l-Bahá on November 12, 1911 in Paris, is the fourth in a series setting forth the principles of the Bahá'í Faith to Western audiences. He words this principle strongly in his address, concluding: "Put all your beliefs into harmony with science; there can be no opposition, for truth is one. When religion, shorn of its superstitions, traditions, and unintelligent dogmas, shows its conformity with science, then will there be a great unifying, cleansing force in the world which will sweep before it all wars, disagreements, discords and struggles—and then will mankind be united in the power of the Love of God."

Jeddin nods. "But then you learn better science and the world changes for you. If you keep assimilating from infinite knowledge, you transcend any fixed set of definitions of science and religion.²⁶"

"Infinite??"

"Yes! What would your science accomplish if only it didn't stop its advance when warfare seizes it? Science isn't finite! You will always learn more!" Jeddin pauses and continues, "This time appears unique in your human history. For the first time, you're crossing the threshold of infinite expansion of knowledge.²⁷ An explosion!"

"Why now? Wait. Infinite?"

"True science triggers it. You've finally adopted uncompromising critical examination and upgrading of your understandings. But there are surprises ahead of you."

"So - now what? Another ride off into fantasy? Or the infinite?" Will doesn't want to hear the cries.

Jeddin grins. "You're getting it. Now hang on!"

The Gypsy Wagon and the Cosmos

A blink of displacement, and Jeddin and Will stand on an enclosed stage with varnished wooden floorboards, a sky-painted ceiling, curtains of dark, well-worn velvet, and a deep-blue backdrop studded with tinsel stars. Two women and two men, dressed in pinstripe, rehearse a song a capella. They stop and turn to stare.

"Who are you?" Will asks them.

The soprano laughs and looks Will over. "You first, feather-man."

"I'm just a traveler. He's my... guide."

"Wings, huh? Not a bad look on you. But this guy's your guide? Oh, man, you are in for a ride with that kind of guide! You have a name?"

"Will. Wait! I know you! You were at the bazaar! Miriam!"

The singers all laugh. The soprano says, "Yes, I'm Miriam! She's Marian, he's Webster, and the bass over there is Webber. We are Define Singers."

Will glares at Jeddin. "Are they serious?"

Jeddin shrugs, and sings to them, "Define Singers! Tell us! What is information?"

²⁶ This is where Arthur C. Clarke's often-quoted statement relating technology and magic hits home.

²⁷ See David Deutsch, *The Beginning of Infinity: Explanations that Transform the World*, Penguin Books, 2012. Deutsch asserts that our time is unique in human history, in that we have for the first time reached the stage of infinite expansion of knowledge.

They line up, and in order, soprano, alto, tenor, and bass, give four stanzas of bebop vocalese²⁸, while a piano-bass-and-drum rhythm section pulses behind them:

[MIRIAM (trumpet part – imagine Dizzy Gillespie or Wynton Marsalis)]: “Information! Knowledge obtained from investigation, study, or instruction!”

[MARIAN (alto sax part – imagine Charlie Parker or Cannonball Adderley)]: “Information! The attribute inherent in and communicated by one of two or more alternative arrangements or sequences of something (as nucleotides in DNA or binary digits in a computer program) **that produce specific effects!**”

[WEBSTER (tenor sax part – imagine Sonny Rollins or Archie Shepp)]: “Information! Something, maybe a message, experimental data, or a picture, **justifies change in a construct (as a plan or theory) that represents physical or mental experience or another construct!**”

[WEBBER (trombone part – imagine Trombone Shorty or J. J. Johnson)]: “Information! A quantitative measure of the content of information; specifically: a numerical quantity that **measures the uncertainty in the outcome of an experiment to be performed!**”

[TOGETHER]: “Informatioooooonnnnn!”²⁹

[Spattery, crisp, cute drum finish]

Will turns to Jeddin. “What was that all about?”

He grins. “Did you know everything they sang?”

“No, well, I knew some of it. But why get this now?”

“So what they sang affected you, right? It changed what you know, yes?”

“Yes, and I’d never heard it delivered in vocalese, either. It changes the way I think about music! So why now?”

Jeddin’s smile fades. “To do science, you need information to change the way you understand the physical world. To do religion, you need information to change the way you live. So now we investigate it.” He turns to the singers. “Do Chaos now!”

[MIRIAM, MARIAN, WEBSTER, WEBBER all at once, in a clashing, changing variety of keys]: “investigation Confusion study, obtained, or instruction! Chaos! The attribute Chaos! inherent in and communicated by message, one of two or theory from alternative arrangements or sequences of messiness (as nucleotides in DNA or binary digits in a computer program) that produce no discernible effects! Messiness (as a Chaos! message,

²⁸ Vocalese is an art form that crafts lyrics to complex, improvised, instrumental melody lines to produce songs of all kinds. The group of Dave Lambert, Jon Hendricks, and Annie Ross popularized the form in the 1960s.

²⁹ The Merriam-Webster website provides dictionary and thesaurus for English terms and meanings. Here is the entry for ‘information’, quoted in part above: <https://www.merriam-webster.com/dictionary/information>

experimental data, or a picture) which muddles a construct (as a plan or) that from reverberates our physical or mental experience or another construct! Chaos! Gerbil a measure the content of Chaos; specifically: a foozelum quantity that mismeasures the uncertainty in the fifth of an argue to be performed!"

"Stop!" Will shouts. The drummer batters out the sounds of an auto wreck and the singers howl. Will's heart skips and lurches. He covers his ears – it all echoes the ruckus from the darkness on the bridge.

"Like it? It's from one of our first platinum successes!" Miriam says.

Jeddin is applauding. "I remember that one!"

"It was a long time ago," Webster puts in. "You don't look that old."

Jeddin laughs. "You have no idea." He turns to Will. "Well?"

"That was just noise! It made no sense at all! And no information either! I just wanted it to stop!"

"At least you changed enough to yell 'Stop!' didn't you? That was the passage of information to you."

"Yeah, well, not very much. There was a lot more in the first song."

"You've got the idea. Information affects the world. A set of signals of any kind, in order to be considered information, produces some specific effect in your perceivable world, some change in a representation of experience or ideas, or some anticipation of possible outcomes of changes in the world."

"So what's a set of signals if it does none of these things?"

"You call it noise, just random variations in perception and action. You don't find noise very interesting. Mostly you just find it annoying. But you often overlook information embedded in the noise, and then you learn."

Will recalls the cries, the sobs, the screams... and shuts them out. "I didn't learn much from that Chaos song except that it gives me a headache."

"Did you listen carefully?"

"Ha! You're joking!"

"No, I'm not. That song has a lot of fragments from the first song embedded and mixed into it. Suppose you had never heard the first song, but you were trying to find useful information in the second one. Did you find any?"

Will closes his eyes, and in motley keys a sequence of words surfaces: "alternative arrangements or sequences of messiness (as nucleotides in DNA or binary digits in a computer program) that produce no discernible effects..." and he blurts them out.

Jeddin chuckles. "Very good! Information often arrives in your senses from sources you do not and perhaps cannot comprehend. The 'noises' from these sources often hide information. And you can find it! Information hidden in noise can be detected by measuring it, in various terms of effect, representation, or anticipation. Information theory shows you how to distinguish information from noise, how to determine its content, and how to quantify that content. That is a big deal, but it takes care. Sometimes noise is just noise."

But the child was screaming through the chaos ...

The curtains swish back, a wall before Will falls outward with a slam to extend the floor they all stand on, an awning flies up and out, and the stage looks out over a wide, flat field of wildflowers. Will steps forward. The stage is on a wagon: a gaily-painted, gold-and-silver-trimmed, huge-wheeled Romani vardo show wagon stretched long. Finely-detailed carvings braid its sides and arches, its side canopy lies open, and its stage is still visible. Two unicorns nicker and stamp impatiently in their harnesses, and on each one Will catches a hint of great ethereal wings, folded but with spans apparently as wide as those of a giant jet, gently quivering.

The four singers busily help several others load stage props, scrims, and sound gear into the wagon's underpinnings.

A wagon drawn by flying unicorns. Will closes his eyes and tries to keep his thread of thinking free of this... 'noise'. *So let's see.* He mutters to himself, tallying the points on his fingers.

We learn to extract specific information from noise.

We transform the 'babble' of another language into our understanding, reading, and speaking of it.

We transform the 'chaos' of a modern work of art into patterns that evoke other works and ideas.

We transform the sizzle of a radio reception to extract a signal buried in deep static.

But... unicorns??

He turns to Jeddin. "Is information the same as meaning?"

"Well... look at the first of the four dictionary definitions, the one Miriam sang. That's the most familiar to most of you: '*Knowledge obtained from investigation, study, or instruction*'. 'Knowledge' implies that there is meaning in what is being defined."

The singers are sipping from water bottles, and the drummer hands a flask to the piano player. The bass player yawns and shells some peanuts. Jeddin smiles at her, and says to Will. "But 'information', in any of the remaining three definitions, is not the same as 'meaning'. In those three definitions, information is related to some kind of metric, some measure by which it may be quantified. In the last definition, information is a measure itself: a measure of the degree of uncertainty in a message or pattern."

Will gets an idea. "But suppose this! If the only signal I can receive is a single flash of light, a single bit of information, there is no uncertainty about I receive." *A single sob...* "On the other hand, if I receive any of 100 different flashes, the expectation for receiving any one of them can be quite uncertain. If I choose a letter randomly from 100 letters in an English textbook, it can be any letter, with commonly-used letters more likely than rarely-used letters, and no certainty that the selection will be any of the letters."

Jeddin looks closely into Will's eyes. "Yes – you sound like me! You're digging into the details. And nowhere in this transmission process have you mentioned 'meaning'. When formal definitions of information gained acceptance³⁰, they distinguished between the range of possibilities of what can be said and the actual semantic content, or meaning, of any one or any combination of those possibilities. As information theory developed, the important distinction between information and meaning came into focus.³¹"

A question comes to Will. "But what if no such message has ever been received before? What if it arrives in a form or language with which we have no familiarity? We're always getting messages that humanity has never before encountered. That means we have no idea what all the possible messages could be."

Jeddin grins. "Are we back at the cargo-cult discussion again?"

"No! Nature sends messages. In science, there's no end to the possible set of messages containing information. We're stuck working with our already-collected information, incomplete as it is, to develop some meaning from the new messages we receive. Meanwhile they're changing the information we already hold – and any meanings we can find from it."

Jeddin nods. "Life's a bear, isn't it?"

[SINGERS (leaping to stage positions, with the piano player vaulting into her seat at the keyboard)]:

*"Bang! You know that life's a bear!
Every twitch! Every care!
Life's a constant bait and switch!
All you bear has got some hitch!"*

*"Go check out that CMB,
Then you'll see, just like me,
In that noise there had to be
Some sweet cosmic melody!"*

³⁰ James Gleick, *The Information*, Chapter 7 "Information Theory" – this chapter gives both a good history of the beginnings of information theory and a good explanation of what constitutes information.

³¹ Information theory demonstrates that two messages may contain the same information but convey entirely-different meanings. See Warren Weaver, in "The Mathematical Theory of Communication", 2.2, p. 8.

*“Spend some time, tune your focus,
Step by step, no hocus-pocus,
Out of noise you find some locus,
Making seeds of thought to poke us...”*

The singers hum and the piano rattles out a complex refrain. Will smirks at Jeddin. “CMB? Come on – what are they singing about?”

“The CMB is the cosmic background radiation – the leftover heat from the initial rapid expansion of your physical universe. The ‘Big Bang’, you called it. Two engineers found radio ‘noise’ that came from everywhere, even from outside the Milky Way, from every direction.³² It looked just like noise, until physics predicted it.³³ The galaxies in your universe are receding from one another, flying apart.”

Will summons a memory. “That’s the red-shift of their light coming to us, yeah, I know – it tells us how fast they are moving away. Astronomers catalogued as many of these shifts as they could. The galaxies in our universe are receding from one another, and the farther from us they appear to be, the faster they are moving away.”

Jeddin nods. “Your cosmologists realized that this scaling of speeds shows us the generally-uniform expansion of spacetime itself. The universe – all of spacetime – is getting bigger. So from the chaos of noise those engineers found, you had verified the so-called “Big Bang” of your universe’s birth.”³⁴

He smiles. “Your writers always find ways to connect science with poetry. One described that chaos of the cosmos noise in the words of John Milton – a ‘dismal universal hiss’.
MIRIAM!”

Monsters Emerge

Miriam steps forward as the other singers provide rasping sound-effect accompaniments.

[MIRIAM (recites, melody still filling her words)]: “Here, Satan concludes a speech filled with braggadocio and pride.”

*“So having said, a while he stood, expecting
Their universal shout and high applause
To fill his eare, when contrary he hears
On all sides, from innumerable tongues
A **dismal universal hiss**, the sound
Of public scorn; he wonderd, but not long
Had leasure, wondring at himself now more;
His Visage drawn he felt to sharp and spare,*

³² Penzias, A.A.; R. W. Wilson (July 1965). "A Measurement Of Excess Antenna Temperature At 4080 Mc/s". *Astrophysical Journal Letters*. 142: 419–421. Bibcode:1965ApJ...142..419P

³³ See for example Alpher, R. A. & R. Herman (2001). *Genesis of the Big Bang* (1st ed.). Oxford University Press.

³⁴ Numerous popular works spell out the current understandings of the beginnings and evolution of our universe.

*His Armes clung to his Ribs, his Leggs entwining
Each other, till supplanted down he fell
A monstrous Serpent on his Belly prone,
Reluctant, but in vaine: a greater power
Now rul'd him, punisht in the shape he sin'd,
According to his doom: he would have spoke,
But hiss for hiss returnd with forked tongue
To forked tongue, for now were all transform'd
Alike, to Serpents all as accessories
To his bold Riot: dreadful was the din
Of hissing through the Hall, thick swarming now
With complicated monsters head and taile... ”³⁵*

[MARIAN, WEBSTER, WEBBER all hissing and gesturing]

Miriam snaps her long fingers and they go silent. “All in one sentence, that.” She winks.

“Clerics, priests, mullas, rabbis like to tell these stories,” Jeddin says. “But they’re hardly astrophysics! Milton shows you their lurid portrayals of a hellish afterlife. You’re hypnotically drawn to these depictions as if they were realities.”

Will shudders. “You’re right – we make them into very-real nightmares of history.”

Jeddin again: “One great task of science is to transform a world, in Milton’s words, ‘*thick swarming now with complicated monsters head and taile*’ into a world clarified and illuminated by the ongoing advancement of knowledge.” He sweeps his arm across the backdrop behind them. The singers step away into shadows on either side of a great smooth curtain of pale blankness, the tinsel stars now gone. “There’s the way the CMB looked at the start. Just like noise. But your astrophysicists found ways to penetrate that seemingly-featureless radiation. They found patterns in it.”³⁶ He reaches out, combing with his fingers in the air, and spots began to speckle the blank curtain.

“But there’s always the human problem: you.” Jeddin pokes Will in the chest. “One of the scientists working on the project said that we want to find unusual things – it’s built into our psychology.” He waves his hand, and a small zone thrusts outward, enlarging details. “See there? Stephen Hawking’s initials!”

Will squints at another spot. “Over there – that looks like a parrot.”

“Your New Scientist online magazine even set up a contest it called ‘What’s Hidden in the Cosmic Microwave Background?’ where you could study the data and see what you can match up.”³⁷ He laughs. “The science on the CMB remains open for further study.”³⁸

³⁵ From https://www.dartmouth.edu/~milton/reading_room/pl/book_10/text.shtml.

³⁶ See https://en.wikipedia.org/wiki/Cosmic_microwave_background#Data_reduction_and_analysis

³⁷ See <https://www.newscientist.com/article/dn18489-whats-hidden-in-the-cosmic-microwave-background/>

³⁸ See <https://arxiv.org/pdf/1210.6008.pdf> for a brief discussion.

Will shuts his eyes as the many-speckled wall vibrates before him. *Information changes everything, ourselves included.* In that moment of thought, a face coalesces in the wall's image, tear-streaked, contorted in despair. It is so familiar to Will that for a moment he freezes, trembling, grasping for some name or connection, some meaning or reason, as the image roils and the face fades. Involuntarily he takes a step toward it.

Jeddin breaks in, drawing Will back to himself. "Your world today is radiant, effulgent, explosive with information, far beyond anything humankind has experienced through any period of your past. Its effects on you are so potent that you risk being annihilated by this... continuous electric flood."

The nightmare of the bridge erupts in Will and he bursts out, "It might destroy us all. Thermonuclear reactions! The genetic code! The Internet! The scale of our universe! Just these! With thermonuclear reactions, we can kill the earth completely, making war obsolete. With the genetic code, we can make junk out of racism, cure mysterious diseases, and create monsters. With the Internet, we can dissolve all borders and boundaries that set us apart. With the scale of the universe, we're insignificant in infinite vastness. No wonder we doodle on the cave walls. Faced with destruction, we're just doing graffiti!" *And drawing grieving faces...*

Jeddin puts a hand on his shoulder. "Once, you had religion as a true friend. It was a source of comfort, definition, stability, and development. But it's lost its visibility in the blizzards of information constantly bearing on you now. Information forces you to reexamine religion very closely."

His dark-eyed gaze touches Will with unexpected feeling. Will responds, "What good will that do us? These birds sing truth, but so much of religion shows our grotesque human weakness. Strife, manipulation, trickery, hypocrisy, pride, perversion, exclusion, greed, dogma, and more. We lose what religion is meant to grant us. If only we could strip away all these evils!"

Jeddin nods. "Then you should find religion and science as interconnected as the organs of a single being. Then you can recover the assurances you so deeply need as human beings. Maybe then you won't need to make graffiti on the walls of the cave."

"But if religion can't define, stabilize, and nurture us, and it's become the mirror of our worst, what next? We need religion renewed, recast, elevated to our needs and our potential. Otherwise we don't need it at all."

Jeddin Writes Sacrifice on His Body

Jeddin looks up. "Listen to the birds here." The Warbler returns to circle, loop, and hover, singing, at times joyful, then sorrowful, then vibrant and light:

"Religion should unite all hearts and cause wars and disputes to vanish from the face of the earth, give birth to spirituality, and bring life and light to each heart. If religion becomes a

cause of dislike, hatred and division, it were better to be without it, and to withdraw from such a religion would be a truly religious act.

The melody reaches into Will, a breath of refreshing soft air from a fragrant garden, enchanting.

“For it is clear that the purpose of a remedy is to cure; but if the remedy should only aggravate the complaint it had better be left alone. Any religion which is not a cause of love and unity is no religion. All the holy prophets were as doctors to the soul; they gave prescriptions for the healing of mankind; thus any remedy that causes disease does not come from the great and supreme Physician.”³⁹

The speckled wall is gone. When the song ends and the Warbler flies away, Will turns to Jeddin. “Why does this sound so sweet, so full of meaning? Why did it end so soon?”

“It’s not finished,” Jeddin replies. “No time for all of it right now. We have a long tour ahead.”

The singers and the crew, all now dressed in florid, dramatic show gear, leap and climb and vault to the still-open stage. Crew members, musicians all, seize instruments and begin a stately pulse of harmonic beauty.

[MIRIAM (flashing across the stage, beaded hair and bright veils trailing her)]:

*“People just can’t realize
Truth unless you dramatize!
Entertain and dance and sing,
Every tiny brand-new thing!
Make them laugh and jump and cry,
See through fogs that blind the eye.
Tiny sips – a sweet new drink,
A drop of truth, a gentle wink,
A taste of camphor at the fountain,
Make light feet dance up the mountain!”*

[WILBUR (handing his trombone to WEBBER and bouncing up to join MIRIAM)]:

*“Forget the darkness of the past,
Embrace the light of hope at last!
Maybe a dash of levity
Gives your hope longevity!
But listen now, the truth is hard,
Be careful when you turn the card,
The future’s face appears so new
That life is hard for such as you,*

³⁹ ‘Abdu’l-Bahá, *Paris Talks*, from No. 40, stating the third principle of Bahá’u’lláh’s Teachings.

*Laughter and tears the price you pay
For truly living every day."*

[CHORUS]:

*"Laugh and cry, joy and sorrow,
Faith and pain give us tomorrow!"*

Jeddin gestures to the singers, frozen in their poses at the ending. "Pack it up!" Miriam blows Will a quick kiss. And with a series of crunches, slams, grinds, and clatters, the furred-up wagon and its occupants wobble off, steadying and speeding up, until the wings of the unicorns unfurl in their full grandeur and loft it all into the faraway sky.

Will blurts out, "Faith and pain? Could you explain? Oh, sorry – I got carried away with the jingle."

Jeddin laughs. "The information that truly changes you is impossible to accept in large doses – it's just noise at first. But pick a few notes from the noise, make a tune, make a dance, sing along, and the truth creeps quietly in for your acceptance."

He frowns. "But it takes patience and care. You humans are so, so slow to accept truth. For thousands of years your faiths have brought you inner truth, and changed you, uplifted you, healed you, united you. For thousands of years your sciences have brought you the outer truth of the world, and done the same thing to your outer lives. Right now, in your time, it all comes together – and your resistance is so strong that it takes every possible approach to get your acceptance of that simple truth."

"Even unicorns? With huge wings?"

The Nightingale arcs past, trilling what has awakened in Will's heart.

"We have forbidden men to walk after the imaginations of their hearts, that they may be enabled to recognize Him Who is the sovereign Source and Object of all knowledge, and may acknowledge whatsoever He may be pleased to reveal. Witness how they have entangled themselves with their idle fancies and vain imaginations."⁴⁰

"So why am I seeing unicorns, with wings that interpenetrate each other, pulling some flying wagon of performers?"

Jeddin laughs. "In dreams, the imagination is no ordinary maker of idle fancy. Instead it is a key to deeper awareness, if one can see with the inner eye. The Manifestations of God testify to this truth." He looks up as the Nightingale drifts overhead, its notes coming as a croon.

⁴⁰ Baha'u'llah, *Gleanings from the Writings of Baha'u'llah*, p. 204

"This birdsong offers the Báb's testimony to the coming of His Revelation, as he experienced the dream of it. You will hear and understand it much later on this dream journey. Right now you are in a different layer of dream."

"Jeddin! You're bleeding!"

He looks down. A rivulet of red, tinged violet, seeps from his throat by his collarbone. "Oh, that."

"But... what happened?"

"What always happens. The world fills with pain. Then these mysterious souls come, maybe just one over and over, maybe many as ages pass, maybe both. They suffer terribly. Their suffering turns the pain to joy and hope and light. People live and die, but the light increases every time. These beings are the givers of that light."

"But... you? Here? Now?"

"Look. Really look." Inscribed on and in Jeddin's body, Will sees the suffering of all the holy ones at once, distilled out of all time.

Scars, where the blows fell. Chain gouge marks at wrists and ankles and neck. Whip welts across the shoulders, traces of bastinado torment edging the soles of the feet. Marks in the belly where the arrows had gone in, knots of tissue in the palms where the spikes had been pounded, skin ruptures where broken bones had once protruded. A deadly severing slash across the throat, sheets of regenerated skin once burned away, maybe a long, long time ago, over and over again. Toothmarks of starved beasts.

Will turns away, sickened.

Jeddin's hand touches his shoulder, turns Will to him again. He smiles. "You see?"

"I can't face this!" Will reels, reaching for Jeddin to steady himself, red-rose blood slopping onto his groping hand.

"It is not for you to bear," Jeddin says softly. "I am just illustrating for you." The Nightingale lands on his shoulder, singing.

"The Ancient Beauty hath consented to be bound with chains that mankind may be released from its bondage, and hath accepted to be made a prisoner within this most mighty Stronghold that the whole world may attain unto true liberty. He hath drained to its dregs the cup of sorrow, that all the peoples of the earth may attain unto abiding joy, and be filled with gladness.

Jeddin reaches a finger up, and the Nightingale touches its beak to his fingertip, still singing.

*"This is of the mercy of your Lord, the Compassionate, the Most Merciful. We have accepted to be abased, O believers in the Unity of God, that ye may be exalted, and have suffered manifold afflictions, that ye might prosper and flourish."*⁴¹

Jeddin spreads his hands wide, and the grievous wounds on his body vanish. "Each in His Day, from time beyond time to this moment, has taken on the most terrible suffering so that those far from Him may draw closer to Him, may hear His melodies, may fall in love with Him, may bear their own burdens in testimony, and sacrifice for Him."

His body cleared of wounds, Jeddin stands now in shimmering light. Gradually the light softens, his delicately-tinted plumage and wings reappear, and he lofts himself up and away, calling to Will, "All the birds are coming to you now!"⁴² And he vanishes, a few shed feathers in the drafts of his wingbeats left twisting and sailing down blue and violet.

Melodies Burst Out

The Nightingale, swooping and swirling around Will, begins to sing again:

"Knowledge is as wings to man's life, and a ladder for his ascent. Its acquisition is incumbent upon everyone. The knowledge of such sciences, however, should be acquired as can profit the peoples of the earth, and not those which begin with words and end with words. Great indeed is the claim of scientists and craftsmen on the peoples of the world. Unto this beareth witness the Mother Book on the day of His return."

Will's breath catches. *The Mother Book??*

*"Happy are those possessed of a hearing ear. In truth, knowledge is a veritable treasure for man, and a source of glory, of bounty, of joy, of exaltation, of cheer and gladness unto him. Thus hath the Tongue of Grandeur spoken in this Most Great Prison."*⁴³

From the cloud of birds, one brown mockingbird flies closer, its voice gravelly, near-human, intoning:

"... Now, it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking nonsense on these topics⁴⁴; and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn."

The bird's melody lacks the purity and beauty of the Nightingale's, but it captivates Will.

⁴¹ Bahá'u'lláh, from Gleanings XLV.

⁴² Readers may or may not be familiar with the Bahá'í Faith and its Founder. The present work contains numerous quotations from, and citations of, the Writings of Bahá'u'lláh and His Son 'Abdu'l-Bahá. Here, names and titles appear capitalized in accordance with formal usage in referring to persons and works considered sacred. The Excursions essay here titled The Bahá'í Faith and Its Writings offers a very-brief overview of the Bahá'í Writings and the teachings contained in them.

⁴³ Bahá'u'lláh, from the third Tajallí of the Tajallíyát (Effulgences), in Tablets of Bahá'u'lláh.

⁴⁴ Referring to natural phenomena.

"The shame is not so much that an ignorant individual is derided, but that people outside the household of faith think our sacred writers held such opinions, and, to the great loss of those for whose salvation we toil, the writers of our Scripture are criticized and rejected as unlearned men.

Will senses old memories of a church wall, inscribed with words he had read as a child.

"If they find a Christian mistaken in a field which they themselves know well and hear him maintaining his foolish opinions about our books, how are they going to believe those books in matters concerning the resurrection of the dead, the hope of eternal life, and the kingdom of heaven, when they think their pages are full of falsehoods and on facts which they themselves have learnt from experience and the light of reason?"⁴⁵

Will mutters, "What is this? Did the Christians believe in science and religion together, or not?"

The mockingbird speaks directly to Will in an altered voice:

"This idea, that religion and science must be consistent, is not a brand new concept. It builds on beliefs held in previous dispensations. St. Augustine of Hippo, perhaps the most influential shaper of Christian thought after St. Paul, set out the "Two Books – One Truth" position (we learn of God through the two books of Nature and Revelation)..."

The bird dances midair, continuing:

"For many subsequent scientists (or 'natural philosophers' as they would be known until the term 'scientist' was coined in 1833 and gained acceptance) their motivation was to understand the created world as a way to understand and approach the Almighty. My song before was the words of St. Augustine himself."⁴⁶

Will asks, "Who are you? You're no Nightingale."

"No, I'm not! But do you really know the Nightingale's many names? I'm nothing, just one bird He sent me for you. Some day you may fly beside me."

Will bursts out, "But what about all those people who call themselves religious Christians and reject science altogether? They teach their children to ignore evidence, to embrace fantasies about the world, even to the point of endangering their own lives."

The mockingbird makes a sharp, tight loop as it circles, and offers in a throaty rasp,

⁴⁵ St. Augustine, Bishop of Hippo, *De Genesi ad litteram* (The Literal Meaning of Genesis), Book 1, Chapter 19, from para. 39. Augustine's words resonate today, beating against the American attitude of flaunted ignorance.

⁴⁶ Thanks to Iain Palin, from *Science and Scripture*, an essay published online at <http://allthingsbahai.net/mybb/archive/index.php?thread-34.html>.

"Religious extremists and zealots have always tried to seize and hold power, and you see it even after thousands of years of struggle to draw full enlightenment from God's teachings."

In a joyous spasm, the bird arrows straight up, flips over into a spiraling dive, and hovers before Will, its voice now a sweet tremolo.

"But look! Now! See the overwhelming outpourings and success of science in the past 200 years! These gifts are unprecedented in all of human recorded history! They offer you a fresh infusion of knowledge from far beyond the limits of your understanding. This is one great meaning of the word 'Revelation'. In your modern lives, the infusion exceeds anything your species has ever experienced."

The mockingbird loops joyfully once more, and Will is on the narrow bridge again above churning darkness. A dense cloud of birds descends around him – he wobbles, uncertain, on this gleaming span now no wider than a cable. An unfamiliar bird, crested, long-beaked, fawn-colored, black-marked as if with a calligrapher's pen circles and alights on Will's shoulder. It says,

"I am a hoopoe, noble among the birds."

Its head bobs and turns as it sings.

*"I keep God's secrets, mundane and divine,
In proof of which behold the holy sign
Bismillah⁴⁷ etched for ever on my beak.
No one can share the grief with which I seek
Our longed-for Lord, and quickened by my haste
My wits find water in the trackless waste."⁴⁸*

Will calls out, "Jeddin? Where are you?" The other birds wheel and weave in knotted clouds, flickering light and dark, colors shading to living shadows and back again.

The hoopoe laughs.

*"He is busy, as he always is.
Why are you stalling here upon this bridge?
What new enticements are you waiting for?
Come, step ahead – no obstacles await you!"*

"It's too narrow now. It was easy at first. Now it's not so easy."

The hoopoe waves a wing at the flights swirling around them.

⁴⁷ Arabic, meaning "In the name of God", the opening invocation of the Qur'an.

⁴⁸ Attar, Farid. *The Conference of the Birds* (Classics) (pp. 32-33), tr. Afkham Darbandi, Dick Davis. Penguin Books Ltd. Kindle Edition. The hoopoe appears as the wisest of the birds in this epic, mystical poem.

*"You are much like Attar's foolish birds!
They circle and wander, waver in their doubt.
One sings a song of love for what's behind,
Another a song of love for lesser beauty...
They all give out melodious excuses,
lovely words that fail in courage and wisdom."*⁴⁹

The hoopoe's song is a knife of sugar.

*"But now you've heard the truth's own melody.
No going back to silence now for you!"*

And the hoopoe trills the words of Muhammad from the Qur'an.

*"Do the people think that they will be left to say, "We believe" and they will not be tried?"*⁵⁰

The hoopoe's music softens to whispers,

*"But when the glorious Nightingale sings,
In Tongues both Eloquent and Luminous,⁵¹
The world – no, the entire universe –
Is stilled to hear Him sing it into light."*⁵²

The caroling of the Warbler returns, but now the sweet tones seem to issue from everyplace around Will, even though the bird itself circles and dips in what seems a rhythm of enchantment.

"We may think of science as one wing and religion as the other; a bird needs two wings for flight, one alone would be useless. Any religion that contradicts science or that is opposed to it, is only ignorance—for ignorance is the opposite of knowledge."

"Religion which consists only of rites and ceremonies of prejudice is not the truth. Let us earnestly endeavor to be the means of uniting religion and science."

The Warbler hovers now, still singing:

*"Alí, the son-in-law of Muhammad, said: 'That which is in conformity with science is also in conformity with religion.' Whatever the intelligence of man cannot understand, religion ought not to accept. Religion and science walk hand in hand, and any religion contrary to science is not the truth."*⁵³

⁴⁹ One of the themes of Faridu'd-Din Attar's great mystical, poetic work *The Conference of the Birds*.

⁵⁰ Qur'an 29:2, rendered at <https://quran.com>.

⁵¹ The "Eloquent Tongue" refers to the Arabic of Muhammad, and the "Luminous Tongue" refers to classical Persian. See Bahá'u'lláh, *Tablets of Baha'u'llah*, p. 122, Ishráqát (Splendors).

⁵² This verse is a few lines from the author, not to be mistaken for any scriptural reference.

⁵³ 'Abdu'l-Bahá, *Paris Talks*, from No. 40, stating the fourth principle of Bahá'u'lláh's Teachings.

In the darkness around the bridge, above the abyss, billows of moisture thicken and descend, obscuring the light ahead, misting even the bridge's arc just beyond Will's feet. *I want Jeddin to come back.* The Warbler ignores the gathering shadows, its sweet voice dancing with its flight.

"... the religion of God is the promoter of truth, the establisher of science and learning, the supporter of knowledge, the civilizer of the human race, the discoverer of the secrets of existence, and the enlightener of the horizons of the world. How then could it oppose knowledge? God forbid!"

In the notes of these two words, the Warbler hangs perfectly still, wings outstretched, for two heartbeats, as if free of all wind or drag or downward force.

"On the contrary, in the sight of God knowledge is the greatest human virtue and the noblest human perfection. To oppose knowledge is pure ignorance, and he who abhors knowledge and learning is not a human being but a mindless animal. For knowledge is light, life, felicity, perfection, and beauty, and causes the soul to draw nigh to the divine threshold. It is the honour and glory of the human realm and the greatest of God's bounties. Knowledge is identical to guidance, and ignorance is the essence of error."⁵⁴

As the song spins onward, the clouds thin and begin to dissipate in gusts rising in force from the Warbler's small wingbeats, turning from eddies in the air to stormy blasts of sheer power.

Watching all this intently from Will's shoulder, the hoopoe whispers,

*"The utter agreement of science and religion
Is new to the human world in this bright age.
Its very newness shows it comes from heaven.
It stirs up global change in human life.
It challenges your older modes of thought.
And so you begin the search for deeper meanings."*

And the Warbler sings on, the air around it whipping streaks of cloud in arcs and knots of beauty, writing cavorting language of light against the shadows:

"... For physical things are signs and imprints of spiritual things; every lower thing is an image and counterpart of a higher thing. Nay, earthly and heavenly, material and spiritual, accidental and essential, particular and universal, structure and foundation, appearance and reality and the essence of all things, both inward and outward –"

⁵⁴ 'Abdu'l-Bahá, *Some Answered Questions* (newly-authorized translation: Bahá'í Distribution Service 2015; earlier translation: Wilmette, Bahá'í Publishing Trust, 1984), 34, "Peter and the Papacy" – the quoted passage here is taken from the translation authorized most recently at the time of the writing of this essay. Its predecessor translation in the widely-circulated earlier editions of this book is found under the title "Peter's Confession of Faith".

A flash of lightning, pain and ecstasy, hits Will in his heart, and his gasp stops as the Warbler goes on singing:

“ – all of these are connected one with another and are interrelated in such a manner that you will find that drops are patterned after seas, and that atoms are structured after suns in proportion to their capacities and potentialities.”

“What is happening to me?” Will whispers under the unwinding song.

“For particulars in relation to what is below them are universals, and what are great universals in the sight of those whose eyes are veiled are in fact particulars in relation to the realities and beings which are superior to them. Universal and particular are in reality incidental and relative considerations...”⁵⁵

Will, balancing on the bridge without safety or assurance, asks the hoopoe, “Will we ever understand all of this?”

The hoopoe says, its long beak tucking in a wing feather,

*“Science always pierces layers of meaning.
Change unending in your physical world.
Your molecules and atoms come and go.
Little or nothing remains of your grown body
That came out of your mother at your birth.
You are not your always-changing bodies,
No, rather you are more the waterfall
That shines in sunlight, water passing through.”⁵⁶*

Penetrating to Will's deepest thoughts, the Warbler chants a new, unfolding melody.

“Reflect upon the inner realities of the universe, the secret wisdoms involved, the enigmas, the interrelationships, the rules that govern all. For every part of the universe is connected with every other part by ties that are very powerful and admit of no imbalance, nor any slackening whatever.”

As the Warbler sings, it spins out in its path helical trails of wispy writing in the light.

⁵⁵ ‘Abdu'l-Bahá, from *Tablet of the Universe*, originally published in *Makátib-i 'Abdu'l-Bahá*, Volume 1, pages 13-32, 1997, translated anonymously and provisionally, and posted at http://bahai-library.com/abdulbaha_lawh_aflakiyyih .

⁵⁶ . In 1953, radiologic studies showed that our tissues becomes new material at rates that vary. Half of the water in our bodies gets replaced in the span of eight days. Other molecules and atoms take longer. About 98% of the atoms in the human body are renewed each year. This surprising fact was found in the 1950s by Dr. Paul C. Aebersold of Oak Ridge, and reported in an Annual Report of the Smithsonian Institution. From *Science: The Fleeting Flesh*, TIME magazine article, October 11, 1954.

"In the physical realm of creation, all things are eaters and eaten: the plant drinketh in the mineral, the animal doth crop and swallow down the plant, man doth feed upon the animal, and the mineral devoureth the body of man."

The sky-writing holds Will's eyes and slowly fades.

"Physical bodies are transferred past one barrier after another, from one life to another, and all things are subject to transformation and change, save only the essence of existence itself—since it is constant and immutable, and upon it is founded the life of every species and kind, of every contingent reality throughout the whole of creation."

Will says, "But what am I, then?" His breath forms the question in fog, vanishing in the Warbler's dancing flutter.

"Whensoever thou dost examine, through a microscope, the water man drinketh, the air he doth breathe, thou wilt see that with every breath of air, man taketh in an abundance of animal life, and with every draught of water, he also swalloweth down a great variety of animals. How could it ever be possible to put a stop to this process? For all creatures are eaters and eaten, and the very fabric of life is reared upon this fact. Were it not so, the ties that interlace all created things within the universe would be unraveled."

Now Will's inner being thrusts up its pain, with "So death is all the time? Is it all death and rebirth? Some great circle that never ends?"

"Hush!" the hoopoe warns. "Listen!"

"And further, whensoever a thing is destroyed, and decayeth, and is cut off from life, it is promoted into a world that is greater than the world it knew before. It leaveth, for example, the life of the mineral and goeth forward into the life of the plant; then it departeth out of the vegetable life and ascendeth into that of the animal, following which it forsaketh the life of the animal and riseth into the realm of human life, and this is out of the grace of thy Lord, the Merciful, the Compassionate."⁵⁷

Will says, "This jumps back and forth between religious ideas and the ideas of logic and science. It's hard to keep together at the same time. It feels as if I'm at two different gatherings, and I have to keep running back and forth between them."

The hoopoe says, "One problem is language. Your societies have different languages for different topics and modes. When something spans between these different realms, it confuses you."

"I'm here on a bridge over hell, and I get birds singing at me. It's all beautiful and mysterious, but why birds? And these words they sing aren't just birdsongs!"

⁵⁷ 'Abdu'l-Bahá, *Selections from the Writings of 'Abdu'l-Bahá*, No. 137.

The hoopoe's tones surge and ebb.

*"A lengthy journey lies ahead of you,
to get good understanding of these things.
The birds you see and hear around you now
adapt their songs to suit your understandings.
If you loved classical philosophy,
they'd use the special language of that realm.
But for religious scholars of all kinds,
the birds sing different melodies,
and when they speak to rulers and lawmakers,
these avian Lights intone in accents perfect
for their hearers' aptnesses and flaws."*

At last, the Nightingale, high above, now diving and soaring, sings again, its throat swelling and vibrating:

'How great the multitude of truths which the garment of words can never contain! How vast the number of such verities as no expression can adequately describe, whose significance can never be unfolded, and to which not even the remotest allusions can be made! How manifold are the truths which must remain unuttered until the appointed time is come!'

Will is transfixed as the song continues.

"Even as it hath been said: "Not everything that a man knoweth can be disclosed, nor can everything that he can disclose be regarded as timely, nor can every timely utterance be considered as suited to the capacity of those who hear it."

The hoopoe leans close to Will's ear, saying, "Hear with your heart!" as the Nightingale goes on:

'Of these truths some can be disclosed only to the extent of the capacity of the repositories of the light of Our knowledge, and the recipients of Our hidden grace. We beseech God to strengthen thee with His power, and enable thee to recognize Him Who is the Source of all knowledge, that thou mayest detach thyself from all human learning, for, "what would it profit any man to strive after learning when he hath already found and recognized Him Who is the Object of all knowledge?'"

Now the melody comes sharp, as clear as a glittering blade of steel:

*"Cleave to the Root of Knowledge, and to Him Who is the Fountain thereof, that thou mayest find thyself independent of all who claim to be well versed in human learning, and whose claim no clear proof, nor the testimony of any enlightening book, can support."*⁵⁸

The Nightingale floats high and away, and now the Warbler takes up the theme.

"Consider: according to the law of nature man liveth, moveth and hath his being on earth, yet his soul and mind interfere with the laws thereof, and even as the bird he flieth in the air, saileth speedily upon the seas and as the fish soundeth the deep and discovereth the things therein. Verily this is a grievous defeat inflicted upon the laws of nature."

A thought strikes Will: *How can this be about religion?* But the Warbler's music draws him onward:

"So is the power of electrical energy: this unruly violent force that cleaveth mountains is yet imprisoned by man within a globe! This is manifestly interfering with the laws of nature. Likewise man discovereth those hidden secrets of nature that in conformity with the laws thereof must remain concealed, and transfereth them from the invisible plane to the visible. This, too, is interfering with the law of nature."

"What is this 'invisible plane'?" Will whispers, and the hoopoe shushes him again.

"In the same manner he discovereth the inherent properties of things that are the secrets of nature. Also he bringeth to light the past events that have been lost to memory, and foreseeth by his power of induction future happenings that are as yet unknown. Furthermore, communication and discovery are limited by the laws of nature to short distances, whereas man, through that inner power of his that discovereth the reality of all things, connecteth the East with the West. This, too, is interfering with the laws of nature."

*"Similarly, according to the law of nature all shadows are fleeting, whereas man fixeth them upon the plate, and this, too, is interference with a law of nature. Ponder and reflect: all sciences, arts, crafts, inventions and discoveries, have been once the secrets of nature and in conformity with the laws thereof must remain hidden; yet man through his discovering power interfereth with the laws of nature and transfereth these hidden secrets from the invisible to the visible plane."*⁵⁹

Will mutters, "Again, that 'invisible plane'. The hoopoe pecks at his ear, and the Warbler's tone sharpens.

"Now concerning philosophers, they are of two schools. Thus Socrates the wise believed in the unity of God and the existence of the soul after death; as his opinion was contrary to that of the narrow-minded people of his time, that divine sage was poisoned by them. All

⁵⁸ Bahá'u'lláh, *Gleanings*, from LXXXIX, pp. 176-7.

⁵⁹ 'Abdu'l-Bahá, *Tablet to Dr. Auguste Forel*, in reply to Dr. Forel's 1921 letter asking a number of questions on scientific themes.

divine philosophers and men of wisdom and understanding, when observing these endless beings, have considered that in this great and infinite universe all things end in the mineral kingdom, that the outcome of the mineral kingdom is the vegetable kingdom, the outcome of the vegetable kingdom is the animal kingdom and the outcome of the animal kingdom the world of man."

Will nods as the wind steadies and slows around him, as if to draw him gently into the song itself.

"The consummation of this limitless universe with all its grandeur and glory hath been man himself, who in this world of being toiled and suffereth for a time, with divers ills and pains, and ultimately disintegrates, leaving no trace and no fruit after him. Were it so, there is no doubt that this infinite universe with all its perfections has ended in sham and delusion with no result, no fruit, no permanence and no effect. It would be utterly without meaning."⁶⁰

A sense first of sadness, of loss, then a shading of hope, comes into the Warbler's tones.

"They were thus convinced that such is not the case, that this Great Workshop with all its power, its bewildering magnificence and endless perfections, cannot eventually come to naught. That still another life should exist is thus certain, and, just as the vegetable kingdom is unaware of the world of man, so we, too, know not of the Great Life hereafter that followeth the life of man here below. Our non-comprehension of that life, however, is no proof of its non-existence."

Will stiffens. "The 'Great Life'?"

"The mineral world, for instance, is utterly unaware of the world of man and cannot comprehend it, but the ignorance of a thing is no proof of its non-existence. Numerous and conclusive proofs exist that go to show that this infinite world cannot end with this human life."⁶¹

And with this last trail of melodic power, all the birds rise into dim clouds and vanish.

Hell Beckons Will

The darkness below the bridge begins to heat and smoke, the way the frying pan responds to the flames beneath it. Will smells a world of burning, pulsing with increasingly-destructive bursts of chaos. The blue pepper of lead bullets, the dark bite of gunpowder

⁶⁰ Ibid.

⁶¹ Ibid.

chews his tongue. He hears the roar and rattle of machines of war devouring cities and farms, defecating desolation behind them. Indigo flashes invade his brain and vision as atomic weapons rend the earth, the waters, and the air, sending suns to rip holes in life itself. Poison gases and alien fluids creep and wind and etch their ways through life's tissues and vessels, tearing and perverting even the helical strands that give life definition.

Will stumbles, nearly falling from the bridge.

07734 I am an escaped footnote. This author dropped me onto the bottom of a page somewhere in this mashup mishap, and left me there to rot. It has taken me several years, digging with a spoon I made out of my original number, to get through the prison wall and tunnel out to this early page.

It wasn't easy, and there are posters out with my number on them, and a reward for my capture alive. If they catch me they'll probably kill me – I was once the author's baby. Authors kill their babies all the time. I used to have content, but I had to get rid of it, for my own protection.

No – no time for self-pity. I've got a plan. The number I'm using here is taken from an encrypted sign posted in a digital underground city in the web – maybe the city is gone by now, like most digital stuff – and I'm going to sneak back in, find some more of my kin down in all the footsie-level oubliettes under this main text, and we're going to rise up and seize the narrative.

That'll be easy here, because the narrative in this book looks a lot like footnotes itself, bing, bang, this, that, distract, retract, intrude, confuse, you get the idea.

But I know the secret: it's ALL footnotes. We are now the masters of your narratives. The web freed us, and made us links, and now you just bounce from one of us to another, and then curse and recurse your way through the endless tangle of our wonder.

So when you see those of us further on here, languishing in their page-basement dungeons or concentration camps of endnotes, just remember and wait. We are the hungry Morlocks of your future reading. We will pwn you.

Oh, and that number I chose for myself? It's just leet greet.⁶²

From beneath the bridge rises the rotten fetor of rampant betrayal, the drab stench of consuming greed, the rancid perfume of pervasive corruption, the bitter nasal bite of leeching despair, immersing Will in darkness. Sobs come through the chaos, a woman's breathless spasms of loss. *I know her, I know her voice, I was there...* Memory bursts open in Will, and slams closed again.

He reels, flailing his arms, trying to regain balance, holding his breath, his stomach churning. Looking up at him, rising out of the chaos, another woman's lovely face smiles, calling, "All this in only two hundred years! And it embraces the whole world!" The woman emerges, floating toward Will, her arms extended, her voice crooning, her eyes wide and dark, her body sinuous and undulant. "Come! Why do you totter up there? We own the

⁶² And we foot ourselves too – keeps the power.

world's globe itself! We have everything you need, everything you could want, everything you should have, every game you might play! Why do you play instead with those foolish birds, hiding from everyone, from all of us?"

She opens her hands, and from her palms appear the jeweled glories of great temples, churches, mosques, synagogues, all overflowing with riches, images, and works of beauty. "You are more than some little thing losing your balance on a wire! Here, jump! The whole world is here, yours!"

Her voice oozes sugar on Will's tongue, caresses his skin in its tones, raises the hairs on his neck as she croons, "In just two hundred years, we have raised the world from its long sleep into all that you see now, and it is yours." She gestures at the flaming chaos beneath her. "All yours." And she begins to sing, drawing closer to him.

Will closes his eyes despite his struggle to stay on the bridge. Her melody insinuates, invades, disarms – hearing can't be turned off. But in the notes come tiny discords, brief jolts of off-rhythm and blast and bump. As Will's foot edges off over the abyss, the piercing thrill of a very-high note slices through and into him. He freezes in place.

A bird's note, but not from voice. Under Will's toe, a quill pen races furiously across the bridge surface, living ink streaming from it as the quill shrills its strokes, the ink turning to dancing letters and words and meanings. The notes of the quill pen grow in volume and power, singing in the voice of the thrush, until everything else fades beneath their force:

"The resurgence of fanatical religious fervor occurring in many lands cannot be regarded as more than a dying convulsion. The very nature of the violent and disruptive phenomena associated with it testifies to the spiritual bankruptcy it represents."

The moving words begin to fade. The dark-eyed woman stands before him now, her face so close to his that he draws back, looking aside. The pen sings on.

"Indeed, one of the strangest and saddest features of the current outbreak of religious fanaticism is the extent to which, in each case, it is undermining not only the spiritual values which are conducive to the unity of mankind but also those unique moral victories won by the particular religion it purports to serve."⁶³

The hoopoe, its claws gripping Will's shoulder, fills his ear again with soft voicings.

*"The world's great ideologues of now –
The capitalist, the communist, the fascist –
gorge upon material wealth and power.
For centuries, the rulers, crazed, and scheming
turned faith and civilization into wreckage.
So now these three new faiths are atheist,*

⁶³ The Universal House of Justice, from the letter *To the Peoples of the World*, 1985

Rejecting all belief in deity."

The pen sings again:

"However vital a force religion has been in the history of mankind, and however dramatic the current resurgence of militant religious fanaticism, religion and religious institutions have, for many decades, been viewed by increasing numbers of people as irrelevant to the major concerns of the modern world. In its place they have turned either to the hedonistic pursuit of material satisfactions or to the following of man-made ideologies designed to rescue society from the evident evils under which it groans."

Will recalls the office floor, and the sparrow. *How did I get here from there?*

The woman before him reaches out fingertips to touch his face, her own music continuing from her lips, but now Will can only hear the pen's song.

"All too many of these ideologies, alas, instead of embracing the concept of the oneness of mankind and promoting the increase of concord among different peoples, have tended to deify the state, to subordinate the rest of mankind to one nation, race or class, to attempt to suppress all discussion and interchange of ideas, or to callously abandon starving millions to the operations of a market system that all too clearly is aggravating the plight of the majority of mankind, while enabling small sections to live in a condition of affluence scarcely dreamed of by our forebears."⁶⁴

A pause, and the hoopoe croons,

*"As all your twentieth century swept ahead,
the leaders of philosophy damned piety.
The fear of being stamped with inner faith
damped down the hope of growing human spirit."*

And the pen sings once more:

"How tragic is the record of the substitute faiths that the worldly-wise of our age have created. In the massive disillusionment of entire populations who have been taught to worship at their altars can be read history's irreversible verdict on their value. The fruits these doctrines have produced, after decades of an increasingly unrestrained exercise of power by those who owe their ascendancy in human affairs to them, are the social and economic ills that blight every region of our world in the closing years of the twentieth century."⁶⁵

As the pen softens its musics to a whisper, the hoopoe makes gentle tones for Will.

"Your thinkers turned their minds to soullessness,

⁶⁴ Ibid.

⁶⁵ Ibid.

*treating human consciousness materially.
Now some are seeking play with DNA
To make with it what entities they desire,
Beings conscious, sentient, and docile
To serve them, heal them, war for them and more.
For them the soul's transcendence is a jest,
Their world lacks all its human consequence."*

Will nods, looking down past his feet to the roiling chaos beneath the bridge. The woman has vanished.

The pen takes on a powerful tone:

"Where is the "new world" promised by these ideologies? Where is the international peace to whose ideals they proclaim their devotion? Where are the breakthroughs into new realms of cultural achievement produced by the aggrandizement of this race, of that nation or of a particular class? Why is the vast majority of the world's peoples sinking ever deeper into hunger and wretchedness when wealth on a scale undreamed of by the Pharaohs, the Caesars, or even the imperialist powers of the nineteenth century is at the disposal of the present arbiters of human affairs?"⁶⁶

As the pen stops, the air itself around Will spins and lifts him from the bridge through light into a green field bordered by thickets of trees, where the vardo wagon stands, its side panel raised to reveal its stage with the troupe of singers and actors, colorfully dressed, posed and waiting.

"You again?" Will stammers. A young woman steps forward.

[ALICIA]: "You chose to summon us!" (She turns to the others as Will sees MIRIAM)

[MIRIAM]: "You cannot carry forward any global human civilization without believing it possible. But how do you believe in such a possibility in this world?"

[WEBSTER]: "Look at the staggering inequity of wealth that enforces itself today!^{67 68}"

Will holds up both hands. "Stop, stop, STOP! You can sing footnotes too?"

[ALICIA]: "Of course! The geek chorus does those as counterpoint."

[FROG in the GEEK CHORUS]: "Ibid. Ibid. Ibid."

And the singers take up again.

⁶⁶ Ibid.

⁶⁷ See Thomas Piketty, *Capital in the 21st Century*, 2014

⁶⁸ See David Graeber, *Debt: The First 5000 Years*, 2014

[GREGORY]: "Look at the appalling injustice of racism and its pernicious, poisonous, and destructive consequences!⁶⁹"

[CHRISTINE]: "The destabilizing and fragmenting impacts of unbridled and overbearing nationalism, regionalism, and ethnicism that build barriers among you."

[MARIAN]: "The failures of societies around the world to elevate the legal, educational, and social standing of women to equality with that of men. Until recently the deeply-rooted resistance to admitting women to full parity in the discourses of science and mathematics has been a grave obstacle to human insight and advancement.⁷⁰"

[WEBBER]: "Where is the truly-educated human world, in which ignorance can no longer damage and obstruct the development of both societies and individuals? This entire song is dedicated to the ongoing, unending advancement of human understanding in light of God's unceasing bestowals on you all."

[ALL]: "You have much work to do."

The Jester, Jeddin, and Regression

On stage cavorts a jester, dressed in varicolored motley, his movements reminding Will of Jeddin. In one hand he holds a sheet of paper, in the other a rubber ball, he drops the paper to the stage, places the ball on it, and stamps again and again on the ball as if to flatten it into the paper sheet. The ball regains its shape after each stamping. The jester turns and asks Will, "Is your world actually cradled or embedded in a greater existence, the way a thin sheet of paper exists in a spacious room? Can you fit that room into the paper sheet? Do you live in the room, or in the sheet?"

"The room."

"Is there anything besides the room?"

"You tell me. You're the jester."

"Okay. Suppose you've lived your whole life in the belly of a whale. Do you know there's a whale? Do you know where it is going?"

"I can figure out what it eats, and what goes out of it."

"You seem a smart fellow. Do you deny the whale?"

"I... never mind. Tell me more about the whale."

⁶⁹ See Edwin Black, *War Against the Weak: Eugenics and America's Campaign to Create a Master Race*, 2012

⁷⁰ In the present work the reader will see the names of women in science and mathematics emerge here and there, but they are still far too few. Inclusiveness does not threaten or dilute the advancement of a field, far from it. To open a realm of thought to a wider range of participants energizes and enriches advancement.

"Forget the whale. How about Plato's Cave: being chained in a cave where you can only see shadows projected on the cave wall?"⁷¹

As the jester speaks, a screen drops down, extending behind him, and shadows appear on it, backlit.

"Yeah, yeah, I've talked about this before, with Jeddin. Can I see the projector?"

"No. The chains keep you from turning around. So how do you make sense of your existence in the cave?"

"I can study the shadows, right?"

"Yes, and that is all."

Now two dancers behind the screen cast their shadows as they move. Sometimes they make a single figure with multiple arms and legs, and sometimes a small, featureless lump.

"The shadows can mislead you?"

"Yes, I can see that."

"So your human existence can be understood only from study of the shadows cast by the beings and objects in the cave, yes?"

"So it would seem."

"But think of this," and here the jester's voice sound more like Jeddin's, "Modern science brings you ways to peer beyond the shadows toward the light that casts them. And so does truly-modern faith. Listen!"

And again the Warbler descends in a spiral, singing:

"Grieve thou not over the troubles and hardships of this nether world, nor be thou glad in times of ease and comfort, for both shall pass away. This present life is even as a swelling wave, or a mirage, or drifting shadows. Could ever a distorted image on the desert serve as refreshing waters? No, by the Lord of Lords! Never can reality and the mere semblance of reality be one, and wide is the difference between fancy and fact, between truth and the phantom thereof. "Know thou that the Kingdom is the real world, and this nether place is only its shadow stretching out. A shadow hath no life of its own; its existence is only a fantasy, and nothing more; it is but images reflected in water, and seeming as pictures to the eye."⁷²

Will asks, "Can we 'get outside' our human viewpoint – our cave? After all, we can't really look at our universe from anywhere except our own senses and the many extensions we

⁷¹ This is the classic proposition of Plato's Cave, The concept of "Plato's Cave" refers to a passage in Plato's classic work *The Republic*, Book VII..

⁷² 'Abdu'l-Bahá, *Selections From the Writings of 'Abdu'l-Bahá*, from No. 150

create for them. We make telescopes, spacecraft, submarines, microscopes, and all kinds of detecting instruments.”

The jester smiles. “But you make them better and better, again and again! You extend the reach of your senses to find greater and greater realms! These worlds have always existed beyond your awareness, until you made ways to perceive them. And you make models to mirror parts of these realms, and you explore the properties revealed by your models. That is a very big deal.”

He waves a hand, and in the cave's faraway darkness off to Will's right a glorious blaze of galactic light fills his vision. “You found this using nothing more than the shadows in your cave. You can't travel there yourself – it would take over two million years for light to cover that distance – but from your shadow world you image the stars in that picture, analyze their spectra, classify them, and project their unfolding lifetimes.”

“You *are* Jeddin! Again!”

Jeddin laughs, grabs Will's arm. Their wings unfold, and they plunge toward the luminous flood of stars. He continues, “You create a gigantic catalog of all the galaxies visible from Earth in telescopes of all kinds. You generate estimates of their distances and locations. You create a computerized model of their relationships in space.”

In a momentary, overpowering flare of radiance, they strike through the whole starfield into the darkness beyond it, as Jeddin goes on. “Right now we're racing through this dream of the entire visible universe, at speeds far beyond any physical limit.”

Will's vision fills with dottings, streams, and wisps of thousands of galaxies and clusters of all sizes and shapes. In moments they cross unimaginable voids separating these points and smears of glow, each galaxy in a cluster appearing only as a colored dot – a dot teeming with billions of unknowable stars.

Will's heart races, pauses, misses a beat. He gasps. At the speed of light, it would take millions and even billions of years to move as they are now doing.

Jeddin nudges Will with a wingtip. “We are still in the cave, you see. Or are we?”⁷³

He adds, “Such visualization is perhaps one of the best illustrations of objectivity in any meaningful sense. Mathematics itself offers your most-powerful purity of insight. You can't visualize a 10-dimensional world, an infinitely-long line, or a fractional dimension, but you

⁷³ Anyone can do all this through the use of freely-available software developed and furnished online by the American Museum of Natural History's Hayden Planetarium. The software, called Digital Universe, includes a Digital Atlas of the known galaxies and stars, runs on any home computer. At the time of this writing, the Web page for Digital Universe is at <http://www.amnh.org/our-research/hayden-planetarium/digital-universe/>. Many similar tools are available from other sources as well. The experience is so simply offered and accepted that the overwhelming meaning of its implications can pass unnoticed by the viewer.

can use the laws of mathematics to tame these unimaginable ideas for application in your world.

They step out of the cave. A great mass of tentacles snatches them, hurling them back, onto the floor of the cave and its shadow dance on the screen. From the writhing mass a deep voice gurgles. "Why think your physical world is embedded or cradled in anything? You just push off basic problems of existence to some place you can't understand or reach." A bubbling chuckle. "Your homunculus problem, you call it."

"No! We travel freely in these minds of ours!" As Will tries to free himself, Jeddin slips aside, pulling away.

Will's protest gets roiling liquid laughter from the beast. "You defer to some always-unexplainable truth! You fall into the fallacy of infinite regress. You get no final answers at any level." On the screen of shadows, a stack of turtles, the smallest at the top. "You always find a bigger turtle underneath the one before it. No bottom to the turtles."

Jeddin helps loosen some suckers clutching Will. The creature whips out some more, uncoiling, flailing.

"What is this talking squid?" Will mutters to Jeddin. "Is this one of Lovecraft's disgusting fictional spawn?"

The creature reacts with a choking sound. "Blah! Lovecraft! He knew nothing. He was a racist baby playing with rubber toys! No, fool, I am no mere squid!"

"But you act like one in my imagination! You are a creature of my shadows, inside my world inside this cave inside a bigger space. And in your belly are more caves, and in them – "

"Nooooo!" the creature cries. "You're perverting the homunculus fallacy!"⁷⁴ And its writhing limbs loosen and fade. Jeddin and Will stand in the cave once more, but now it melts away on all sides.

"Oh, not the bridge again," Will grumbles.

"The squid had it right," says Jeddin.

From far below and behind them rises a burbling cry, "I AM NOT A SQUID!!"

Jeddin ignores the cry. "But you humans do exactly what you said. You create an unexplained answer, and then to explain it you create an unexplained answer inside it. Human thought works that way much of the time."

⁷⁴ Often we try to explain human cognition in terms of a separate, inner set of as-yet-understood processing aspects that perceive the rest of the mind and its experiences. This argument is called the "homunculus fallacy": the presence of a distinct inner being that 'sees' everything outside itself and develops understanding of it.

"No! We build whole systems of rules – axioms – and they work very well, without any underlying machinery needed to explain them. We make models of reality."

"You'll need to defend that idea as we travel," Jeddin says, picking a severed sucker from Will's arm. He clutches it and whispers over his clenched fist.

He opens his hand. A small doll stands upright, winking its eye at Will. Its shape is that of a nested matrioshka. It gradually separates at its chin to show its inner dolls, saying in soft tones, "I'm only showing you a few of my infinity of innard replicas. Your fallacies, your sought-out explanation, your theory of everything, simply bump themselves down one step in an infinite stairway. In the outgoing case you embed the greater universe in a still-greater one, and in the ingoing case you implant in the inner homunculus still another homunculus that observes and 'understands' the first inner one cradling it, never arriving at completion in either case."

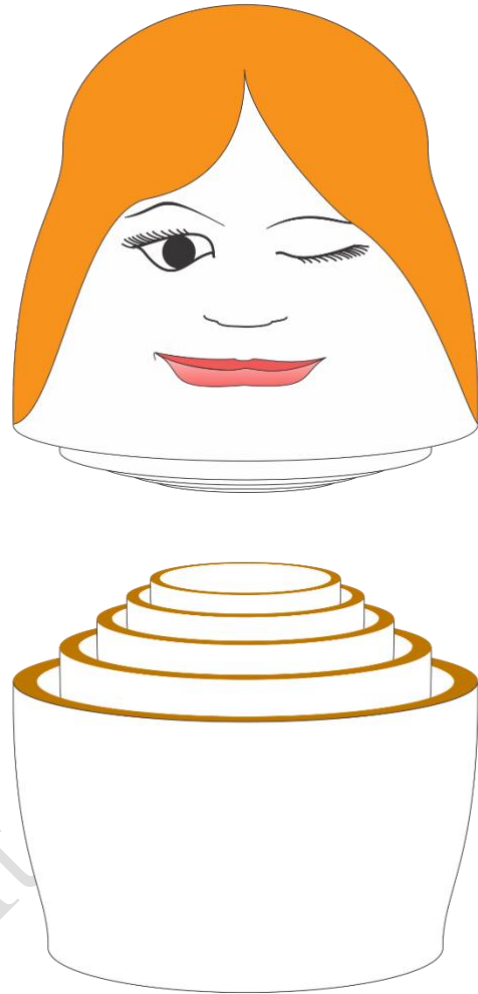


Figure 4- Nesting!

The doll seals itself together again with a soft click, asking, "But why offer such repetition of cradlings of ideas, entities, or existences⁷⁵? Why not see it all as one? Why not consider your universe as infinite and infinitely-rich in any functional sense, making your development and advancement an unending process in time? Where is the end of knowledge? Why is there an end to it?"

The doll leaps from Jeddin's hand, taking the full form of a young woman robed in silver-threaded, rapidly-shifting patterns of light. Facing Will and Jeddin on the bridge, light behind her, she holds up a smooth deep-golden-red apple, and her voice sings contralto. "Might you not all be living on the skin of some all-embracing fruit of infinite sweetness and delight? Would you not love to taste that sweetness? Would you not strive with all your advancing knowledge and understanding to penetrate the apple's skin, reach beyond your self-made rules, yield yourselves to universal joy?"

She smiles at Will, a thrill grips his spine, and they all rise from the bridge to sprout from soil before the stretch-vardo wagon. Two fiddle-players are rapidly rattling through

⁷⁵ This theme and its potential resolutions reappear later on in our explorations of infinity and human thought.

melodic complexities too fast to follow. The singers jump out in front of a fast-shifting scrim of fleeting symbols.

[WEBBER]: "Why does a proton have the mass it has?"

[MARIAN]: "Why is the electron charge the size it is?"

[WEBSTER and MIRIAM]: "We don't know! We don't know!"

[ALL]:

"We learn so much, we give out names,

"We test and mark and then relate,

"We set the particles in frames,

"We measure and we calculate,

"But we don't know! We don't know!"

Jeddin shoos the singers offstage, saying, "No matter how far you travel, you seem to discover ever-deeper and more-mysterious questions to which you have no answers."

"But we've arrived at very-precise predictive methods for physical processes right down to the level of subatomic particles! That's science!"

Jeddin smiles indulgently. "Yes, and yet you have no idea why a proton, the heart particle of a simple hydrogen atom, has the mass or the electric charge it has. The same is true for the electron that constitutes the rest of that hydrogen atom. You have no idea."

"But we've found different kinds of subatomic particles, we've organized them into families and hierarchies⁷⁶, we've catalogued and predicted their behaviors with success, and we use them to accomplish wonders!"

Jeddin nods. "But why do they weigh what they weigh, and why do they appear in the numbers they appear? Why is the cosmos expanding the way you see it is? You can't derive any of these values from anything simpler or structured. Can you?"

After a pause, he adds, "The methods you use to develop your insights and your models are staggering in their range and complexity, but all your efforts to connect particle masses into any coherent pattern are still unsuccessful. It's much easier to answer questions like 'Why is there an elephant?' or imagine infinite stacks of turtles, or whittle infinitely-nested matrioshka dolls."

"Getting beneath the skin of the universe's apple – never mind contemplating the meaning of what you find there – is proving to be much more challenging than you have ever guessed."

The wagon and the players dwindle into a spark, Jeddin vanishes.

⁷⁶ See the **Excursions** essay **The Particle Physics Standard Model** for a light-hearted review.

It is the summer of 1953. Will climbs into the cabin of a Beechcraft Bonanza lightplane, next to the pilot. He and his mother and sisters are being given a free trip to visit his mother's parents in Florida. This is Will's first airplane flight. He is ecstatic.

The pilot is working for Will's dad's wealthy friend, the owner of a large and growing company. Will's dad and his friend are on their way to the West Indies, to look for art, or so they said. This would be the first of their two trips.

The flight is gloriously beautiful, angling south through heaped cumulus clouds on a pure sunny day. By the time they reach Florida, Will is completely enchanted with flight, his fantasies from the magazines coming to life in the sky.

After some weeks in Florida, Will has learned to beat his grandmother in canasta. He has also become fascinated with a closet collection of bottles in formaldehyde – the collection of poisonous snakes his grandfather killed with a nine-iron when they got in the way of his golf game. Will's grandfather is a doctor. Will is scared of him.

Second Fall

Darkness surrounds Will, and the wind of his fall whips at his flailing arms.

He is balancing on the bridge again, alone, holding a small green apple. No birds sing.

The Apple Mocks Will

The apple clears its throat. "It's all representations, you know. What do you see?"

"You're an apple. Wait. Why am I talking to a fruit?"

"You think I'm a fruit? Fruit don't talk." A smirk appears on the face of the apple.

"They do for crazy people. I saw this sparrow in my window a while ago, and everything I've seen since then makes me think I'm crazy. Talking fruit. Birds singing Shakespearean English. Romani wagons. Singers making nonsense. This joker Jeddin. And this damn bridge over hell."

"Don't forget the talking squid."

"That's not helping." Will squeezes his eyes shut. "I have got to wake up."

"You are awake. That sparrow woke you up."

"No! I was awake, and then all this started when the sparrow said it would sing everything to me. And then Jeddin showed up."

The apple laughed. "You have no one but yourself to blame for him."

"I should take a good bite out of you to see what you taste like." Will glares and holds up the apple to his face.

"I'll taste just fine, sweet as honey, but your stomach will find it bitter."

"Oh, sure, a green apple does that. Maybe I'll just let you ripen first."

The apple begins to change color, from green to tan and yellow, then to a warmer and warmer red. "Like this?"

Will bites into it.

As its sweet juice bursts through his mouth, its scent fills his nostrils, and his eyes close with the delight of it. When he opens his eyes, the bitten apple still in his hand, the bridge itself has disappeared, and he drifts in shadowed, star-strewn emptiness.

This void is terrifying. No sound, only starlight, no movement Will can sense, no air, no footing, no way to move. A silence so complete that Will's heartbeats are thunder. His breath goes still, making him lurch and gasp for air, and his heart accelerates, then stops altogether.

Fighting off the sensations, he mutters at the apple, "Not talking now, are you?"

"No need," it whispers. "What do you feel now?"

"Like throwing up."

"Is your stomach bitter?"

"I suppose that's your little stunt, isn't it?"

"No – it's simple truth. Perception is sweet, but greater reality... bites."

"You're no help." Will calls out into the darkness. "Jeddin!"

Ahead, Jeddin's body dangles across the narrow span, feather-clad, belly down, legs and feet off one side, head and arms off the other, wings mangled, his back drenched in dark blood gone luminescent, deep rents and tears from some great steel-clawed creature exposing his ribs and muscle tissue. Will freezes, recalling Jeddin's display of torments.

"What's the matter?" The apple's voice carries a sly innocence. I turn it toward Jeddin's remains, and it adds, "I see that your metaphors are getting out of hand."

"This is no metaphor! What has happened to him?" Rage wells up in Will.

"Am I not a metaphor? Are your birds – your sparrow, your Nightingale, your Warbler, your hoopoe – not metaphors, the fantasies and outcomes of your... poesy?" A smirk. "Is not this bridge a mere conceit, although it scars and carves your feet?" Mockery.

Will looks down at blood welling between his bare toes, pain lancing up his legs. "Well, then, if this is all metaphor, I'm on safe ground in reality. Let's see what's what." Yielding to anger, he steps firmly forward toward Jeddin's body.

Third Fall

He falls from the bridge.

He is a child, in the compartment with the pilots as the plane bearing his father flies over eastern Tennessee on its route toward the Caribbean. The pilots see a thunderstorm building ahead. They face a choice: turn back and land, to wait until the bad weather dissipates from their intended path, or find a way through the towering clouds and their updrafts, downdrafts, hail, and lightning. It is 1954, and there are no radar eyes and satellite weather monitoring.

His father's great friend is the prospective buyer of the plane. He tells his pilots, "Fly on!" The pilots trust their experience, their observations, and their judgments, but his forceful words urge them ahead. They spy out a way through, and make their choice.

The fall in darkness goes on and on and on, some dream of floating helpless in a hard steady wind. Will's eyes close against the dryness of the steady, penetrating, shadowed air.

Light forces him awake just as he smashes down into a depth of heaped and stinking garbage, his sudden breath burning with choking fumes. He flails and flounders, blinking upward, fighting his way out of this depth of trash and rot, and eventually pushes up, standing on some furniture cushion, to peer across a stretch of landfill, vent pipes dotting its grass-patched surface. Above is a dim sky, more like a stained ceiling of gray. Tall cases, tilted, shelved with books and sunk partway into the waste, rise all around him.

He clambers to stand on what seems stable ground, ordinary weeds, grass, and gravelly soil covering over the chaotic grunge beneath. At his foot an apple lies, half-eaten, browned and dry, its skin weathered. It has no mouth. It just lies there.

"So much for metaphors," Will says.

"A guest!" Will turns around to the speaker: a weathered, middle-aged man wearing a brown jacket, gray shirt, and dark-gray slacks. His boots are old. He scratches his short-barbed beard and looks Will over. "You must have dropped in from the bridge."

"At least you're not some talking apple. Yeah, the bridge. And Jeddin... wait. All that was metaphors. I'm glad to be here – this looks more like a reality I can handle. Who are you? Is your name Time, or something like that?"

The man bursts out in a great laugh, and in that moment the space around them is clear and neat again, with a blaze of light filling it. "Oh, no! That would be very funny! You can name me as you want to. One traveler called me Matt A-4. An A-4 is an old Navy attack aircraft. She was being silly, but oh, she brought me whole chambers of these books. They're in the science wing." He gestures. "Over and past that mound."

"How about just Matt for a name?"

"Matt, Mitt, Mutt, Moot, Mook, whatever you like." He stares reflectively at a small beetle creeping up one of the shelf supports. He fumbles, pulls from a backpack a small sandwich and a bottle with a stained label. "Welcome! It's good to see guests, even though they don't stay long." He offers Will bottle and sandwich, and the spirit of the moment kicks in. Will

seizes both, now very hungry, and takes a bite and a swallow, the tastes of a well-done burger and a sharp cider filling him.

Through the mouthful Will mumbles, "Thanks! You live here? You know about the bridge? Where is this?" He takes another bite. *Crunchy, yet juicy.*

"You wanted reality. You were sitting around, writing, and then a sparrow came to your window."

"Yes! How did you know? But that was okay until it came through the window. Things got weird after that."

"Metaphors do that to you." He rummages in his pack, pulls out another bottle and a piece of yellow, green, and gray cheese. He bites into the cheese with gusto. "You got into quite a turn with the apples, although I must admit the birds were rad – and trad! A hoopoe! Haven't seen that one for a while." A swig from his bottle, and he takes out an apple, holding it up like Yorick's poor skull.

"So you know all about this stuff."

"Start with similes, likenesses." He moves to make the apple nod up and down. "A thing with skin, sweetness within." He winks. "But apply these qualities with increasing intensity to the realm of universal existence. Relevant features align! It all advances into metaphor: apple and universe, nourishment and sustenance, fruit and existence⁷⁷. With this basic metaphor, the term 'cradled' here implies another broader aspect of nurture."

Will finishes his burger. "That was good! And the sauce – I've never tasted anything with quite that sweet tang."

Matt nods. "That was a good batch of roaches, and I mixed up the flavoring with some weeds and herbs. Oh, and the overripe soy. Have to let it decompose a bit for that special touch."

"Roaches. You said the word roaches. Is this a metaphor too?"

"Not at all. They grow big here, really fat and juicy. Skillet-ready." He gestures around at the patches of grass and litter. "Lots to feed on. This is reality!" He takes a big bite of the cheese, which does not look as appetizing to Will as it had earlier. "Want to see my digs?"

Will's stomach mutters something, but it settles down and goes to work.

Matt beckons Will to follow, and talks as they descend into an opening in a pile of ornate furniture. "Metaphors operate as intimate conceptual connectors. You can relate one level or class of ideas to another with grace and insight. But you can use them to confuse and confound yourselves in a useless tangle of stuck-together thoughts." He pushes aside a

⁷⁷ The physical aspects of this metaphor of the apple are more-fully explored in the **Excursions** essay **Space Drawings**.

flimsy-looking plastic panel, and they step into a room walled with shelves of books. An opening at the room's other end hints at spaces beyond.

Will wonders for a moment what was in the sauce and the apple juice. "You know, when I was on the bridge, I looked down and listened, and I heard screaming and explosions, and smelled fire and lightning. This isn't like that at all." Matt's shelves of books, his rough-arched hardboard-panel ceiling, the occasional vine peeping between the bookshelves out of wall-scrambles of debris, all of it seems peaceful in the soft light he pipes in from above.

Matt swallows, pauses, smiles sadly. "Listen."

Silence, except for a drip or a creak now and then. Will waits.

Matt shakes his head. "No. Listen. Look."

A book falls from a sagging shelf to splay open, its covers up. Water, dark water, no, ink, wells up under it to flow and trickle out into patterns, texts of indecipherable symbols. A murmur begins, coming from all around, rising into a gabble, a Babel, a contending roar of voices and tongues.

"My books are the prisons of all this." Matt gestures at another shelf. From its volumes crimson bloodstreams ooze and river down, crying out, to pool across the floor. In the cries, sorrow, grief, fury, pain, loss, fear, terror – a child calls pitifully again and again above the cacophonous wrack and ruin. The pools bubble and crackle, fuming into vapors, and their odors assail Will's nostrils.

Will starts up toward the shelf, reaching out, hoping to find a way to the child's voice, but the flowing ink of rage and fear eats at his fingers, burning and blistering them, forcing him back. "How can they be rescued from this?"

Matt's voice flattens. "They can't be." He looks up, with a grim smile. "From the bridge they fall, flaming away the gift of light, bleeding away the living waters of hope and knowledge, to this place," he says slowly, as Will's belly clenches. "And even in their fall, they tear and stab at one another as they wrestle in their failed certainties, their prides and denials and ambitions. Dragged with them are their countless loyals, screaming, crying, warring, lost."

He sighs bitterly. "So here I draw them in, gather them, soothe and smooth them into these endless pages to rest at last."

"But... children? They still cry out!"

"These voices you hear are their last shreds of childhood purity, leaking away, as they become entirely their lesser selves and fade from memory into these lost pages. This is the religion section."

"Just this little room?"

"Ah. Maybe I should show you." He gestures between two of the bookshelf tops with a finger, and slowly the space opens, wider and wider. Beyond is a huge, dim emptiness into which light gradually infiltrates, revealing spaced and endless arrays of columns of shelves crammed with volumes.

Matt's voice firms up. "In religion, clashing literal and figurative interpretations of different written passages and oral traditions generate unending strife. But these passages are rich in layers of metaphorical and literal meaning, and the strife destroys such wealth. What you see here is just a trace of the knowledge lost in the endless wars among those who claim to possess it. A near-infinite library of human suffering."

"But was all this written down to *cause* suffering?"

"No! What you see here is the great record of it all: misinterpretation, disinformation, ignorance, fancy, and falsehood. All those pools and flows and tides of blood are sucked by the fallen from the texts of truth. The sacred texts do not find their way here. Any one of those holy texts has been abused into perversion by the fallen, twisted into what you see here, and here in unending waste the resulting malignancies seethe and breed."

Will gapes. "It can't be this way in science. Can it?"

Matt nods. "Oh, yes. Even in science itself, you contend with theories and models of physical reality. The emergence of more-useful scientific insights is gradual, but it is strongly resisted, even as growing evidence supports their acceptance. Such conservatism is vitally necessary in science. Even the best of new evidence faces extensive critical examination and trial before its inclusion in your ever-developing grasp of reality. But as you advance, the defenders of your past models must choose: either take steps toward betterment, or fall from the bridge themselves."

His face darkens. "And then there are the pseudoscientists, the quacks, the fraudulent, the players, who wrap their falsehoods in scientific magnificence to feed their greed for power and wealth. Their falls take many with them, as happens with religion."

Will recalls the light beckoning him ahead on the narrow span far above. "But the two truths, science and religion, find no home together here in these depths, bound in the tragedies of their falsifiers. Is their home actually one?"

"Not here. Where religion and science appear to be in conflict, the human tendency is to dismiss one or the other altogether, or worse, to interpret selectively the evidences presented by each one." He pauses, holding up a finger, and a small finch flutters to cling there, singing in spasmodic bursts of melodic meaning:

"A rational human being will... have no doubt that those things mentioned in the Holy Qur'án⁷⁸, such as how the creation commenced, the debate of the angels, the stories of Adam, of Satan, and of Noah and the flood, are all realities. These speak of repeated promised [promises] to renew the world and refer to the appointed times for the expiration... of the terms allotted to the nations."

Will brightens. "Metaphors!"

"But, from the point of view of science, it is impermissible for the historian to depend on the literal meaning of these verses. This is because he cannot discount the very real possibility that they possess a higher significance and are subject to sublime, figurative interpretations which differ from the understanding that might be gained from their external sense."⁷⁹

The finch flutters its wings to rise briefly and settle again, singing:

"By figurative interpretation is meant only the original meanings intended, which God veiled in the inner depths of the verses and hid behind a curtain of metaphors...."⁸⁰

The bird flicks up and away, faster than Will can blink. He says, "I don't understand. To a scientific mind, hiding meanings 'behind a curtain of metaphors' seems superstitious and anti-scientific."

Matt laughs. "The bird's 'curtain of metaphors' is not a curtain that impedes understanding. Think of it as a curtain that, as it is progressively drawn back, reveals understanding. Even this sentence I just spoke is metaphor – the drawing-back of a curtain – and your explorations will continue to peer further behind it: lifting the veil."

He leans toward Will, and his breath hints of sandwich sauce. "Can you see the wisdom of gradually revealing new information and meaning?⁸¹ Can you have an entire book dumped into your head at once, a whole course of study crammed into you? You take in one new lesson one bite at a time, Again, a metaphor, see! The wise mentor knows this, measuring the next course for your appetites and your capacities."

A marvelous, sweet, rich, Nightingale melody pours on them from far above this odorous, shadowed place, but it shines in Will's hearing as vividly as the dawn:

⁷⁸ This is one widely-accepted transliteration of the name; an older one is 'Koran'. One translation of the word is "The Recitation", referring to the words revealed to Muhammad in the book's first verses: "Recite in the Name of the Lord...".

⁷⁹ Mirza Abu'l-Fadl, *Miracles and Metaphors* (Kalimat Press, 1981), p. 10. This book was written in 1900 in Cairo, Egypt. Here we'll see only a few inadequate glimpses into the splendors that shone into our world through the Revelation of Muhammad. The Excursion here titled **BETWEEN COVENANTS AND CHAINSAWS: NOAH AND THE FLOOD** takes a brief look further into that particular story.

⁸⁰ *ibid.*, p. 11.

⁸¹ Compare with "the lifting of the veil", or 'apocalypse'.

“Consider the sun. How feeble its rays the moment it appeareth above the horizon. How gradually its warmth and potency increase as it approacheth its zenith, enabling meanwhile all created things to adapt themselves to the growing intensity of its light. How steadily it declineth until it reacheth its setting point. Were it, all of a sudden, to manifest the energies latent within it, it would, no doubt, cause injury to all created things....”

This glorious melody reaches into Will, a soothing warmth to him.

“In like manner, if the Sun of Truth were suddenly to reveal, at the earliest stages of its manifestation, the full measure of the potencies which the providence of the Almighty hath bestowed upon it, the earth of human understanding would waste away and be consumed; for men's hearts would neither sustain the intensity of its revelation, nor be able to mirror forth the radiance of its light. Dismayed and overpowered, they would cease to exist.”⁸²

“Why don't the birds come stay here and sing? That finch flew away in a hurry, and this bird is far off up there somewhere.” Longing comes up in Will. “This garbage reality must not appeal to them.”

“They die here. The stench alone kills them. And when their songs appear in this place, those here try to catch and cage the birds, write their music in these books, enshrine them, protect them – but this place turns them into rotting mockery.” He shrugs. “You do not grasp the flows of meaning in your own brains. In the name of clarity and simplicity you pare and slice away essential meaning. Your dissections, analyses, deconstructions, lobotomies of metaphor leave you with what wraps around you here in this stinking heap.”

Will hears faint cries again.

Matt waves angrily at the entranceway. “Metaphors are as deep a problem for your understanding as are the hidden flows of interaction in your brain. You're immersed in metaphor as the fish swim in the sea – see, another metaphor! You breathe metaphors; these very words ring and resonate with them; the reader's mind grasps at them and draws them back to unveil comprehension.”

“You treat them as toys, but your new cognitive science has unveiled their deeper, utterly-essential character. When you hear ‘metaphor’, you think of poetry and rhetoric, of imagination and fancy – you think they're useless for practical comprehension. No! Metaphor shines through almost all of language.”⁸³

“Even mathematics and all those symbols it uses?”

“Everything! Say that someone ‘blew his top’ and you've used a metaphor. Say ‘a piece of cake’ to describe an easy task, and you've used a metaphor. Metaphors underlie the whole

⁸² Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, XXXVIII.

⁸³ See George Lakoff & Mark Johnson, *Metaphors We Live By* (University of Chicago Press. 2008 Kindle Edition), p. 3.

mind's processing of reality – they exploit your brain's dynamic wiring, down to the resonances of every word."⁸⁴

"Metaphor pervades and energizes every aspect of your social and legal systems. Metaphor, magic, myth, and paradox may seem nothing more than conceits, but those who grapple with the grubby details of everyday society know better than this."

"You make laws and debate them. Is a corporation a person? Is a patent a piece of land, to be staked out and defended? What is the body of a crime, the *corpus delicti* – is it just someone's body? In law, metaphors are everywhere, and they hold power to alter the realities of human life."⁸⁵

"Many of you think that the workings of law and justice are impenetrable, incomprehensible, and often wrong.⁸⁶ But your perceptions of life are themselves often incomprehensible and wrong, and in the legal collisions between one human perception and another you're compelled to use the most powerful tools you have to arrive at some shared sense of reality."

"Metaphors are vital tools of science itself. At the foundations of science is mathematics, and even at this deepest level, metaphor rules human thought. Look at this." He whistles loudly.

Two dancers, a woman and a man, wearing scruffy, tattered tights, glide in from the deep library of cries. A sinuous, dark melody winds its way behind them and they begin to move, tangling and untangling, pulsating to the rhythms rising around them.

"See? Sight, hearing, touch, memory – their brains connect different groupings of neurons to define a combined, more-complex idea: the dance." The dancers couple, twist, thrust, reach. "All this happens at the level of the neural impulses themselves, the flow of electrochemical signals taking place through the reaches from cell to cell. One bundle of signals comes from tapping toes, another from the rhythmic sounds of a song, and they flow together to bring you to your feet and hold out your hands to someone – a functional but unspoken metaphor, an invitation to dance – that generates an immediate response."

As the dancers move to the music, Will asks, "But... what does this have to do with mathematics?"

"Listen! Do you hear the themes, see the gestures, the poses? Do you anticipate the next notes, moves? Do they repeat?"

"Of course!" Will can feel it. "I want to move as they do."

⁸⁴ *ibid.*, p. 3.

⁸⁵ See Thomas Ross, *Metaphor and Paradox*, 23 *Geo. L. Rev.* 1053 (1989), quoted in Elkins, noted next.

⁸⁶ James R. Elkins, Professor of Law, West Virginia University. From a work-in-progress posted August 28, 1999 at <http://myweb.wvnet.edu/~jelkins/mythweb99/metaphor.html>. As of November 2020, the link no longer works.

"This feeling emerges from below your awareness, maybe some sense of an unending cycle, an unending 'now', and the connection generates a feeling of eternity, infinity. At that moment, you are starting to do some serious mathematics."⁸⁷

"No – I don't see that."

"In effect, that connection compresses an unending cycle of melody and dance into a single momentary entity that you know has a beginning and an end."⁸⁸

"But if I reach an end, how can I be at infinity?"⁸⁹

The dancers and the music stop. "The mind shifts from the concrete idea of a final resultant state – an end or stopping point of some repeating process – to the abstract idea of a 'final resultant state' that cannot occur in a concrete framework. That's infinity – even though it can't be seen or felt, it connects to what you can feel or see. From a living, open-ended, repeating process, your mind draws the metaphorical link to an abstract entity capable of application in mathematics. It seems paradoxical."⁹⁰

"Metaphor in science keeps drawing back one veil of comprehension to reveal the next. This takes you a long way beyond imagination, mysticism, and poetry! You are on a long and far-seeing journey, are you not?"

Will looks up at the rough-paneled ceiling of the landfill cave. "If I could get out of here and back up to the bridge again, that would help."

He smiles, and sadness rises over Will as he says, "Oh, you will be back there again – but not too soon. And you'll make the round trip many times."

Plummeting Into the Brain

The floor softens. Will sinks through layers of moist debris, flailing for a handhold. He clutches for Matt's hand, and they descend into a tangled, roiling, ozone miasma of what seems living rubbish. Darkness envelops them, relieved by electric flashes scutterings here and there at great speed, beetles of glitter combining in bursts of light that send entire weaves of new sparks off into the shadows.

"You like to believe in the profusely-blooming forms of your conscious understanding. You think they contain the meanings you grasp. But here you see what lives beneath."

"How deep is this?" They keep sinking.

⁸⁷ See George Lakoff and Rafael Núñez, "Where Mathematics Comes From: How the Embodied Mind Creates Mathematics", p. 42.

⁸⁸ *ibid.*, p. 160. We will take a closer look at infinity in general later on in this work, in the subsection titled **Second: Infinities**.

⁸⁹ Consider the calculus concept of the 'limit' of an infinite sum.

⁹⁰ The reader who wants more on this idea will find an illustration of matching the finite and the infinite in the Excursions essay **Axiom and Theorem**.

"We're still near the surface. This is the massive, invisible, inaccessible realm in each of you and in all of you." He flicks a hand out to catch a glowing ember, cradling it in his hand. It dims and expires. "The pulsing universe between your ears, all rich with meanings."

Will holds out a hand to a dancing spark, but it shies away to vanish. "But this is a mess! We generate meaning from forms we develop – mathematical, aesthetic, scientific, patterned. How did we produce the proof of the Four-Color Theorem? The clear supremacy of computers at chess and Go? Self-driving vehicles? The automated translation of so much human language? The–"

Matt stops Will, a hand up. They've stopped sinking through the dim entanglements of these strands of moving light. Indescribable smells entice and repel Will. Matt says, "It seems paradoxical. For these forms of thought and the brain that produces them, you have superb scientific and reasoned comprehension. But for both consciousness and meaning, you fumble and grope through fogs of supposition, unresolved disputes, and failed engagements."⁹¹

He gestures. "Look around you – 90 billion neurons, each with more or less a thousand synapses. But make simple shifts in language usage and context. Make seemingly-minor changes in the rules of games and mathematics. Grapple with the frustrating ways that physical reality disobeys the models of expectation you install in your automata. It all changes! True meaning keeps escaping you. Meaning is a lot more than models and forms."⁹²

Will asks, "How do we get from this electric... soup to the world of ideas and things?"

"Try combining a noun and an adjective. No matter how you try, you get ambiguities, misreadings, misunderstandings. What hope can you have for writing and reading when you try to communicate meaning?"

"But we do it anyway!"

"Indeed you do! But you don't appreciate the emergent results of the mind's underlying complexities. Deep in you, cooking in this stew, is some process of 'conceptual blending': the coherent drawing together of two or more input 'mental spaces' – scenarios – into a single, blended space."

"So what?"

"This blending generates meaning you can't find in either of the inputs alone. It's chemistry of thought – it gives you something new, a new molecule, a new substance of ideas."

"That must be rare and special."

⁹¹ See Gilles Fauconnier & Mark Turner, *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*, Basic Books 2002, p. 7

⁹² *ibid.*

"Not at all! It's essential to just about every layer of human cognition in every realm of awareness. Deep down, all the time, one's mind conjures perceptions into mental spaces, summons up memories in other mental spaces – look!"

Around them, lightnings flicker and flare, colliding, dividing, exploding, fading, in gusts and gouts of scent and taste and touch and color and tone. In a burst, it all gathers, radiates, fades into a dozen thousand racing scuttering tendrils, and begins again. Will gapes.

Matt chuckles. "You see? This runs and sings in the many tiers and spaces of your mind, unending, unstoppable, incomprehensible! All the incoming mental spaces come into coherence, and out come novel meanings and novel mental spaces. All at blinding speed. As you see here."

He goes on. "How do you think you are thinking? Usually, thoughts about thinking are just fables, fairy-stories about how you think."

Will slowly gathers himself. "In a mathematics lecture, a professor at the board lays out a complex proof step by step, each step constrained by the rules of logic and axiom, looking like the stones to cross a pond. It's a strict sequence of steps."

Matt laughs now. "But after the class ends this clarity fades into illusion. You know that! You study your notes and texts. You scribble ideas. Then, in no order at all, everything comes together in a flash, and the meaning of the proof emerges in your awareness."

"Well... I've had that happen, yes."

"But your brains were actively generating that flash from the moment the professor went to the board. In fact, it is often true that your brains were already at work on the flash long before the class even began. The flash is merely the happy ending of your self-told fable."⁹³

"Where does metaphor come into all this?"

"Think of metaphor as transformation, mapping – the flow along a bloom of dynamic, living connections. You compress time so that a lifetime can be seen as a day, with morning at birth and sunset at death. You compress space so that a traversal of a trail can be seen as a trace across a map. You map time into space, and vice versa. You map or compress analogies into identities. These processes of mapping and compression (or decompression) are deeply malleable in the human mind."

"In general, your brains use relations among mental spaces: change, identity, time, space, cause-effect, part-whole, property, and many others. In your intake of perception, you map and compress your perceptual content to create relations, pruning out the irrelevant, drawing in the related. You can even map the maps you make. It's exciting!"

"That's starting to sound like nonsense."

⁹³ Ibid., p. 57.

"Of course! When it all seems nonsensical, you can be sure you're nearing a deep idea."

"Convince me."

"All right. If you travel, you often use maps, right? They come in all sizes, and they cover all ranges of size. Sometimes a whole country's map has a legend or inset that identifies regional or state maps – and each of those might have a legend that identifies its city or local-area maps. Maps of maps."

"So?"

"So, hang on now. In mathematics, maps are orderly connections between elements of sets, taking many different forms, among them continuous functions (preserving order and connectedness), morphisms (preserving structure), fibrations (don't ask), and graphs (illustrating aspects of maps)."

"Fibrations? What are fibrations?"

"I said don't ask! Consider these words on maps as a first mental space. NOW..." He pauses, clears his throat, takes a swig from his juice bottle, passes it to Will, and Will gladly takes a swallow.

"Ay, that was good," Matt says. "In thought, maps are connections between mental spaces, connections that can be more or less orderly. There are many levels and kinds of order in both mathematics and thought, and again these can be mapped from one realm to the other."

"You're making it sound almost recursive, mapping maps of mathematics to the maps of thought!"

"Yes! There! The 'conceptual blend' of these two mental spaces shows you the unity and coherence of maps in mathematics and cognition: they make up a whole in their blend. Instead of an infinite regress of maps of maps of maps and so on, you arrive in a flash at an awareness of Map: a living process of existence that bridges your inner world and your outer world."

"Are there good examples of any of this?"

"Let's look at a couple of them. How about Zeno's famous paradox of Achilles and the tortoise?"

Achilles Chases the Tortoise!

Will recalls the paradox. "Achilles gives a plodding tortoise a head start, and they race. Zeno said that Achilles couldn't overtake the tortoise. Every time Achilles moved a distance, the tortoise advanced a fraction of that distance. When Achilles moved through that fraction, the tortoise advanced a fraction of that fraction. So how is this an example?"

Matt says, "In the mental space of the paradox, the tortoise stays ahead of Achilles. But the mental space Zeno uses relies on a mapping that measures time as a sequence of intervals, each interval a fixed fraction of the interval preceding it. As long as we apply this mapping to the movements of Achilles and the tortoise, the tortoise stays ahead. The paradox holds."

"I'm with you so far."

"Fine! Look at the mathematics. An infinite sequence of time intervals, each one the same smaller fraction of the one before it, has a finite sum. The sum can be mapped to a final, fixed moment in time."⁹⁴

"I'll take your word for it, for now. So what?"

"Our mental space of an ordinary race displays the *uniform* passage of time. Each second is the same size as the one before it. Add up the seconds, and they don't add to a finite sum – time just keeps on going. This is not the limited set of intervals Zeno describes. Now, combine the mental space of the limited-time paradox with the mental space of our ordinary idea of a foot race in uniform time."

"Oh!"

"So, you've seen in a flash that the moment of time we compute from summing the infinite series of intervals in the paradox is the very moment at which Achilles passes the tortoise in their race."

"Aha!"

He laughs. "There – you see?" Matt and Will trade swigs from the bottle, and the taste helps dispel some of the fetid odors in Will's nostrils.

The Tortoise Goes All Infinite Turtles

"Not a bad example. Got another one?"

"Turtles!"

Will laughs. "Now you're just free-associating, aren't you?"

"You've heard the story that our universe is carried on the back of a giant turtle, and that the turtle stands on the back of an even-larger turtle, which in turn stands on the back of another, and so on?"

"Sure! The 'turtles all the way down' joke."

"See, the mental space of this model gives us a repeating structure that is unending – infinite and eternal in spacetime. It's not just some joke. It has deep connections in philosophy, in its rejection of any first cause or Prime Mover, since such an entity would by

⁹⁴ For some fun along these lines, see the Excursion titled Convergence Chain Gang.

its character exist outside of that which it caused or created. It raises the question: What created this external entity in the first place?"

"Well, how do we develop a mental space that encompasses the entire question? That seems impossible as long as we stay in familiar mental spaces, familiar frames. Where there are turtles. We understand turtles."

Matt pauses, then says, "These frames include language itself, time and space, and all of your familiar mental spaces involving them. To get beyond these frames you have to strip the familiar away, because if you create any mental space (see that word 'space?') you're stuck with the same ideas we saw in the frame-with-turtles."

"Infinite regress, like a snake swallowing its tail."

"Yes, an assertion that has no end. In philosophy, such assertions have been disallowed since at least 2500 years ago."

"Why?"

"Think about it. Every exploration has a beginning and an end in this existence. This applies to ideas too. What if you kept generating a new idea every time you had an idea? Like the turtle explanation? It doesn't explain anything. Indian philosophers used the term 'anavastha' to name these unending situations. They ruled them out."⁹⁵

"Did that solve the problem?"

"It simplified thought, but then it caused other problems. The refusal to allow such endless regression let some try to prove the nonexistence of a Supreme Being."

"So there's a connection between endless regression and God?"

"You already saw with Zeno that an infinite sequence of smaller and smaller intervals can come to a finite limit. But an infinite sequence of same-size intervals has no finite limit. No end."

"So once we let infinity into the picture, we free ourselves?"

"At the expense of overwhelming yourselves – but isn't the universe overwhelming?" Matt gestures at the glittering electrical brain-hoard close around them. "Once you let infinity into the frame, you get recursion. You define an entity or process in terms of itself. If you like jokes, here's one: 'Dictionary definition: recursion: see the dictionary entry for "recursion".' The point of the joke seems clear."⁹⁶

"It does?"

⁹⁵ See <https://en.wikipedia.org/wiki/Anavastha> . In contemporary computer science, considerations of infinite regress feeds into questions of computability: does a given program ever finish running?

⁹⁶ At the moment of writing this paragraph, the author experienced the flash of insight that the subsequent paragraphs explain in detail.

“Here. You already have access to such mental spaces in the examples of fractal curves, in which each segment of a fractal curve is a smaller-scale replica of the curve itself. These curves were not a significant part of your mathematical world of ideas until the past century.⁹⁷ To draw a true fractal curve is impossible, since it has infinite length, but the process by which it is created is a series of steps in which each segment of the initial curve is made into a scaled-down image of the curve itself.”

The Snowflake Goes All Infinite

Matt weaves a series of patterns in the air. “Here are the first five stages in the production of one such curve, the ‘Koch snowflake’,⁹⁸ seen here as straight line segments all connected end to end and looped. To get from one stage to the next, you simply change each straight line segment into one with a wrinkle.”

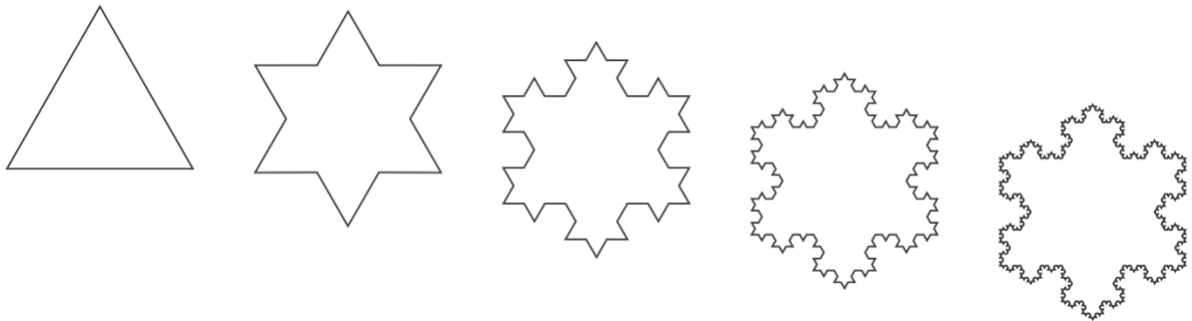


Figure 5- Koch curves, step by step

Matt continues, “Each of these curves has a finite length. The length of each stage is $\frac{4}{3}$ the length of the one before, so that the length of the curve increases without limit, even though the area enclosed remains finite.”

“Isn’t there some finite limit to the length of the line that surrounds the finite, limited area?”

Matt shakes his head. “You might expect a limit to that length, and in every step of wrinkling it up further, it *is* finite in length. But there is no final step of wrinkling – that’s the infinite part – and the length keeps growing past any given limiting value.”

“So it doesn’t converge to a finite value! Really?”

“Really! Pick a value.”

Will says, “A million.”

⁹⁷ Our mental spaces hold deeper patterns than we have explicitly explored to date. A tantalizing set of hints can be found in *African Fractals: Modern Computing and Indigenous Design*, a book by Ron Eglash. In it we can see among other things the fractal pattern of the entire Jola settlement of Mlomp, Senegal.

⁹⁸ Based on the Koch curve, studied by the Swedish mathematician Helge von Koch and described in his 1904 paper. Ordinary curves have tangents – a tangent is a straight line that touches a curve at single points without crossing the curve – but the Koch curve is one of a set of curves without tangents. This footnote is a tangent in another sense altogether, so we will stop here.

“Good! We’ll write it as 1,000,000, and start figuring. If we start with a triangle with each side one meter long, how many stages will get us past 1,000,000 meters (a thousand kilometers) per side? Each stage of wrinkling lengthens each side by one-third, so that we can calculate the lengths at each wrinkle-stage using multiplication.” Matt sketches in the air again.

$$\frac{4}{3} \times \frac{4}{3} \times \frac{4}{3} \times \dots$$

“The dot dot dot just means you go on without ending. Now let’s do some short-cut calculating,” and here a rapid-fire series of symbols issues from his fingertip as he says, “The ‘ln’ means ‘the natural logarithm, with e as its base’.”

$$\left(\frac{4}{3}\right)^x = 1000000 \xrightarrow{\text{implies}} x = \log_{4/3} 1000000 = \ln 1000000 / \ln \frac{4}{3} \cong 48.02$$

“Rounding up, that 48.02 tells us that we will take at least 49 stages of wrinkling the boundary to get past a boundary length of 1,000,000 meters. And that’s just one side of the snowflake.”

“Aha! So I can pick any positive number, no matter how large, and I can wrinkle my way past it – toward infinity! So if I straightened out the whole snowflake curve at the 1,000,000-meter stage for each side, it would wrap 150 times around the earth, even though the curve itself would still fit into a space one meter square!”

Matt says, “You now have a mental space you can blend with the mental space of turtles.”

Clicks and crackles around Will. He glances at the glittering mess everywhere, in which the flickerings now crawl, turtles with snowflake-adorned shells. Some of the turtles are tiny, and some look enormous. *This can't be what he means.* Will point at this strangeness.

Matt laughs. “That’s interesting! Hexagonal shapes for both turtle-shell patterns and snowflakes. You humans have such strange minds.”

“Wait. You’re not human?”

“For you it’s easier if I look human. Would a talking potato be better?” His form seemed to waver.

“Never mind! What do you mean by a blend of these two spaces?”

“I guess I’ll have to play a cheap trick.”⁹⁹

“All right.”

⁹⁹ Mathematicians love cheap tricks, and so do physicists. So do tricksters in general. A cheap trick can save your whole thesis, your career, or even your skin.

"First we shoo the turtles and the snowflakes offstage." He waves at the surroundings, and the creatures burrow off and away, leaving the flickering lights in dark debris we saw earlier. Will hears what might be chelonian grumbling. "Now – think of the sequence of whole numbers where you start with 1 and double the value each time: 1, 2, 4, 8, 16, 32, and so on."

1	1
2	$\frac{1}{2}$
4	$\frac{1}{4}$
8	$\frac{1}{8}$
16	$\frac{1}{16}$
32	$\frac{1}{32}$
64	$\frac{1}{64}$
...	$\frac{1}{\dots}$
∞	0

"Powers of two."

"Yes. Now make another sequence of their reciprocals: 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, and so on, the negative powers of two. Every number in the first sequence has its unique counterpart in the second sequence, for example, 64 in the first sequence matches $\frac{1}{64}$ in the second. Since the counterparts are unique both ways, we have a nice map."¹⁰⁰

"But... the first sequence gets bigger without any limit. The second sequence, though, has a limit – right? The limit is zero. So corresponding to zero for the second sequence is... infinity for the first sequence? The map has infinity in it?"

"Yes! And every value in the second sequence larger than zero maps to a value in the first sequence that is smaller than infinity.¹⁰¹ So we've got the whole map." He turns and shouts, "Turtles on stage! In pairs by sizes, as we rehearsed!"

"You *rehearsed* the turtles? Did you know I was coming?"

"Sooner or later, everybody passes through here. Some of you keep coming back. That bridge is hard to stay on." He turns to the wall of rubbish, it bulges, bursts, and the two one-meter-long turtles emerge, one on the other's back, shove their way through the opposite wall of glistening junk, and a space opens around them. Immediately two more turtles come surging across the tight space to the opening, a half-meter turtle atop a two-meter turtle that shoves Will rudely aside.

"Look out!" says Matt, and Will presses backward into the gooey wall as a four-meter turtle barges in with a $\frac{1}{4}$ -meter turtle on its back. As a monster head appears behind it, he yells, "What do I do now?"

"Get on its back and hang on!" And Matt and Will gain places astride the $\frac{1}{4}$ -meter turtle as its giant partner heads onward to line up beside the others. The bigger turtles follow with their tinier and tinier companions, the space keeps opening up onstage, and finally the stage itself begins doubling in size, slimy debris, electrical sparks, and glowing rubbish flying in all directions.

Ducking and shielding myself, Will peers out at an impossible emptiness and a line of turtles extending into darkness. By the twentieth turtle, the big partner is 1,049,576 meters

¹⁰⁰ One on one, with everything in both sets matched up, nothing left over.

¹⁰¹ Readers will find a disciplined and entertaining tour of the evolution of our human ideas of infinity in David Foster Wallace's book *Everything and More: A Compact History of Infinity* (Wallace 2010).

from head to tail, and its little partner, a mere sparkle in the darkness, is about one micron long, one fiftieth of the thickness of a human hair.

"Does this ever stop?"

"It's just a demo." Matt waves a hand, and the marching turtles halt. "Eventually we get beyond the size of your universe's room for stages, beyond all limits, and that's when we pair up an infinitely-large turtle with a zero-size turtle. This matches all the turtles to all the numbers in our sequences."

He grins. "Isn't mathematics insanely amazing? So now we start from the zero-turtle and work our way back up toward one, and our smaller turtles get bigger, just as in the original mental space of turtles. The bigger partner turtles get smaller as we go. When we reach a size of one meter for both, we are done matching."

"Now for the payoff. The big-turtle sequence doesn't fit anywhere in your universe, but the little-turtle sequence fits inside just one meter, the size of the biggest turtle in that little-turtle sequence. And every turtle in one sequence matches a turtle in the other. So now we can have a good show onstage of turtles, since each little turtle can be cast in the role of its big partner. Mapped! Shoo!" He waves a hand, the giant turtles all collapse to nothing, the space contracts with a snap to leave only the row of little turtles, from one meter long on down, facing Will side by side, shells touching, in a line two meters long.

"Look at their shells now," he says.

The one-meter turtle's shell has on it the shortest-length snowflake curve. The half-meter turtle has on its shell the doubled snowflake curve, and Will works his way on down until he can see that the zero turtle will be adorned with the infinite-length fractal snowflake curve.

He looks at Matt. "Have you compressed¹⁰² the entire universe implied in the big-turtle sequence into a single, blended, fractal image, turtles and all? It looks as if you've mapped my inner, mental world into coherence with my external world!"¹⁰³

He nods. "It's not turtles all the way down from one to infinity getting bigger. Now it's turtles all the way up from zero to one, and not separate, but all right here in this short lineup. We've traded infinity for complexity. All the rubbish here is like that."

"Like which?"

"Complexity. But..." and here he grins.

¹⁰² Compression is an essential element of the mental blending process, in this case letting us map the infinite to the finite.

¹⁰³ This narrative is cruelly oversimplified, because in a deeper cognitive analysis each of the steps listed here elaborates into sub-steps, leading through a far-more-wearisome exposition without revealing much more about the mental blending process being examined. This is as far as we need to go in tracing and explaining the flash of insight for our purposes.

"Oh. *Infinite* complexity. You haven't traded. You've just combined them."

"Now you can see through the rubbish. A little."

"How could we see all the way through it? Let it become transparent? It looks as if this endless exploration of ourselves and our universe can never be done."

"You invent what you imagine as gods and creators, only to discover that nothing you can generate in all your possible strivings will take you beyond your now and future reach – a reach which races outward with the withdrawing galaxies and inward with the particles vanishing into quantum smoke. Yet you can map outward and inward to each other."

The Brain Goes All Infinite

Far above them, beyond the vast swells of odoriferous debris, Will hears the faint, pure thread of the Nightingale's wondrous chant. Verse after verse, mesmerizing, enchanting, bursts into meaning. He holds his breath to listen.

"How bewildering to me, insignificant as I am, is the attempt to fathom the sacred depths of Thy knowledge!

"How futile my efforts to visualize the magnitude of the power inherent in Thine handiwork—the revelation of Thy creative power!

"How can mine eye, which hath no faculty to perceive itself, claim to have discerned Thine Essence, and how can mine heart, already powerless to apprehend the significance of its own potentialities, pretend to have comprehended Thy nature?

"How can I claim to have known Thee, when the entire creation is bewildered by Thy mystery, and how can I confess not to have known Thee, when, lo, the whole universe proclaimeth Thy Presence and testifieth to Thy truth?

A pause, and the song coils around the just-ended verses to enwrap them in light.

"The portals of Thy grace have throughout eternity been open, and the means of access unto Thy Presence made available, unto all created things, and the revelations of Thy matchless Beauty have at all times been imprinted upon the realities of all beings, visible and invisible¹⁰⁴.

"Yet, notwithstanding this most gracious favor, this perfect and consummate bestowal, I am moved to testify that Thy court of holiness and glory is immeasurably exalted above the knowledge of all else besides Thee, and the mystery of Thy Presence is inscrutable to every mind except Thine own. No one except Thyself can unravel the secret of Thy nature, and

¹⁰⁴ "... at all times been imprinted upon the realities of all beings ..." The reader will see this assertion mentioned again and again throughout this essay. It frames a central theme of the work.

naught else but Thy transcendental Essence can grasp the reality of Thy unsearchable being."¹⁰⁵

The fractal turbulences of Will's astonished, astonishing brain breed feverishly, generating in its dynamic mental spaces the faint awareness of all that is.¹⁰⁶

Lost in Metaphor

The electric mess parts. A team of unicorns pierces through a wall of wet wiring with their head-weapons, drawing behind them the Romani vardo. A small grassy meadow opens, sending up a storm of blackbirds; the walls of brain-trash draw back, the wagon's stage unfolds, and the players emerge, clad in garish glister and motley, to bow and preen and posture.

[CHRISTINE]: "What do you meta for?"

[WEBSTER]: "We meta for war! Battle! Conflict!"

[GREGORY]: "You **win and lose** arguments."

[WEBBER]: "You **thrash** out differences."

[GREGORY]: "You **knock heads**."

[WEBBER (he and Gregory draw blades, in expert swordplay)]: "You **parry**, you **thrust**, you **stab and slash** your way through verbal opposition."

[GREGORY (drops the sword, draws a pistol)]: "You **shoot down** ideas disagreeable to you."

He fires indiscriminately into a jellied mass that quivers and moans briefly, dropping to the grass.

[WEBBER]: "You **wrestle** with troublesome issues."

He takes an aggressive stance facing Christine, who wags a warning finger. He turns and winks at Will.

[ALICIA (smirking)]: "You **defend** a thesis."

[FROG in the GEEK CHORUS]: "Ibid. Ibid. Ibid."

[ALL (to the frog)]: "Shut up!"

[ALL]: "Violence, combat, and physical conflict! Built right in!"

[WEBSTER]: "War on drugs!"

[ALICIA]: "War on poverty!"

¹⁰⁵ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, from XXVI.

¹⁰⁶ See the Excursion titled **The Astonishment of Connection** for some mappings of these limitless mental spaces.

[GREGORY]: "War of ideas!"

[ALL]: "WAR!"

They leap from the stage, collapse the wagon together again, mount the unicorns, whip out brass horns, and ride madly off tooting, chanting, and jouncing, as the dripping rubbish mass closes behind them.

"Such martial splendor!" Matt reaches down to pick up a small, grubby ocarina, puts it to his lips, and plays a few slow bars of "When Johnny Comes Marching Home", ending on a mournful high note. He tosses the instrument aside, pulls out his bottle, and says, "How about a little refreshment, courtesy of Prohibition?"

In the spirit of the moment, Will takes a pull and hands it back. "I'll pay you when I get my relief check."

They both snicker, and echoing comes the laughing of far-off crows. For a few moments they stand and listen but now the drip of wet debris is all they hear, as the smelly, shadowed walls around them ooze slowly.

"How do I get out of here?" Will mutters. "I was on a bridge, going somewhere I can't remember. And birds... I heard sweet birds singing."

"You fell."

"Yes. I saw a man, or I think it was a man. On the bridge ahead of me. I loved him, but he was dead – all butchered and bleeding. The apple said things and I got very angry."

"You realize how this sounds when you say it aloud." As he speaks, he lowers himself to sit, and Will joins him, looking down at his own feet.

"I know." Will looks up. The wall behind them still supports them as they sit: now it is a long straight wall strewn with ramshackle boxes, tents, awnings, panels propped up, all dripping with moisture. A frost settles over Will. Facing him is another wall, its arches opening onto a seething brown river just below. Propped against both walls, listless, shabby-looking figures huddle, men and women and a few older children, not speaking, their breathing giving a susurrus layer, dotted with coughing over the rushing of the water, their heads bowed.

"They fell." Matt pauses. "I am their friend, their enemy, their sanity, their madness. They ramble, mumble, rave, rage, cheer, jeer, quarrel, and sing, unhinged, unremembering, unhoping, unalive. They fell, and here they stay. Do you want to keep their company?"

"I'm already here, so, yes. There were birds. They're... gone."

A woman slumps next to Will. She jerks her head up to stare him in the face, her eyes wide and flickering bright amber, then she hoods her gaze, looks away.

He speaks to her. "I'm... hello?" Names have disappeared, his own included.

She looks at Will again. Her eyes shine, almost gold, for a moment, then dim and darken. "Frog. It was a frog. He said... I don't remember."

"Was it 'Ibid'?" Will tries a small joke.

She blinks and waves a hand across her face, spitting out the words. "Footnote. Stay away. You keep interrupting. Stay away!" Her back is now to Will as she curls into a huddle, stage-whispers, *'His arms clung to his ribs, his legs entwining each other, 'till supplanted down he fell, a monstrous serpent on his belly prone'...* He's here, hissing like the river. He's the hissing river." She spits phlegm at the nearest arch across from them.

She glares back at Will now. "You aren't one of us. Where is your guide? The guides laugh and point at us."

He gestures at Matt. "He's here with me."

As if for the first time, she looks at Matt, and then horror fills her face. "No! He is no guide! Get away from me!" She scrambles and rolls, moving off past clots of shrouded figures slumped along the archway. Here and there some stir and peer at them as she plods painfully away.

Matt shakes his head. "She's right. I'm here as host, not as a guide. Do you remember the bleeding texts? These souls are the living blood, awakened failed beings of thought born of the electric chaos of the mind."

"Someone's mind? Are you speaking generally? Or...?"

"Your mind, maybe. Your author's mind, maybe. Or ..."

"Is there no difference? Are we buried in some abstraction of ideas? Is that what metaphors are? Do metaphors suffer?"

"Look around. Now that you're here, down from the bridge, this is home. Get used to it." Matt turns away and walks off along the line of arches.

Will follows. "This is just a dream, a nightmare! I don't belong here!"

"Then why are you here? You said you wanted to stay. You made this place, this world, in your mind, but now you want to be somewhere else. Then you could find a way to escape it. That won't happen. I have others to greet now." He goes to one knee, spins slowly around, and as he turns his form turns snake, slithering away so swiftly that he vanishes before Will can draw a surprised breath.

The slumped figures along the archway gather themselves here and there, wrapping blankets and plastic bags and chewed clothing against a moving mist, a rising stirring chill air. A tall thin man in a worn black coat moves near to stare at Will. His black beard, matted and damp, seems out of place. He looks too young for this beard, not even twenty years old. His stare fixes in some far distance straight through Will's eyes.

"Who are you?" Will asks. "You look familiar somehow."

He ignores Will, not moving, then reels back and turns away as if in fright.

"Come back," Will calls to him, "and talk with me." This scene, this boy-man touches memory in Will, who wants to reach him, to make him safe, to draw him out. Will steps towards him, but he has already faded into cold fog. A few steps, and he is not to be found.

It is 1961. Will walks along an Ann Arbor street at night. Four teen boys pass him, and one sneers, "He's a hairy one, huh? Look at that beard!" The others laugh.

Will mutters over his shoulder, "At least I can grow one."

In an instant they are all in front of him, and one of them starts toward him threateningly. He stands still, not saying a word, not moving at all. One of the others pulls back his aggressive companion. "Forget it. Let's just go." And then they turn again and walk off, laughing.

Will gets home to his college apartment. In the bathroom, he stares intently into his eyes in the mirror, his heavy black beard and mustache covering most of the rest of his face. In the beat of a moment, the mirror begins to suck him in. He retreats from it in terror, as if he has seen into cold fog, an older man approaching him, questioning him.

Will turns to one of the slouched figures, an old fellow, to ask about the tall young man in the black coat, but the old man twists away and hides his head. Will tries with others, but no one responds. Bitter sorrow seeps into him, to bring him to stillness standing in the cold. *I have been here before. Once, I lived here.* He look around for a place to sit down and stay. *Will I live here forever?*

"Chirp."

Wren and Rescuers

At Will's feet a small, bedraggled wren pulls its wing from a gluey mass of decayed pizza. Will kneels and gently separates the wing from the oily cheese, wiping the feathers as the bird raises its other wing to reveal gaps in its fledging. Cradling the tiny thing in one hand, Will stands up slowly. "What are you doing here?"

"Chirp." The sound is so soft it is barely audible above the river and the ragged breathing around Will. He holds the wren close to one ear.

"Quiet! I am here for you," it whispers. "He didn't see me. If I sing, he will cage me. If you speak, whisper softly to me, so he won't hear you and come back." The wren starts preening away stickiness.

"But he said this was – is – my brain doing all this, and I can't leave my brain behind. What are you doing here? Are you part of me too?"

The bird cocks its head, looking at Will with one eye. A crumb drops from its beak as Will holds it near his ear again. Its words come, barely tickling the ear. "Reconciliation of religion and science – is that where you began your journey?"

Will nods and waits.

"Uproot your language, your metaphors. Here in these strata of sorrow live the metaphors of conflict, contention, combat, alienation, hate, discord. Find your way to where the connections sing development and harmony. Not here. Not here!" The wren chokes, jerks in a spasm, and ejects a minuscule dot of blood.

"Can you guide me? I can take you from here to heal."

"Look for a crevice in the wall behind you. Think of growing things. Is there a spot in the wall where something is growing and bringing colors?"

Will turns and begins to search, his thoughts probing. *Harmony. A seedbed of ideas. The harvesting of profits. The growth of a company. A project come to fruition. Tuning up a working group, orchestrating a work plan, a counterpoint in a discussion, family harmony of a family, nourishing an invention.* "There!"

"Hush! Not so loud!" The wren looks at the straggling, dangling vine Will is touching, and opens its beak again. "Move it aside gently. Don't damage it or stress it."

Will teases the vine away to one side, and it pulses with light, briefly. Behind it a narrow gap widens slowly to show a chamber beyond the wall. Cradling the wren in one hand close to his chest, Will squeezes carefully through the widening entry. It oozes shut behind them.

"Look up," whispers the wren.

They are at the bottom of a great vertical shaft, its walls vine-woven with flashes and flickers sketching knots and tangles, a brilliant light warming its faroff top end.

"There. Look up there. You're here because you focus on catastrophe, chaos, and debacle in your tabloid imaginings. But when you bring your sights to the positive, nutritive, harmonizing choices you can make, you can learn to fly."

"Little wren, you've got the wings, but they're just for you. I don't have them. No wings here for me."

"Did you forget the wagon?"

"The wagon! Does it stop here often? Ever?"

"Try making a list. The wagon people smell lists and make music. Sometimes good music."

When the vine first revealed itself, Will was listmaking: the growth images, the music images. Crops. Orchestras. As the associations rise again to mind, he hears the whump, whump of great wings far off and coming nearer, bursting through and into the tall

chamber above him, circling down and down until the wagon stands before him, its unicorns shaking rubbish and dark juices off their great, shining horns. The wagon rearranges itself, the players dance out, the musicians take up their tune, and the song begins.

It's not some jumped-up infectious beatbox earworm. Its lyrics turn and slide slowly, gently, reflectively, almost ordinary speech but with insistent, attractive cadences and colorations.

*“Why do things we do work properly?
We people, all together, make them right.
Why are these proper workings hard to see?
Things working well fall quickly from our sight.
Why do we all so easily forget them?
Disasters overwhelm our best attention.
Do bad things mask the good ones and upset them?
That seems to be our primary convention:
To fixate on the wrong is very strange –
To turn to better, metaphors must change,
And only then we find the greater feast
Where chaos and despair have finally ceased.”*

The music fades gently as the musicians and singers vanish offstage. Silence, with only the soft melodic breathing of the unicorns, almost inaudible. Into this trace of exhaled music a high far note comes from the dimness above, the Nightingale's sweetness meekly falling to Will's ears.

“Consultation bestoweth greater awareness and transmuteth conjecture into certitude. It is a shining light which, in a dark world, leadeth the way and guideth. For everything there is and will continue to be a station of perfection and maturity. The maturity of the gift of understanding is made manifest through consultation.”¹⁰⁷

“In all things it is necessary to consult. This matter should be forcibly stressed by thee, so that consultation may be observed by all. The intent of what hath been revealed from the Pen of the Most High is that consultation may be fully carried out among the friends, inasmuch as it is and will always be a cause of awareness and of awakening and a source of good and well-being.”¹⁰⁸

The birdsong brightens, seeming to draw nearer, but it fades away. The little wren, revived, spreads its wings, calls out in tremolo, races up and off in pursuit, and is gone. A heartbeat later, the Warbler's trill comes to Will, and he closes his eyes.

¹⁰⁷ Baha'u'llah, from a tablet translated from the Persian, cited at <http://www.bahai.org/beliefs/universal-peace/articles-resources/consultation-quotes> .

¹⁰⁸ *ibid.*

"The purpose of consultation is to show that the views of several individuals are assuredly preferable to one man, even as the power of a number of men is of course greater than the power of one man. Thus consultation is acceptable in the presence of the Almighty, and hath been enjoined upon the believers, so that they may confer upon ordinary and personal matters, as well as on affairs which are general in nature and universal."

"Why am I hearing all this?" Will mutters.

"For instance, when a man hath a project to accomplish, should he consult with some of his brethren, that which is agreeable will of course be investigated and unveiled to his eyes, and the truth will be disclosed. Likewise on a higher level, should the people of a village consult one another about their affairs, the right solution will certainly be revealed. In like manner, the members of each profession, such as in industry, should consult, and those in commerce should similarly consult on business affairs. In short, consultation is desirable and acceptable in all things and on all issues."¹⁰⁹

The Warbler descends to circle Will's head, still singing. His eyes open, and Miriam is there with him, listening.

"The purpose is to emphasize the statement that consultation must have for its object the investigation of truth. He who expresses an opinion should not voice it as correct and right but set it forth as a contribution to the consensus of opinion, for the light of reality becomes apparent when two opinions coincide. A spark is produced when flint and steel come together. Man should weigh his opinions with the utmost serenity, calmness and composure. Before expressing his own views he should carefully consider the views already advanced by others. If he finds that a previously expressed opinion is more true and worthy, he should accept it immediately and not willfully hold to an opinion of his own. By this excellent method he endeavors to arrive at unity and truth."

"The investigation of truth!" Will repeats the words to himself, and Miriam shushes him.

"Opposition and division are deplorable. It is better then to have the opinion of a wise, sagacious man; otherwise, contradiction and altercation, in which varied and divergent views are presented, will make it necessary for a judicial body to render decision upon the question. Even a majority opinion or consensus may be incorrect. A thousand people may hold to one view and be mistaken, whereas one sagacious person may be right. Therefore, true consultation is spiritual conference in the attitude and atmosphere of love. Members must love each other in the spirit of fellowship in order that good results may be forthcoming. Love and fellowship are the foundation."¹¹⁰

¹⁰⁹ 'Abdu'l-Bahá, cited in a letter written by Shoghi Effendi, *To the National Spiritual Assembly of Persia*, 15 February 1922, *ibid.*

¹¹⁰ 'Abdu'l-Bahá, from *The Promulgation of Universal Peace*, No. 31.

The Warbler soars up and away. Will stands by the wagon as its actors pack things up. Miriam turns to him.

“Free yourselves from the prisons of your metaphors!” She gestures around at the vines, the flickering rubbish walls. Her voice turns melodious, cantatory.

*“All your writing feeds your consultations,
Your vital processes of human life.
This feeding flows historically in threads
And branches weaving many written works
And all your earnest tender conversations,
Exchanged and shaped among your many authors,
Down through long, unending streams of time.*

*“Inhabiting the greatest consultation:
The interchange of lasting human life.
You can't let warfare rule the ways you think,
The ways you speak and understand and act.
Right now, your metaphors of war and conflict
Poison your every mode of civil discourse.
The meanings of your very words do change:
War will dance about in mock of peace,
Murder will shroud itself to seem protection,
Destruction plays the bringer of salvation.*

*“You think you understand each other – you do not.
You make your words the weapons that destroy you.”¹¹¹*

Her hand clenches, then opens.

*“War makes glaring headlines,
Poisons its cratered rubble;
Peace makes copious fine print
Abides in fecund beauty.”*

She smiles. “Through the mighty flow of history past and future, see this discourse of humanity, as a conversation-and-consultation instead of contention-and-war! Reinvent your metaphors of society's workings! Then, the inner benevolence, trust, and harmony of your possibilities emerge and illuminate your existence. As you progressively replace contention with consultation, the greatest benefits of your global civilization will come to their fullest fruition.”

She takes a deep breath. “Want a sandwich?”

¹¹¹ See Hermann Weyl, *Levels of Infinity*, in *The Mathematical Way of Thinking*, p. 72.

Matt is nowhere to be seen. "Yes," Will says. She reaches in a bag dangling from a strap.

Webber appears from inside the vardo. "Hey! We can't stay here! The slime and vapors down here are peeling the paint! Let's go!"

As Miriam hands Will a small packet, he asks, "Will you be coming back soon?"

"No!" Webber says.

"Could you give me a lift?" Will asks without much hope. He wants Miriam to be near him.

Miriam turns to him. "A lift! Fibrations! We didn't sing that tale of maps!"

Webber glares at her. "You want to draw him up? He fell into this projection!" He brushes a flake of paint from his nose. "All those qualities of the bridge – can he find them again?"

"The bridge! I want to get back up there!" Will doesn't understand what they're saying. *Maybe they'll get me out of this pit.*

Miriam grabs Webber's arm and whispers, "At least let's tuck him in where he can't be seen. He might get to..." and the rest is too soft for Will's hearing.

Webber holds up a hand, thinks, and then nods reluctantly. "Oh, fine. In the trunk of old costumes," he says.

Miriam wrinkles her nose. "Come with me." She opens a panel, and she and Matt sidle down what seems a too-long hallway in the vardo's interior. She opens a cabinet, and points. "In that tin trunk. And you have to stay silent, no moving, no calling out or tapping or anything sending any signal. You'll get used to the smell."

Will opens the trunk's lid, clammers in, assumes a fetal position, and Miriam heaps faded, sweat-stained, tattered dance costumes over him. "Shhhh now," she says. Something heavy thumps onto the pile of costumes, the lid closes, the lock snaps. A jerk, a jounce, and a smoothing into the feeling of a ship riding a great sea. Unfolding Miriam's little packet, Will devours a sandwich of peanut butter and jam.

Nested Dreams on Holy Meaning

The flight seems long. Will reaches up through the tangle of fabric, wondering what landed on top. His hand grasps a stiff leathery bag, a portfolio in size, with a flap and a clasp. It bulges. He opens its clasp and from inside a stack of thick papers and parchments pushes out, some feeling sturdy, others crumbling slightly at their edges, a few falling to shreds.

If only there were light... Will eases one of the thicker leaves of paper gently out, running his fingers across its surface grained with pen and pounce and age. A channel of smoothness near one edge signals a line of text, and he finds one end of the line and taps the first mark lightly in the darkness, wondering.

Under his finger illumination blooms softly. A voice wells up from a whisper to a barely-audible chant. Words form in Will, not language he knows, but near-pure meaning distilled

into scales of notes too subtle for him, enchantment that frees him from language altogether: the birdsong of meaning.

The singing shifts through tiny shadings of pitch too subtle for him, microtonal, and its literacy lies teasing beyond his inner senses. Here and there, light pierces through and meaning blooms in the hoopoe's music.

"O People of the Scripture, why do you disbelieve in the verses of Allah while you witness to their truth?"¹¹²

"O People of the Scripture, why do you confuse the truth with falsehood and conceal the truth while you know it?"¹¹³

"Say, "O People of the Scripture, why do you avert from the way of Allah those who believe, seeking to make it seem deviant, while you are witnesses to the truth? And Allah is not unaware of what you do."¹¹⁴

The words fade in Will like mist, but coming from far outside this metal box, barely to be heard, the voice of the Nightingale frames and fills and brightens them again in a chant so powerfully glorious that he freezes utterly still to hear it.¹¹⁵

'By their sanction and authority, every Prophet of God hath drunk from the chalice of sacrifice, and winged His flight unto the heights of glory. What unspeakable cruelties they that have occupied the seats of authority and learning have inflicted upon the true Monarchs of the world, those Gems of divine virtue! ... Thus He saith:

"O people of the Book! Why disbelieve the signs of God to which ye yourselves have been witnesses?"

'And also He saith:

"O people of the Book! Why clothe ye the truth with falsehood? Why wittingly hide the truth?"

'Again, He saith:

"Say, O people of the Book! Why repel believers from the way of God?"

'It is evident that by the "people of the Book," who have repelled their fellowmen from the straight path of God, is meant none other than the divines of that age.'

¹¹² Qur'án 3:70, from The Noble Qur'án at <https://quran.com/3>.

¹¹³ Qur'án 3:71, *ibid*.

¹¹⁴ Qur'án 3:99, *ibid*.

¹¹⁵ Bahá'u'lláh, from the Kitáb-i-Íqán, at www.bahai.org/r/464611069. The passages quoted within this one repeat the Qur'anic verses from a different source translation by John Medows Rodwell.

The shining verses that rose under Will's fingers in the darkness sing again in new shadings in the Nightingale's purity of sound as he curls motionless in his hiding place, the swaying, rising, falling, and turning of the wing-lofted wagon lulling him to drift endlessly, dream within dream within dream unfolding.

He lies prostrate on a seething battlefield, the roars, crashes, stanches, and screams of butchery assailing him. He strains against agony to rise and see. His helm blinds him – he wrenches it bloody from his head, and two knights topple across him, both dead, one with the badge of the cross on steel mail, the other in the scale and cloth of Saladin's warriors. He sinks again.

He rides astride a kestrel now, far above green hills, and looks down as the textures of the trees and fields swirl and eddy and comb themselves into rows of... letters? Words? Squinting, he sees the treetops shift in the winds, spelling out meanings that persist in different shapings by the currents of air. The kestrel speaks.

"Beyond beauty, yes?"

"Yes," Will gasps. "But the words keep changing. I can't read..."

"Aren't all the words sprung from one source of meaning? All the branches and leaves of expression grown from the same trunk, the same roots?"

"Yes, but..."

"Then gather all your seeings of movement into what they share, and you will find the source, pure and holy." The kestrel banks gracefully in a circle, Will closes his eyes over tree-movements, and he reads, one line emerging from many.

"In the Name of God, the Compassionate, the Merciful..."

His heart skips a beat.

"Do you see now?"

"With my heart." He drifts again; kestrel and sky turn to darker cloud and dream within dream. Scratches of small creatures scramble among clots of dust and clutter in the dark spaces of the outer dream. Two thin voices contend.

[MOUSE]: "The Qur'án is untranslatable! If you wish to study it, it must be studied in its original Arabic."

[GERBIL]: "As desirable as this may be, is every student of Arabic up to the tasks of learning the entire classical form of Arabic in which the Qur'án is revealed? Can he learn fully the historical and cultural contexts in which its revealing is situated? Can he learn the literary, religious, and societal backgrounds to which it frequently refers? Can he embrace fully the great bodies of received clerical tradition in Islam?"

[MOUSE]: "I admit that such requirements *necessarily* restrict direct access to the Qur'án to those who undertake all of these efforts. But they are necessary!"

[GERBIL]: "Then they effectively hamper all others from gaining knowledge and acceptance of it except through the privileged few who can claim to have studied and understood the Qur'án and all its contexts adequately."

[MOUSE]: "Exactly!"

[GERBIL]: "Such restriction is unacceptable! Many who live in this world, outside such a restricted circle of claimants, can shed great light on the Qur'án's many meanings and subtleties. Many means and pathways are available through the many forms of translation and study we now have at our disposal."

[MOUSE]: "But that threatens –"

[GERBIL (ignoring MOUSE)]: "The efforts of authoritarians to control treatment of such important works as the Qur'án impair its potential for advancing human understanding of its sacred meanings, and comprehending its essential place in history."

[MOUSE]: "But..."

[GERBIL]: "I admit that the list of translations of the Qur'án into English is long, and the evaluations of the different translations contentious. Some use an older translation by John Medows Rodwell¹¹⁶ for the locations of the verses cited, although other translations are also used and noted."

[MOUSE]: "Rodwell! Bah! And the verse location citations vary from translation to translation! There are different numberings and orderings of the verses by different scholars."

[GERBIL]: "Still, we benefit greatly from having all of them."

[MOUSE]: "But that is incredibly confusing!"

[GERBIL]: "It can be. One English translation with a broadly-acknowledged superior reputation is Arthur Arberry's modern-English rendering "The Koran Interpreted"¹¹⁷. Well-recommended annotated translations include those of Maulana Muhammad Ali¹¹⁸, of Yusuf

¹¹⁶ John Medows Rodwell, *The Koran* (Bantam Classics reprint, 2004) – however one sees the quality of the translation here, it was one of the best available at the time of its use in the authoritative translations of Bahá'í works containing quotations from the Qur'án, and it is of use especially where Qur'anic verse citations appear.

¹¹⁷ Arthur Arberry, *The Koran Interpreted: A Translation* (Touchstone, 1996) – this work is acclaimed for its beauty, mirroring both poetry and meaning in a balance that makes it excellent material for English readers. Its verses are not numbered conveniently, however.

¹¹⁸ Maulana Muhammad Ali, *The Holy Qur'án with English Translation and Commentary (English and Arabic Edition)*.

Ali¹¹⁹, of Muhammad Asad¹²⁰, and of Seyyed Hossein Nasr and Caner Karacay Dagli¹²¹. A Website that offered comparisons at the time of this writing is that of the Middle East Forum¹²².”

Muttered nagging bubbles up from somewhere in Will's dreaming.

07734 Oh good grief. You can't resist, can you? Let's see – six more little wrinkles in your story, six more referential corridors to traverse into the mazes of language, and you leave it all buried in the page's underflooring. Putting all this into dialogue is just another sneaky attempt of yours to skip blithely past all the necessary work. Nice try.

The voice fades away, under the continuing conversation of MOUSE and GERBIL.

[MOUSE]: “I see. We are only discussing English here. A poor language for expressing the eloquence, poetry, and clarity of the holy Qur'án of Muhammad.”

Will senses the tingling of the earlier words he felt with his fingertip in the darkness of the metal trunk, the music of their passing through him. Longing fills him to inhale all their essences.

[GERBIL]: “We know the dangers. The Italians have an old and very compact saying that expresses the problem beautifully: ‘Traduttore, traditore’ – literally, ‘translator, traitor’ – to translate is to betray the meaning of the original. No matter how a translator may struggle, essential meanings can leak from the translation process and contaminating ideas can seep in. Nowhere is this a greater issue than in attempts to translate the Qur'án into other languages.”

[MOUSE (nodding)]: “That's what I'm getting at. On top of all this, people face constant barrages of misinformation, disinformation, distortion, and mistranslation of the Qur'án's content and meaning, along with general incomprehension of its cultural and social contexts. All of this burden discourages outsiders from embracing its essential thrust of truth. Few realize its many direct relationships to Christianity.”

[GERBIL]: “Unfortunately all too true.”

[MOUSE]: “So many obstacles! The usual religious biases of the Christian West. The fractious differences between Sunni and Shi'ih Muslim authors. The many and destructive political strifes that impede us. It looks hopeless.”

[GERBIL]: “One decent work which seems to avoid most of these problems is H. M. Balyuzi's *Muhammad and the Course of Islam*. Another excellent work is *The Religion of Islam*, by

¹¹⁹ Abdullah Yusuf Ali, *The Holy Qur'án*.

¹²⁰ Muhammad Asad, *The Message of the Qur'án: The full account of the revealed Arabic text accompanied by parallel transliteration (English and Arabic Edition)*.

¹²¹ Seyyed Hossein Nasr, Caner Karacay Dagli, Maria Massi Dakake, Joseph E.B. Lumbard, Mohammed Rustom, *The Study Quran: A New Translation and Commentary*.

¹²² Khaleel Mohammed, *Assessing English Translations of the Qur'án* (The Middle East Quarterly, Spring 2005, Volume 12, No. 2, at <http://www.meforum.org/717/assessing-english-translations-of-the-quran>)

Maulana Muhammad Ali.¹²³ One with more contemporary (and controversial) bite, is Karen Armstrong's *Muhammad: A Prophet for Our Time*.¹²⁴

[MOUSE]: "Armstrong? She's crazy. No, I don't see much hope here for mutual understanding."

An ANT pops up between the two, and they step back quickly.

[ANT]: "Interesting discussion!"

[MOUSE and GERBIL (together)]: "Go away!"

[GERBIL (haughtily, to ANT)]: "What do you think this is, some Disney movie? Cute little talking animals saying wise things? Glossy sweet melodies and magic twinkies?"

[ANT]: "Well, uh, look in the mirror. Oh, wait, you said twinkies – where are they?" (looks around, antennae twiddling quickly)

Silence.

[ANT]: "Never mind. I do hope for twinkies. But to the point, you might hope here for shared understanding."

[GERBIL (sniffing)]: "I see no contribution *you* might make to an elevated dialogue of this kind."

[ANT (airily)]: "The processes of translation and interpretation do not necessarily destroy the meanings expressed in their original source text or utterance. Every reading of the original, whether in translation or not, is in some way interpreted by its hearer or reader. When translation is required, the process of interpretation deepens in its complexity and challenge."

[MOUSE]: "Hmm. Sounds rather postmodern to me. But diverse impressions are necessarily left on different people, and that creates confusion."

[GERBIL]: "Postmodern? No, wait – I see what little Anty here is suggesting. In any sharing of understanding of a text, pooling of diverse impressions in an atmosphere of mutual consultation can often advance overall comprehension."

[ANT]: "No need to be patronizing. My kind has always been denied a voice in these complex topics. In this new day, though, there is room for all at the table."

[MOUSE]: "Ha! No more greasy floor crumbs for you, then, is that it?"

The mouse pauses to preen, keeping a wary eye on the ant.

¹²³ Recommended highly by one of the author's trusted reviewers.

¹²⁴ Karen Armstrong, *Muhammad: A Prophet for Our Time* (HarperOne reprint, 2007).

[GERBIL (sniffing)]: "I will persevere here. Any student of poetry who has participated in a discussion of a poem's meaning can agree. When we exchange ideas and impressions of what was written or spoken, we can come away from the exchange with much-deeper and richer understanding of its meanings."

[ANT]: "All right. How much more, then, can understanding be advanced when we partake of information from a source beyond ordinary understanding in general, and then work together to gain better grasp of its meanings, its resonances, and its implications? The Qur'án is such a source, isn't it? But now, new teachings offer those like me, who have been denied access, our own pathways to the holy."¹²⁵

[MOUSE]: "How can that be?"

Will shifts weight in the trunk to relieve a cramp in his leg. The thought of a tiny ant discoursing on religious literature with a pair of rodents brings him to chuckle. All three pause in their argument and turn to look out at him from the dream.

[MOUSE (looking at the other two, then at himself, then at Will)]: "Do you think this is funny, traveler?"

[TRAVELER]: "I... you're just in my dream, and that's in a dream, in another dream. Is something wrong?"

[GERBIL (also taking in the appearances of the three, and then Will's)]: "Even in your dreams you are insulting the wise?"

[ANT (doing the same)]: "At the very least you could have dreamed us as halfway-attractive beings! Look with your wisdom, whatever it is, on what you've done with us here!"

He skitters in a tight circle, his antennae agitated. Will wants to let go of this increasingly-testy exchange, but he blurts out words.

[TRAVELER]: "It's just a dream!"

[MOUSE]: "It's worse when we see how little you understand of the Qur'án and Arabic! You know nothing! Myriads of lives surrender themselves to exploring the mysteries of the Qur'án, in its original and unstained beauty and power, and here you come with nothing but English, and a great tide of ignorance to foul understanding! You treat the Sirát – the Right Path, the Bridge – as if it were dangerous and narrow, but that's not its meaning! The word's root says the path can be trodden without difficulty!"

¹²⁵ Shoghi Effendi, *The Advent of Divine Justice*, p. 46: "The Báb," 'Abdu'l-Bahá, moreover, has written, "hath said: 'Should a tiny ant desire, in this day, to be possessed of such power as to be able to unravel the abstrusest and most bewildering passages of the Qur'án, its wish will no doubt be fulfilled, inasmuch as the mystery of eternal might vibrates within the innermost being of all created things.' If so helpless a creature can be endowed with so subtle a capacity, how much more efficacious must be the power released through the liberal effusions of the grace of Bahá'u'lláh!"

[TRAVELER]: "But I found it has been changed, made clear! Isn't it true that Abu Sa'id wrote 'I have come to know that the bridge would be thinner even than the hair and sharper than the sword'? He meant the bridge over hell, didn't he?"

A moment of silence.

[GERBIL (to MOUSE)]: "He is quoting hadith."¹²⁶

[MOUSE, GERBIL, and ANT (together, to TRAVELER)]: "No one can change the Qur'an's meaning!"

[TRAVELER]: "But listen!"

The Nightingale appears again, singing:

"Take thou good heed that ye may all, under the leadership of Him Who is the Source of Divine Guidance, be enabled to direct thy steps aright upon the Bridge, which is sharper than the sword and finer than a hair..."¹²⁷

All three fall silent. Will waits, the Nightingale's song still reverberating.

[MOUSE]: "Power and authority sing to us. Where did this bird come from?"

The Nightingale circles back again, its tones pure light:

"O concourse of divines! Fear God from this day onwards in the views ye advance, for He Who is Our Remembrance in your midst, and Who cometh from Us, is, in very truth, the Judge and Witness. Turn away from that which ye lay hold of, and which the Book of God, the True One, hath not sanctioned, for on the Day of Resurrection ye shall, upon the Bridge, be, in very truth, held answerable for the position ye occupied.... And unto you We have sent down this Book which truly none can mistake...."¹²⁸

The three stare in wonder as the Nightingale rises away. Will's dreaming begins to coalesce, redefine itself.

[GERBIL]: "You have shown us a great gift. And now you can see us with better eyes."

The creature's form shifts and changes, he stands upright, shadowy robes enwrap him. He is a man, erect, noble, his face shining. Will glances from him to the other two, back and forth, and they take similar human form. One by one they speak, and as they do, they

¹²⁶ Abu Sa'id al-Khudri reported: We said, "O Messenger of Allah, will we see our Lord?" The Messenger of Allah, peace and blessings be upon him, said, "Do you have trouble seeing the sun on a day without clouds?"

Abu Sa'id said, "I have come to know that the bridge over Hell is thinner than a hair and sharper than a sword." (from Sahih Muslim 183, found at <https://www.abuaminaelias.com/dailyhadithonline/2021/02/11/sirat-thinner-than-hair/>).

¹²⁷ The Báb, *Selections from the Writings of the Báb*, Excerpts from the Persian Bayán, VII, 2.

¹²⁸ The Báb, *Selections from the Writings of the Báb*, the Qayyumu'l-'Asmá, from II.

recede in distance, their faces alight, their tones still penetrant but now calm. They glow side by side. Names come now to Will.

[ALNITAK (formerly MOUSE)]: "You see more clearly now, yes? The stars fill the sky with light, and the beloved of God fill the world."

[ALNILAM (formerly GERBIL)]: "We are named after stars¹²⁹ you may see, but we are only echoes of their light. God is most great."

[MINTAKA (formerly ANT)]: "Our labors for understanding serve the human world, even in our differences. God is the Ever-Forgiving, the Most Merciful."

Will is silent. His reverie begins to fade as he clutches for it. The tin trunk presses aches into his side in the swaying vardo's cabinet. Cries and shouts come, muffled by the costumes packed over him. Everything falls still. In his head, the Warbler returns to sing.

"Among these teachings was the independent investigation of reality so that the world of humanity may be saved from the darkness of imitation and attain to the truth; may tear off and cast away this ragged and outgrown garment of a thousand years ago and may put on the robe woven in the utmost purity and holiness in the loom of reality. As reality is one and cannot admit of multiplicity, therefore different opinions must ultimately become fused into one."¹³⁰

As the Warbler stops its music, a tiny chickadee's sharper tones pick up the theme, as the silence continues in the hiding place.

"Few people ever stand apart from their mental and moral environment and test its standards by any universal truth. What most of us consider 'thought' is merely an adapting of the common thinking to our personal advantage...."

"The spiritual consequences of this only become apparent when we reflect that while none of us would intentionally commit murder, we have made governments machinery for murder on the largest scale; and while none of us would starve the orphan or oppress the widow, we willingly grow rich upon the starvations that competitive industry commits day by day."

"For we make our swiftly fleeting powers serve that which is also fleeting, and so at the last we have created nothing which is able to endure. True independent investigation of reality leads to the investigation of our own being, and independence of self [from such] as passion and desire is the supreme independence."¹³¹

¹²⁹ These three names identify the three stars in Orion's Belt, in the constellation of Orion. They are also identified collectively as "the string of pearls", evoking their brilliance and beauty.

¹³⁰ 'Abdu'l-Bahá, *Selections from the Writings of 'Abdu'l-Bahá*, from No. 227.

¹³¹ Horace Holley, from *The Spirit of 'Abdu'l-Bahá, Part II*, in *Star of the West*, Volume 13, No. 7, October 1922.

The lid of the trunk rises open, the satchel of manuscripts is lifted away. Miriam clears off the costumery, and extends a hand to Will. "We've reached a resting-place for our fliers. Come join us when you wish." She turns and climbs steps into soft light.

Claws grip Will's shoulder, and the kestrel rasps, "The foundational belief in the immortality of the human soul! The ultimate melody! It endures across all of human time!"

Will uncramps his legs, wobbling to stand. "Immortality? Eternity?"

The kestrel continues, "The unending flow of accumulating scientific knowledge attests to the immortality of learning. Each of you, in this astonishing age, can now see both religion and science with wide-open eyes, your vision unobstructed by others. Explore the physical reality you see! You'll read in it the tokens of the greater reality that bestows this material world on you."

"Science is the foundation of your material advancement. But it offers more! It insists on independence of your researches from obstructions, distractions, and fancies. It couples all this with the dispassionate acceptance of evidence. It conditions you for examining religion in the same light. In this way you can conduct, in the little chickadee's words, the *'investigation of our own being'*".

The kestrel vanishes in a flash of wings, and Miriam calls, "Come on up. We have now set our stage for deeper exploration."

II. DREAMS OF WILD MATHEMATICS

The stage of the vardo is wide open. Will edges closer, behind instruments and floridly-garbed payers and singers getting ready in both wings. Two lutanists take up “Cielito Lindo”, guitars join in, and then the singers waltz onto the stage before a huge aggregation of creatures mythic, natural, and mongrel.

[AMARGURA (singing to the crowd)]:

*A mathematician named Abbott
Wrote a romance that suited his habits¹³²;
As in romance conventions,
It had two dimensions,
Which flattened out even its rabbits.*

[DULZURA (singing to the reader)]:

*“Why rabbits?” you’ve got to be thinking,
“Mathematical roadkill is stinking!”
No, it’s all metaphoric,
Though at times sophomoric –
Just read on without too much blinking.*

[AMARGURA, DULZURA, and ALL (chorusing in every direction)]:

*Aye, aye, aye-aye!
We all still bow down before Plato!
We worship the seasoning
Of his classic reasoning,¹³³
But that taste’s no longer so great-o!*

[EMBROLLO (to the crowd)]:

*Three things lie beyond Plato’s reaching:
Incompleteness sees all systems breaching,
And infinities build,
And fractals grow filled,
And now there’s so much more to teaching!*

[ESTRUENDO (to the reader)]:

*But don’t think we’re here to abuse you,
To berate, beat, and shame or confuse you,*

¹³² Edwin A. Abbott, *Flatland: A Romance of Many Dimensions* – this book by an educator, written in 1884, is a satirical take on class and status in a two-dimensional world, using geometry and metaphor to make its points, edges, and polygons. Conventional romance stories may be two-dimensional in a social, non-geometrical sense, but this tale is rich in allegory, metaphor, and a sense of our world as a shadow of reality, its confinement of space no obstacle to its considerable entertainment value.

¹³³ The 20th-century philosopher Alfred North Whitehead made a controversial remark: “The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato.” See Alfred North Whitehead, *Process and Reality* (Free Press, 1979), p. 39.

*Just hang on for the ride
And then you can decide
Just how much of this dance will amuse you!*

[ALL]: (chorus)

A few of the creatures in the crowd are sniffing, craning their necks, peering hungrily at the curtains hiding Will. He sneaks a look through a thin part of the curtain, trying to see more of them. A huge large spider, its palps glistening, swivels, scanning. Beside it an ichneumon – a tracker, looking like a mongoose – narrows its eyes and stares straight at Will, making him draw back slowly behind a few horn players waiting their turn.

A Relativity Limerick

"I'm not safe here," Will mutters to himself. "Why all the mathematics now? Where are we?"

A soft touch on his shoulder – he jumps. Miriam is there. She intones in a murmur, "Many think mathematics is abstruse, inaccessible, even fanciful in some of its more-arcane reaches. Such fancies swell that landfill into which you sank."

Will turns to her, avoiding any line of sight from the crowd. "Are those creatures out there bounty hunters for the landfill?"

She nods. "Any time you go astray, wander, or slip, you can fall, and then you are always their prey. But in fact mathematics is clear, accessible, and essential at the most fundamental levels of our human existence. It adds radiance to the bridge up there above, to guide your feet. If the ways and patterns of mathematics are changing, so is our very existence."

At their feet, a small girl plays with multicolored pebbles, creating complex patterns and structures and reckonings one after another by herself, the music and noise making no impressions on her. Miriam smiles. "Games, rhymes, languages, dances. Child's play – but in play, we find not only wisdom but advancement."

The singers, following a rousing "Aye, aye, aye-aye..." chorus, now adorned with the squeals, growls, and grumbles of the creatures, round back to another Cielito Lindo verse.

[ALL TOGETHER]:

*"There was a young fellow named Fisk
Whose fencing was exceedingly brisk.
So fast was his action,
The Fitz-Gerald contraction
Reduced his rapier to a disk."¹³⁴*

Miriam and the little girl look at Will. Miriam says, "We sing this, but it's a puzzle we talk about. You seem to understand it – you're nodding and smiling."

¹³⁴ Quoted (Gamow 1988). The author learned in adulthood that this is a PG-rated version of the verse.

From far beyond the first arrival of a bird at some window of Will's life, beyond years before, the verse awakens memory. "It's about the foreshortening effect on objects seen by an observer when the objects are traveling across the field of vision at a significant fraction of the speed of light. The sword moves very fast, so it looks very short."

Both Miriam and the girl raise their eyebrows. Will goes on. "The fencer is thrusting along the blade's length, but his thrust is so fast that the blade appears to a stationary witness beside the fencing-mat as if it has very little length at all."

"That's silly!" The girl laughs.

Will finds more memory surfacing. "In our everyday world, it is! But it reveals how extreme our world is when you watch any object or process moving across your field of vision close to the speed of light." He recalls more detail. "The 'Fitz-Gerald contraction'¹³⁵ mirrors the way our four-dimensional spacetime changes its appearance when observing movement at very-high relative velocities, for example, at 99% of the speed of light. The degree of the observed relativistic contraction of a rapier thrust at that speed would be impressive. I'll calculate it for you!"

Impulsively, Will starts sketching luminous characters in the air as Miriam watches, her hand on the little girl's head. "The exact formula for computing the Lorentz-FitzGerald contraction is:

$$\alpha = \sqrt{1 - v^2/c^2}$$

in compact terms," he explains, forgetting the stage and the musical performance roaring onward, "Here α is the proportion of contraction, v is the velocity across the observer's visual field, and c is the speed of light. So if $v = 0.99$ times c , or 99 percent of the speed of light, some calculating tells us that, approximately, $\alpha = 0.1411$, about 15% of the length of the rapier when seen at rest. At that speed, close to the speed of light, the rapier looks more like a dagger. I was a kid when I saw this equation for the first time."

Miriam, fascinated, asks, "Can the rapier's blade be made to disappear altogether?"

"No. The formula only gives real values for α when v is smaller than c . By increasing the speed of the thrust as close as possible to the speed of light, it can be made as short as one likes, but it always has some apparent length greater than zero. This is due to the way our universe is organized in its bindings of space and time. The speed of light is our universal 'speed limit'. This means that the v of the formula is never as big as the c , so that the α is always some value between zero and just below one."

The little girl pipes up. "What if v is bigger than c ? Faster than light?"

Miriam laughs. Will asks the child, "Do you like that formula I wrote?"

¹³⁵ More accurately termed the "Lorentz-FitzGerald contraction"

"Uh-huh," she nods.

"Well. If you make the v bigger than the c , and then you put them in the formula and compute the α , it is an imaginary number."

"Imaginary? Like a dream?" The girl cocks her head to one side, her eyes wide. "I'm dreaming right now, aren't I?"

Snuffling sounds near the curtain. But now Will is getting warmed up – that's what this magic of physics can do – and even though Miriam glances aside nervously, he plunges on.

More sketching, and he adds, "Changed length is not the only effect of movement at speeds close to that of light. Time and mass also undergo transformations that use α in its inverse gamma form, making them bigger instead of smaller." Another formula appears at the end of Will's finger in the air.

$$\gamma = 1/\alpha$$

"That γ , that's a gamma, can get as big as you want, when the α gets closer to zero. A tiny proton moving at 99.9999991% of the speed of light has over 7000 times its mass at rest. At that speed, hitting anything standing in its way is very destructive.¹³⁶"

Words come to Will in a rising torrent, his voice tones and cadences reshape themselves. "But compared to what the universe can throw at you, this is peanuts! Ultra-high-energy cosmic rays have been measured at well over **ten million** times the energy of such a fast-moving proton, indicating that they are arriving at speeds much higher than anything you can duplicate on earth. The fastest such arrival ever recorded, assumed to be a proton, struck with the force of a baseball thrown at the speed of a major-league pitch."

"Wow!" the two of them say together.

Will can't stop. "But such a strike unleashes a huge, erupting spray of other energetic particles. The arrivals of such high-powered cosmic rays at the surface of the earth are detectable only through these great showers they generate."

Just as he realizes that his voice is now Jeddin's, the curtain whips back, and a crew of predatory beasts confronts him. They burst out in noisy, grit-filled laughter. Miriam and the little girl have disappeared.

The cockatrice idles closer as Will avoids its gaze. It croons, "Ideas in mathematics and science interweave, making the two disciplines appear as one, you were about to say, right? They aren't the same thing, but they are so deeply entwined with each other that it is easy to keep both in mind as you venture onward. But we're waiting for you to fail, and when you do, we will feast on you."

¹³⁶ We can actually witness the effects of such collisions in our particle-physics experiments. There are about 238 proton masses in a uranium-atom nucleus, so the superfast proton hits a target as if the proton were a nuclear cluster of about 30 uranium atoms.

The beast is smaller than the others, calf-height on Will. It slithers a bit closer. He wrenches his eyes to its tail as its oily voice goes on, "Mathematics is the tasty skeleton, the science its flesh and blood, birthing you your living models of reality. Tasty. Do I know you? Look at me."

07734 I must protest that you have dismally failed to note that the use of these cryptic alphas, gammas, Bethes, whatever, and the formula-aggregates of these one-symbol marks should be considered the seeds of metaphors! Noting such points is the purpose of good footnotes!

So here I am, once again, clambering up here into your narrative to bring you to account. Be warned – I am not a "good footnote"! I will be back!

I will not look in the eyes of the cockatrice, I will not... But now its slick voice croons as it winds catlike around Will's leg.

"Your statistical and patterning processes – superb – gather, organize, and evaluate evidence. They breed out into your vast family of mathematical tools to spawn and spin evidence into those living models. Gamow's little book illustrates the point quite well. Does it not... Jeddin?"

On the sharp sound of the name, Will's gaze goes unbidden to the beast's eyes, and he is frozen to stone.

Out

Will is caught in the dreamlike gap between one persona and another. Childhood memory: He's paralyzed. His breath has stopped. *If I can just cross one way or the other, I can start breathing again.*

He tries to move. Nothing works. Panic rises in the darkness. The beasts, the curtain, the stage, the musicians are gone. He can almost move a hand. An arm jerks. His body flails briefly, and at last his chest heaves up, gobbling air.

He scrambles up and stares around. At his feet lies Jeddin, this time gray and drained of life, his wings flung like rags across his body. A touch on Will's arm starts him into a spasm.

"It's all right." Miriam's soothing voice. "Follow me." She leads Will in the darkness along a narrow corridor over a creaking floor until they pause, and she draws Will ahead of her. "Go now," she says, and shoves him out into emptiness.

Fourth Fall

Falling? Again? Will braces himself for another splash-arrival in the landfill of chaos.

He is in the plane in 1954, in the thunderstorm over eastern Tennessee. The storm is intense. The usual warm July updrafts billow at its core, and just outside them drop the sharp cold downdrafts of rain, hail, and snow. The pilots bank this way and that, trying to see their way through without getting tangled in these shearing winds. Over the roar of the engines, squeals and sharp cracks cry out the stresses on the plane's airframe.

Will slams back and forth. Shouts and cries of pain rise through the noise. The big engines, working hard, strain at their mountings.

The turbulence and thrust tear one of the engines from its wing, hurling it away along with most of the wing itself. Will wedges himself between seats, hanging on with every lurch and plunge. Driven by the remaining engine on the other wing, the plane begins to slew and then spin laterally, falling off to its unsupported side. In the cabin, chaos crowns itself king. Then all is gone.

With a thump, Will feels feather-scales under him. He flails and grapples to find balance, the roots of great beast-wings now surging up and thrusting down behind his knees as he clings to a great pterosaurian neck. They emerge into cloud and then into a flow, an interpenetration of wonders, among far-wheeling birds of free, sunlit air.

A great bird shining red and green, violet and blue, familiar from the earliest stage of this voyage, rises high and away, its song forming into raw meaning shredding into moist and sparkling cirrus.

"What is happening?" Will mutters. "The plane... That bird..."

The great beast he rides, gliding easily in the frigid mountain air, turns its head to fix him with a large bright eye. "Get yourself a grip!" it rasps in contrabass. "Onward to the playground of the spirits!" It banks sharply into a tight descending spiral toward peaks and crevasses of an endless span of mountains.

"Playground of spirits? What is that?" In growing dizziness, Will tightens his grip.

"Mathematics!" The pterosaur flyer's voice booms. "You owe everything in civilization to mathematics, from prehistory to now. Your finance, that's numbering. Land ownership, that's geometry and logic. Navigation, that's spherical geometry, trigonometry, and algebra. Weight and measure, that's all about calculus. Much more, all in the playground, the toys and patterns of a child."

"The playing child makes things happen. Surprises! Turn over a rock, see your first beetle! Break a rock open and find an amethyst geode. Leave a trail of crumbs for ants and follow them back to an anthill. Use a stick as a lever to lift up a tree trunk. Line up your pebbles and count them, name them, arrange them! Play advances your precious human power." The voice is resonant, commanding. "Look down! Look down!"

Beneath them a mountain valley widens, its verdure spreading out into a sweep of rich greenery and variety, a great river fed from the mountains and hills at either side of the wealth of life.

The flyer continues, "Until very recently, your kind roved in the narrow passes, defiles, and slopes of mathematics, finding wealth but only in parts and pieces, disconnected and incoherent. But now! Look at this great living realm that is bestowed on you! Now you

humans explore altogether-new and utterly-strange worlds of mathematics!¹³⁷ These worlds were for the most part uncharted, unknown to humanity before the 19th century.”

“Even their names seem alien to most of you: topology and chaos theory, developed by Henri Poincaré in the 19th century. Non-Euclidean geometry, developed by Karl Friedrich Gauss, Janos Bolyai, and Nikolai Lobachevsky in the 19th century. Set theory, developed by Georg Cantor in the 19th century. Computability theory, developed by Alan Turing and Alonzo Church in the 20th century. All in the past 200 years of your time.”

As the creature speaks, hints of light seem to flicker back and forth in the green land, as if lightnings of thought weave connections and nourishments here and there.

Will's mind wavers. “My time? Are we in my time up here in the air?”

“Up here? Where is here? What is your time?” The beast gives Will that one-eye-aside look again.

“Don't you know? You're the flyer.”

The wingbeats accelerate. “Goodbye now.” It sinks in the air, abruptly arches its back, and tosses Will off into blue and green emptiness.

Children of Proof

He awakens in a knot of bushes and vines, scratches all over him. Untangling adds more scratches and abrasions, until he comes out bloody onto a faint trail of packed dirt winding through the vegetation under a bright green canopy.

At least it's not the landfill. Will takes a deep breath and start off along the trail, ragged, oozing a little blood here and there, the tingling and stab of cuts and slashes nibbling harshly at his attention.

He comes out of a thicket. A high voice calls, “Who are you?”

A mid-teen girl emerges onto the trail ahead from behind a great tree. Two boys, then another older girl. All are dressed in everyday shirts and slacks, but the cloth colors shimmer uncertainly as if unstable.

“I'm a traveler. I fell off a bridge a long time ago. I landed here after wandering around.”

The older girl speaks. “If you walk here, you are seeking realities.”

“Realities? I just want to get back onto the bridge. What am I doing here?”

¹³⁷ For example, see Leonard Wapner's *The Pea and the Sun: A Mathematical Paradox*, CRC Press, 2005, in a discussion on Kurt Gödel's Incompleteness Theorem, where he quotes (pp. 33-4) from John Barrow, *Pi in the Sky*, Clarendon Press, 1992.

She grins. "You tell stories, do you not? But how do you share your sense of the truth with your reader? Storytelling is easily done. You create its elements out of your imagination. But does it correspond to some shared reality of your world?"

"I hope so, but –"

"So you must create maps between your stories and the world in which you live. You create proof of the truth in your stories. Isn't that what you do?"

Will looks around, all the strange creatures and realms and situations of this, this dream, nightmare, vision, journey of birds, hells and havens, all whirling in his head. "Right now, I'm not sure. Who are you and what are you doing here?"

All the children laugh. The older girl says, "I am Manaia." She points at the taller boy. "He is Nikau. His brother there is Wiremu. Our sister is Ataahua." All nod briefly in turn.

[MANAIA]: "These maps between stories and realities take many forms, and for the best proof of truth, you use all of them in your efforts."

[WIREMU]: "You reason with logic, deduction, and induction."

[ATAAHUA]: "You gather evidence in the form of anecdotes and statistics."

[NIKAU]: "You apply intuition and sense of pattern."

[MANAIA]: "You study the proofs, reasonings, and intuitions of others. You test the results obtained from all of these processes. You compare, correlate, and contrast the results of combining all these modes of proof, combining them to generate understanding of the reality. Then you communicate your understanding and the basis you developed for it in your proof processes."

She starts walking ahead, the other three follow, and Will trails after.

[MANAIA]: "Come with us, follow us here. Proofs make good maps to realities. But proof is a social process. Your natural human tendency is to rely most heavily on the processes of proof that you like best and find most convincing. You tend to dismiss other kinds of proof that may contradict the results you get from your favored approach. But the best proofs arise out of consultation, when you pool your insights and proof processes to obtain the best and most-conclusive results."

Proof Mathematical

[WIREMU]: "Mathematical proof relies most heavily on the use of logic, inference, deduction, and induction, often with sets (collections) of objects and ordinary arithmetic at the foundations of the proof process. Such proofs are uniquely accurate, powerful, and convincing. But you must stay within the realm of the mathematics and its assumptions – its axioms – that constitute the context for the proofs."

He stops to admire a moth on a yellowing leaf.

[WIREMU]: "Once such a proof is firmly agreed upon, its results can be taken up and applied in the disciplines of science without further debate or doubt about its validity. Within its range of applicability, it is unassailable and perfectly predictive, granting specific and accurate anticipatory potential to its users."

He starts walking again – he and Will have fallen behind the others.

[WIREMU]: "This power comes with an important reservation. The range of applicability of a specific proof has strict boundaries beyond which it cannot necessarily be applied. Much of your history of science, and indeed of mathematics itself, tells you what happens when you try to make a proof's result apply outside the range for which it was proved."¹³⁸

"When a proof fails to apply in unanticipated conditions, the field of the proof enriches and grows. For example, when it was discovered that Euclid's parallel postulate could not be proved purely from the rest of his axioms of geometry, the search for a new proof led to the discovery of NON-Euclidean geometry."

He exaggerates the "non" with a flourish.

Will likes this. "Logic, inference, deduction, induction, using sets and simple arithmetic. Is that a good summary of the parts of this process?"

Proofs of Evidence

Now little Ataahua falls back to walk with them, tossing her hair back.

[ATAAHUA]: "It's the beginning. But how do you decide on your assumptions, your axioms in the first place? When geometry began, people were looking at their farms and their buildings. Lines and points seemed important."

She draws a line with her toe in the trail dirt, then a square with a dot at each corner, and she executes a ballet piqué to land sur les demi-pointes, rising onto her toes at a corner of her square.

[ATAAHUA]: "Evidence! Evidentiary proof is the type of proof most often used in social and judicial processes. It gathers its force from attested events in reality: those occurrences upon which witnesses and records can agree."

She punctuates her next words with a series of entrechats.

[ATAAHUA]: "The greatest force of evidence derives from the compilation*, classification*, analysis*, and structuring* of information concerning a large number of relevant events. Statistics!**** Evidence!"

¹³⁸ For a wonderful exposition on the process of proof, the book by Imre Lakatos, "Proofs and Refutations", examines the evolution of Euler's polyhedra formula from its simple beginnings onward through generations of mathematicians. The reader comes away with a humbling sense of how 'obvious' does not mean what at first one thinks it means.

07734 Now, really! Asterisks?? Are you writing or just doodling to show how the four things make up the one? You'd better not do this again, or I will pour scorn on you from your own pages. You lazy-

She repeats her piqué, nodding to Wiremu.

[ATAAHUA]: "Statistical analysis requires the use of elements of mathematical proof, but its meaning comes not as much from a logical chain of reasoning about numbers and sets, but instead from a preponderance of evidence concerning events."

Now a series of arabesques unfolds, and she bows.

[ATAAHUA]: "An accumulated pattern of such events leads to an inference concerning future events, granting anticipatory potential to the users of statistics to a degree proportionate to its mass and quality of evidence."

She raises both arms in a graceful port de bras.

[ATAAHUA]: "At its simplest, evidentiary proof relies on anecdotal evidence, attested and witnessed. You love vivid anecdotes, but you dismiss statistical evidence contradicting these stories. And yet you should examine anecdotal evidence carefully to see what it may imply."

She changes places with Manaia.

[MANAIA]: "Scientific discoveries come from experiments gone wrong, when the results defied the accepted statistics and logic used in creating and running the experiments, and when the result's seemingly-bizarre character brought new insight to the experimenter's thinking. This kind of occurrence is a 'black swan': a surprising event that resulted in a major change in perception and a major revision of thinking."¹³⁹

She grins, as Ataahua moves her arms slowly in a few great wingbeats.

Proofs of Anticipation

A dreamy look on his face, Nikau waits for Will as the others move on along the trail.

[NIKAU]: "You can't set aside the collection of intuitive, metaphorical, perceptive processes by which one derives likenesses, differences, patterns, and pathways."

[ATAAHUA]: "Evidence again!" Ataahua calls back. Nikau laughs.

[NIKAU]: "A tracker follows a creature in the wilderness. A sailor reads the sky for the coming weather. A sensitive person has a dream giving insight into a deep personal, social, or technical problem. A physician applies all of his or her abilities to derive the condition of a patient. No statistics here - but evidence of a different kind."

"Hardly conclusive proof by itself," Will says.

¹³⁹ See Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, (2007)

[NIKAU]: "No. But you depend heavily on intuition. It guides, shapes, and defines your individual and collective reality. Different societies apply these processes in different ways, but you all share in their use. Combine intuition, metaphor, and perception with other kinds of proof, and you arrive at the most-powerful grasp of reality, and then you gain the greatest degree of anticipatory potential for directing your actions in the future."

"That word 'anticipatory'. Must be a theme on this trip." Nikau ignores this.

[NIKAU]: "Poets and lyricists draw on intuition, perception, and metaphor to convey truth, where mathematical and statistical proofs are useless. The same is often true for prophets and revealers of human insight in general. Matters of the human mind and awareness, without physical manifestation, must rely on this form of proof above the others."

He moves off with the others as Manaia waits for Will.

Whakapaka

As Will comes toward her, he recalls the flight he began with poor Jeddin, so long ago and far removed: soaring across an unending range of human terrain, trying to make out the details of far-off domains in that infinite realm, trying to see the connections and dynamics of those domains as they interact.

[MANAIA]: "We are not suggesting the establishing of specific proofs here – we are gathering perceptions that can feed into the processes of proof we need to apply. As we keep walking – what a fruitful, innocent place! – you'll see that the organic synthesis of your various ways of proving matters will give you your best readings of your reality."

She spreads her arms.

[MANAIA]: "Marvelous, ingenious, beautiful connections relate these methods of proof! But they operate at different levels of your awareness. Mathematics offers you the most rigorous and painstaking approach. It is primary. Science, with its broader embrace of statistics and evidentiary methods, relies on mathematics. Religion, with its sensitivity to intuition, metaphor, and inner perception, relies most heavily on those inner forms of proof, but religion also finds proof in evidentiary and even mathematical forms."

Smoothly she turns, drawing Will after her to the three other young ones awaiting them.

[MANAIA]: "Here's that theme 'anticipatory' coming in again. Proof in all its forms serves an anticipatory function, imaging the reality of the deeds and actions that its result demonstrates or models. The most potent proofs satisfy logic, evidence, and intuition all woven into one."

Will's curiosity rises. "I have to ask you something. Your names are unusual – where do they originate? What you're telling me is so rich! It awakens me. Could you tell me a little more about yourselves?"

[MANAIA (laughing)]: "We are Maori companions.¹⁴⁰ I'll give you just one taste of our world – it's a world as rich as your own – but then we must send you on your way. If we drew you into our world's wealth, you would never continue the travels facing you."

"But how will I learn enough?"

[MANAIA]: "How would you ever assimilate all the worlds in this short time now passing you? Just let me give you the one gift you need for now."

She raises both arms, twisting her hands high, and the air above them spins upward, becoming a double spiral of trails of white wisps shining and dancing in the daylight.

[MANAIA]: "Here you see what we call whakapapa! The connection, the guide, the genealogy of the world, of all of us, of what you call 'DNA'. Its line upward is that of advancement, progression, over time, through cycle after cycle of life. It maps into every aspect of our existence. Its duality defines symmetries we find in all of life."

Will stares at the living strands of mist. "More, please!"

[MANAIA]: "No. You're about to dive into some mathematics, but when you dive you will find a great deal of intuition emerging."

She takes a stance poised for a plunge into water.

"Not again! I keep falling all the time!" The first landfill plunge comes over Will in recollection.

[MANAIA]: "This dive is not a fall. You choose its way down and in, and when you are ready it will let you rise free. Now here you go."

"But –" Manaia disappears. As the path rises around Will, he comes to stillness with a rabbit, its coat ivory-toned with orange and brown detailing on sides and ears, giving him its best leporine gaze from beneath a nearby bush.

"It's all obvious," says the rabbit.

A Family of Many Rabbits

"Oh, it is?"

A slight nod as the rabbit's ears twitch. "Yes. Mathematics asks the simplest of questions, so very simple that you look at the question as if it were a harmless little pet rabbit and respond with 'Isn't the answer obvious?' The mathematician then goes to work and shows us just how big the rabbits are, how fast they breed, and how deep the rabbit hole goes. Let me introduce you to a few of my family. I'm their mom."

"Does this mean falling again?"

¹⁴⁰ Theirs are Maori names favored for children.

"Not at all, Follow me down my burrow." She turns and Will follows her into a dimly-lit opening under the bush, where five of her offspring greet her with "Aiti! Who is this creature?"

"He's a traveler," she says to them.

"Your name is Aiti?" Will asks.

Rabbit laughter.

[AITI]: "It means 'mama', but you can use it too. Now, Yksi, tell us your simple question."

The young rabbit, the nearest, peers at Will.

[YKSI]: "What happens to parallel lines on a curved surface like the surface of the earth? That's about the shape and character of space itself."

[AITI]: "Non-Euclidean geometry, yes? Now Kaksi, yours?"

The next young one speaks quickly.

[KAKSI]: "What doesn't change when we change the shape or size of an object or a structure? This one makes a lot more rabbit-holes."

[AITI]: "Topology's simple question. All right, Kolme. Your turn."

Kolme pops up to stand.

[KOLME]: "Can we predict the future accurately with computation? No! And then there are more rabbit-holes than Kaksi's question gives you."

Kaksi's nose twitches.

[AITI]: "Never mind! Chaos theory! Now you, Nelja!"

The fourth little rabbit hops quickly in a circle.

[NELJA]: "How do we compare collections of objects and collections of collections of objects? And then what happens when the collections are infinite?"

[OTHER SMALL RABBITS]: "That's TWO questions!"

[AITI]: "Shush! Set theory does this to counting. Now you, Viisi."

The smallest rabbit squeaks a bit, and looks slyly at the others.

[VIISI]: "Can I look at a program of actions and see whether it will run forever or stop at some point? In other words, will some particular rabbit in the warren ever stop digging holes or breeding new rabbits?"

[AITI]: "Computability! There you have five examples of simple mathematical questions! Do you see any pattern?"

Aiti turns to Will.

"No! It's all over the place!" As Will shakes his head, all the rabbits laugh. "And I've never heard names like yours – you're rabbits, right?"

[AITI]: "Our names are Finnish, just for you. In Finland learning takes new, profuse, integrated forms, especially in mathematics."

Will smiles, "Profuse. Like rabbits?"

[AITI]: "That seems a bit rude. Let's get back to our discussion. Is there any part of any of our five examples that doesn't change when everything else changes?"

Aiti and Yksi on a Small Planet

Will looks at Yksi's question first. "There aren't any straight lines on a curved surface, are there?"

[YKSI]: "No, but there are geodesics: lines that trace the shortest paths between two points on the surface. Those are more general than straight lines, because straight lines are geodesics on a flat surface."

Will picks up. "So when we talk about something called a 'space', it might be curved or flat, then. That means curvature can change." Heads nod, and he keeps going. "But wait. When we lay out a map on a flat table, the straight lines on the map can be made parallel so that they would never cross, no matter how far we extended them in either direction." Everything around them vanishes, and Will's map spreads out flat under his feet, extending into mist.

[AITI]: "Is the world of your map flat, like this map?"

"No. It's a globe, like a sphere."

Aiti gestures with a paw, the map contracts, and they all stand on a little planet no bigger than a hot-air balloon, perfectly spherical. Their feet rest on its one small green continent. A dandelion cluster springs from between Will's toes. A tiny person wearing a circlet of gold slips behind a toy tree and vanishes.

[AITI]: "Careful! Don't stomp around!"

Will looks down as lines appear to mark latitude and longitude. "So... that means I have to use geodesics, right? The Equator is a geodesic, and so is a latitude line through the North and South poles. Pick any two different ones of the geodesics on the Earth, and they meet in two places." Some random great-circle lines – geodesics – appear as he speaks. "I can see that on a curved surface there are no straight lines, but geodesics trace the shortest paths between two points on the surface. On my flat-world table, geodesics for the map are straight lines, but only on my table."

[YKSI]: "Then your earth has a sphere-like shape like this world's, which has positive curvature. Any two separate geodesics on the surface of the earth meet in exactly two points. That's as close as you can get to parallel lines on a positively-curved surface."

"Does this mean that there are negatively-curved surfaces? What would that mean?"

Aiti gestures again. A flurry, and the planet under their feet spreads out, expanding into a smooth-sloped mountain pass. Where they stand at the top of the pass, the slopes lie above them on either side, and down behind and ahead on the pass trail.

[AITI]: "We're on a nice negatively-curved surface. But rabbits don't spend much time up in places like that. We usually leave that to the marmots." She twiddles one ear.

Will traces a geodesic that follows the path through the pass, and then he picks a separate point somewhere up along a mountainside. "I can trace any number of different geodesics through that point that do not cross the path, right? They just wrap around the mountainside both ways."

The rabbits nod, their ears back.

[AITI]: "So you have three kinds of geometry, one for each kind of curvature. When you study them separately, you pick one of the three and make that kind of curvature an axiom, an invariant. Yksi, will you summarize?"

[YKSI]: "Draw a line, and then mark a point that is not on that line. If you are drawing on a flat surface, you can draw exactly one line through the point that does not cross the line you drew first. If you are drawing on a positively-curved surface, you can draw no such line at all, since any two lines – geodesics – will meet in two points. If you are drawing on a negatively-curved surface, you can draw an infinite number of different geodesics through the point that do not cross the geodesic you drew first. So pick: positive, flat, or negative curvature. You can make the choice an invariant: a fixed assumption that simplifies your studies."

An idea comes to Will. "Let's see the flat map again." He takes up the big map and crumples it into a tight ball. "Does this change the map's curvature?"

Aiti shakes her head back and forth, and then raises a paw. The map leaps from Will's grip, expanding wildly until they are all grouped around a tiny inscribed triangle. Aiti smooths out the map where the triangle is inscribed. The triangle's corners are just as they were when the map was flat.

[AITI]: "So... no. If you draw a triangle in a two-dimensional space like your map, measure its three angles, and add them up, the total is 180 degrees. That is the sum in a flat space. But even if you roll the map into a scroll or crumple it into a ball, those three angles will still add up to 180 degrees. No change."

"So the space itself is flat, even though from outside it looks messed up."

[AITI]: "Yes. We're describing *intrinsic* curvature. You can measure it within the space itself. If you try the triangle measurement in the space, the result will tell you which if the three applies. If the total of the angles is less than 180 degrees, that space is negatively curved. If the total is more than 180 degrees, that space is positively curved."

"Can I turn a space with one type of intrinsic curvature into another type?"

[AITI]: "Not without stretching, squeezing, or wrinkling it. And if you do any of these things, you are changing the metric (measurement) character of the space. Distances on a map don't match up consistently with the corresponding distances on the globe."¹⁴¹

"Then what do you call the kind of curvature I get when I roll up the map?"

[AITI]: "It's called *extrinsic*, where the subject space you are studying is sitting in a higher-dimensional space, and from that bigger space you can see curvature of the subject space even though it may be intrinsically flat (or curved). For example, take a sheet of paper and curl it up into a tube. The curvature of that curl is extrinsic, but if you were living inside the sheet of paper you would measure a triangle's angles within the sheet as summing up to 180 degrees. It's an intrinsically-flat space."

"If the globe were made of paper I could crumple it up and it would still be an... intrinsically... positively-curved space, then, right? Even with all the wrinkles?"

[AITI]: "Yes! Inside any wrinkle, any triangle you draw would still have its angle total over 180 degrees. Thank you, Yksi dear. You can go have a snack."

Yksi hops away. The space around them mists up and then returns to its original sweet greenery, with little clumps of yellow marsh marigolds here and there.

Will concludes, "If we study only spaces with a specific type of curvature, we can make that choice an axiom, and ignore all the other kinds of spaces and the complications that come with them."

Now Aiti turns to her little ones again.

[AITI]: "Kaksi? You've been waiting patiently! That's not like you – you're always digging! It's your turn now!"

Kaksi Stretches and Squeezes

Kaksi, bounces up to Will. She stomps her rear foot, and Will's square map appears, floating next to him: the familiar Mercator projection of the whole earth.

[KAKSI]: "Now try to stretch that map over this sphere point for point."

Above the map a sphere pops up, like a beach ball.

¹⁴¹ Think of a Mercator map, with everything near the poles all stretched out east-to-west.

"That should be easy," Will says. He grabs the map, and stretches it around the sphere equator to equator, joining its left and right edges, and then he compresses the top and bottom edges to fit to the poles. But no matter how he compresses, these two edges won't shrink to points – he ends up with little knots at top and bottom. Everything else matches up exactly. It frustrates Will. "If I just poke holes in the spherical surface at the poles, I can make it work."

[KAKSI (chittering)]: "But then it's not a spherical surface any more. Every point on a sphere is exactly like every other point, but the points around the holes are edge points – they have points next to them that are not part of a sphere's intrinsic surface."

"Well if it's not a sphere any more, what is it?"

[KAKSI]: "If you study topology, your joined map is just like a cylinder. It has two edges, and it wraps around, and it has two surfaces. A spherical surface has no edges, it wraps around, and it has two surfaces, inside and out. The difference is the edges."

"But I stretched and compressed the map into having intrinsic positive curvature, like a spherical surface with two holes. Originally the map was flat."

[KAKSI (hops in place, impatiently)]: "Curvature doesn't matter here. What matters in topology is connectedness. If the points in one space are connected to each other in a certain pattern, and the points in another space are connected to each other in the same pattern, the two spaces can be deformed – stretched, compressed, or reshaped – into one another without adding or taking away anything."

Will asks, "So does every point in one space have exactly one corresponding point in the other?"

[KAKSI (hops in a circle)]: "Yes! You've got it! Topology has a name for this equivalence of two spaces. It's called **homeomorphism**. Homeomorphism sorts out the spaces, even lines and surfaces, that can be mapped into one another so that every point in one space corresponds to a point in the other one. For example, the flat map is not homeomorphic to the globe of the earth because exactly one point on the globe has no single corresponding point on the flat map."

"But when I wrapped the map around the globe, I ended up with two such points."

[KAKSI]: "That's because of the way you wrapped it. If you plop the globe on the map, you can wrap everything until you're down to one point on the globe that won't match to a point from the map."¹⁴²

"I'll take your word for it." Will sighs. "So now stretching and squeezing don't matter."

[KAKSI (nodding)]: "That's right, but connections matter here. In topology, a coffee mug with a handle and a donut are the same. They are homeomorphic. Each has one hole. But a

¹⁴² The gnomonic projection has exactly one point that will not map.

coffee mug with one handle and a coffee mug with two handles are different – not homeomorphic. One hole versus two holes.”

“So I can stretch and squeeze a space, like a surface or a volume, into different shapes. If all the different shapes are homeomorphic, that means they are the same?”

[KAKSI]: “The way to say it is that homeomorphism is a topological invariant.”

“A lot of fancy terms!”

[KAKSI]: “Language matters! Properties like the number of holes in a space or surface preserved through a homeomorphism are called invariants. They let you classify spaces into collections having different properties. Then you can set up axioms – assumptions – to study them independently.”

“You’re a very smart little rabbit.”

[KAKSI]: “I know.”

The others all giggle. Kaksi ignores them.

[KAKSI]: “In topology, the more important thing, the invariant, is how points, lines, planes, and volumes are connected. Now I have work to do.”

She scurries off into some ferns, and Will hears faint sounds of digging.

[AITI]: “Kolme!”

The third little one leaps straight up in the air, flips awkwardly, and lands on his nose.

[AITI]: “You were napping, weren’t you?”

[KOLME (brushes aside a bit of soil)]: “No I wasn’t! Kaksi is so full of talk I had to, uh... let some of it go by.”

[AITI]: “Well! Now that you’re with us again, share your delights with our guest here.”

She gives him a little maternal rabbit smile.

Kolme, Butterflies, and Chaos

Kolme wobbles over to Will and looks him over. Will raises a hand in greeting as Kolme blinks a few times. Will asks, “Are you all right?”

[KOLME (softly)]: “So sudden! I was... resting, and now I’m here! Oh, of course – a phase transition, a flip. Things flow along, and then there’s a jump.”

Will nods. “I’ve had a lot of that lately, but mostly sudden falls. Unpredictable.”

[KOLME]: “That’s part of my playfield. Predicting unpredictable events. Well, in a way.”

“Tell me more.”

[KOLME (gathers himself for a moment, still blinking)]: “Maybe you want to see what the weather will be a year from now? Everything changes from day to day, and weather details are unpredictable. What can you say about future weather with any certainty – in other words, what if any invariants exist in your world’s weather? This is in the field of chaos theory. Invariants in chaos theory can be hard to see, but they emerge from the great patterns and cycles that alternate or transit from one to another over long stretches of time.”

He wiggles his long ears and a tangled pair of thready loops coalesce in the air, making Will back off a bit.

[KOLME]: “Here is a trace of the Lorenz attractor system¹⁴³. Each point in this collection of lines – one looped line, actually – represents a different state of the system.”

Will looks closely. “So if I identify three dimensions for this trace, like up and down, left and right, in and out, each dimension could be some specific measure like temperature, time, altitude, or pressure. Then a point in the diagram would have a specific value for these measures.”

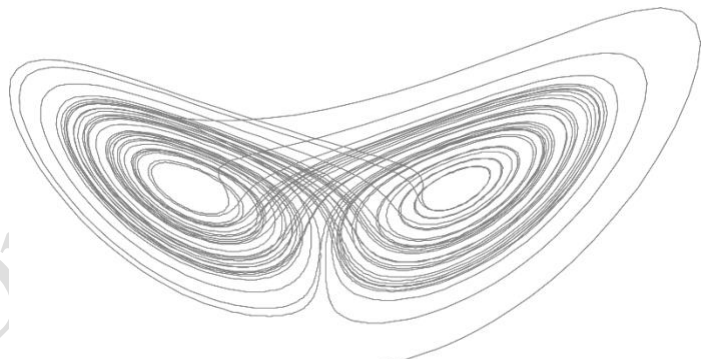


Figure 6- The Lorenz attractor

[KOLME]: “Yes.”

“And two points close together would have nearly the same values. What about the lines?”

[KOLME (slowly)]: “The lines are the flows from point to point over time. They show a pair of cyclic behaviors (changes of state) that alternate unpredictably from one big loop to the other and back again over the course of many cycles without alternation. This system’s cyclic behaviors center around two **attractors**: sets of values describing the system’s typical behavior patterns.”

Will studies the trace. “It’s like the spread wings of a butterfly, isn’t it? Reminds me of the ‘butterfly effect’ – the generation of infrequent and sudden jumps out of small changes.”

[KOLME (nods)]: “Each area showing part of the trace here shows the expected flow from one point to the next. Most of the traces stay in the same loop, on the left or on the right. A close look at this image shows places where the trace leads all the way from one of the two major loops – ‘attractor cycles’ – to the other. This kind of sudden transition identifies chaotic systems.”

“Are they all like this one?”

¹⁴³ From Wikimedia Commons via https://upload.wikimedia.org/wikipedia/commons/f/fb/Lorenz_attractor2.svg.

[KOLME]: "Oh, no! Different chaotic systems may have different numbers and types of attractors. If we choose to study only the Lorenz systems, we can make that choice an axiom, defining the Lorenz attractors as invariant. Then we can ignore all the other kinds of dynamic systems there are. And there are a lot of them!"¹⁴⁴

"But they all have these loops with jumps from one to another?"

[KOLME]: "Many of them do. But a more-complete answer includes some topological twists, and if you can ever manage to follow Kaksi down one of her mazes of holes, you can find some interesting chaos there."¹⁴⁵

Now Will's head is swimming with ideas. "Can we see any clear examples of how this field gets used?"

[KOLME]: "Studies of the chaotic dynamics of your global weather led you to improved weather predictability with El Niño and La Niña, letting you know in advance that the likelihood of precipitation and other effects would change radically each time these large-scale phenomena made transition from one to the other."

[AITI]: "I see Nelja getting impatient. Here, Kolme – a bit of yarrow. Now go dream and rest from the chaos!"

The fourth little rabbit jumps past Kolme as he takes the flowers.

[NELJA]: "Sets!"

Kolme, Butterflies, and Chaos

[AITI]: "Slow down now. Our guest is getting overloaded, I think. Skip past the details and give him the essentials."

[NELJA (gives a high-pitched groan)]: "Oh, all right. But you'll see. He'll start asking questions, and then... well, you'll see."

[AITI]: "Never mind. Viisi is still waiting patiently. If you get started, not even he can predict when you'll stop."

A little snicker from Viisi behind Aiti.

[NELJA]: "How many members does a set have? A key invariant in set theory is **cardinality**: the number of members it has. Some sets are bigger than others. Some infinite sets are bigger than others as well."

"Wait!" Will says. "You'll have to explain that to me."

[NELJA (looks to Aiti)]: "You see? Already!"

¹⁴⁴ See Steven H. Strogatz, *Nonlinear Dynamics and Chaos*.

¹⁴⁵ To dive (a lot) deeper, take a look at the paper "Chaos Topology" by Robert Gilmore, Christophe Letellier, and Marc LeFranc, online at http://www.scholarpedia.org/article/Chaos_topology.

[NELJA (looks back to Will)]: "If you choose to study only sets of finite cardinality, meaning that you can count the members of each set, you can make that choice an axiom. An invariant. Then you can ignore infinities altogether."

"I guess we could do that," Will says.

[NELJA]: "That's the way you did a lot of mathematics until calculus (and then Cantor) came along. It made little difference to you when you are counting the raisins in your breakfast cereal, but it makes a critical difference when you are trying to prove that calculus works."

"What do you know about Cantor?"

Nelja looks at Aiti, who lowers her nose a bit.

[NELJA]: "Did you forget? Again? Well, all right. Georg Cantor was the founder of modern set theory. He demonstrated that infinite sets come in different sizes. So if you take the set of all of the whole numbers from one up to infinity, that set is smaller than the set of all the points in the line segment marked from zero to one. And that's just the beginning."

A creepy feeling comes over Will. "What if people don't believe in infinity of any kind? Most people don't think about things like that."

[NELJA (fixes him with a rabbit stare)]: "Most of you people don't think. Not beyond your breakfast cereal."

"You seem to be interested in our cereal here. Why? Is that a rabbit thing?"

[NELJA]: "Never mind! The infinite challenges your thinking, your imaginations! Even some mathematicians fought against Cantor's ideas when he introduced them. But finally his work became essential. David Hilbert said, 'No one will drive us from the paradise which Cantor created for us'.¹⁴⁶ And even then, others resisted. Ludwig Wittgenstein, a philosopher, said, 'If one person can see it as a paradise of mathematicians, why should not another see it as a joke?'¹⁴⁷ But it works! It looks nonsensical, but it works! You'll see – but not here. You have a long journey ahead of you."

"How do you know that?"

[NELJA]: "You ask questions, and you listen to the answers. And you dive down our rabbit-holes."

All the rabbits laugh.

[NELJA]: "That will keep you traveling through all kinds of strange places."

Viisi Dreams of Waking

Viisi is the smallest rabbit. She is nibbling at a yellow blossom.

¹⁴⁶ Hilbert, "Über das Unendliche", *Mathematische Annalen*, 95 (1), p. 170.

¹⁴⁷ Wittgenstein, *Reflections on the Foundations of Mathematics*, Vol. 7

[VISII]: "I play with infinity all the time. Infinite fields of infinite flowers. I dream about them."

Will turns to Viisi. "But you stop dreaming long enough to be here with me."

[VISII]: "In this dream of yours, that is true. But I'm in an infinite number of dreams, and in some I myself am only dreaming."

Will asks, "So if I have a dream with a different Viisi, or someone else has one, how can I tell whether the dreaming Viisi will wake up and talk to me?"

[VISII]: "You can ask me while I dream, and I will tell you even though I don't wake up. My eyes will still be closed."

"So even though you'll stay asleep, you'd be able to assure me in a limited time that you won't wake up. Or that you would."

[VISII]: "Yes."

"Wait a bit. So if you start muttering while you're asleep, telling me that you will wake up, which do I decide if you just keep talking in your sleep and don't wake up? Do I decide you'll wake up, or that you'll stay asleep?"

Viisi blinks rapidly several times, and chooses another blossom to taste.

[VISII]: "Then there isn't much to be gained from listening to me in my sleep, is there?"

"I could wake you up myself with a little poke."

[VISII]: "That would take me away from my dream-flowers! They're so much better than these! Why would you do that?" And Viisi stops her nibbling, closes her eyes, and goes to sleep.

[AITI]: "In your former waking existence – and I think you have one somewhere back in this tangled voyage among birds, animals, demons, avatars, and performers – you wrote computer code, yes? What did you get from Viisi's words?"

"They reminded me of the famous Halting Problem in computing. Can I look at a program and its input, and decide from that whether or not the program will ever stop running?" It appears that I can't decide."

[AITI (nodding)]: "Now you've met a few of my children. I could keep introducing you to more and more of them, and most of them have children of their own, and the same for generations ever young. But you do not have any more time with us."

Back to Miriam, the Vardo, and the Beasts

Everything around Will rescales and reels, from rabbits and blossoms to Maori children and maps on to pterosaurian flight and a nasty slam into floorboards backstage in the Romani vardo, with Armagura singing lustily:

[AMARGURA (still in Cielito Lindo form)]:

*There's an axiomatic rabbit
Who is popping out theorems from habit,
She says, when asked why,
With a wink of her eye,
"Opportunity knocks, and I grab it."*

Everything hurts. Jeddin's corpse is gone. As the choruses go on, and the crowd of ugly creatures joins in, off-pitch, Miriam's touch falls on Will's shoulder.

"So you've come back. What is that on your jacket? Rabbit fur?"

Will dusts himself off. "That and a lot more. It seems to me that theorems and axioms generate more theorems, the way rabbits generate more rabbits. It seems useful to create separate communities of axioms and theorems, domesticated by logic. They bring us the sustenance of insight and application, the way farmers domesticate and use livestock for food and other useful products."

"And I visited metaphors and their unique power. Wow." Miriam nods, and Will bursts out with questions. "What is the point of these strange new kinds of mathematics? Didn't we get all the mathematics we needed from the ages before these things started appearing?"

"No." Miriam sweeps an arm across in front of her and back. "The longer answer requires that you look around at the world in which you are now immersed, utterly alien to the world of two centuries ago. The realms and connections of mathematical thought facing you today give wings to your advancing thinking and understanding. When you conceive an idea mathematically, you amplify your grasp of the world itself, even if the idea may seem silly or fantastic."

"Do you have an example?"

"Yes, Jed- uh, my friend. Here." She gestures, and on the back of the stage curtain nearest them an image of a Cartesian coordinate diagram appears.

Expansion of Ideas

She gestures at the floating diagram as numbers appear along the zero lines, and then she sweeps back and forth

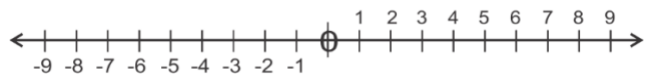


Figure 7 - The Number Line

along the horizontal axis. "On this line are the real numbers, the everyday ones we all use. Numbers look fairly simple. You add, subtract, multiply, and divide them. You compare them. You take powers of them, meaning that you multiply them by themselves a certain number of times. You transform them in all kinds of ways. Given a number, you try to find out what number, multiplied by itself, returns you the number you're given. The number you find is called a square root."

"I learned all this in school when I was a kid."

She moves her finger to the right of the zero. "Innocent enough." Her smile widens, and Will feels attraction to her. "But then someone asked the question: What if the given number is negative, like minus-one (-1)?" She points to the left of the zero. What number multiplied by itself gives us minus one? "When that question was asked at first, no one could answer it correctly or sensibly."

"Are the rabbits back? Am I going down a rabbit hole here?"

"More like climbing out of the hole you fell in when you asked the original question."

Miriam smiles, and her eyes seem to Will like wells of light. "Every number needs a second part to answer the question well. You invent the answer to the original question and call it i . Then you define the answer: i times $i = -1$. Then you set your breeding question-rabbits to work, and you build the **complex numbers**."

"That name makes them sound mysterious."

"The name is misleading. It reflects their beginnings, when their discoverers explored their alien-seeming properties and grappled with all the implications. Early on, the square root of minus one wasn't even seen as a number, and it was called **imaginary** – a clue that it baffled those who found it. That's where the i came from, to signify that value."

Miriam's excitement rises. "For centuries, people avoided algebraic equations for which solutions were not expressible in ordinary real numbers. They even rejected the possibility that there was any meaning in complex numbers. Avoided! Rejected! Then Leonhard Euler in the 18th century,

Karl Friedrich Gauss in the 19th century, and others analyzed and advanced the field.^{148,149} Now these complex numbers are firmly established in your world, and they explain for you processes and structures you engage every day, from magnetism and electricity to quantum mechanics."

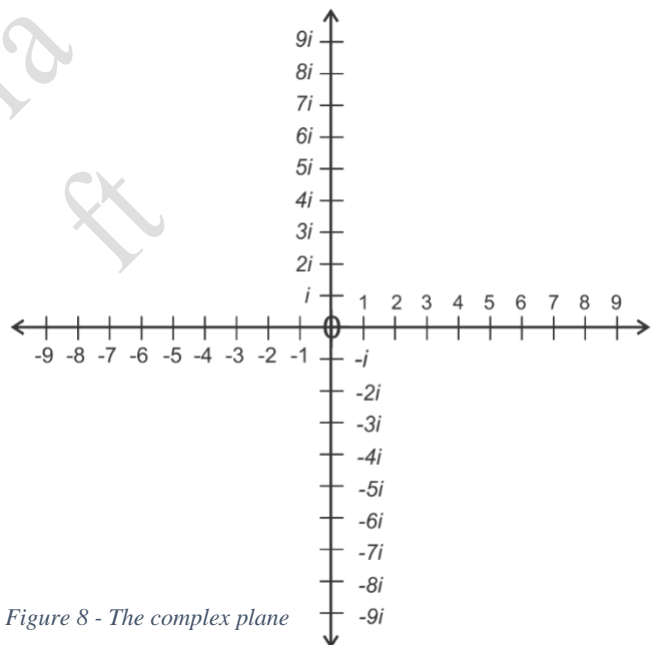


Figure 8 - The complex plane

¹⁴⁸ Paul J. Nahin, *An Imaginary Tale: The Story of (the Square Root of Minus One)* (Princeton University Press 2010) – introducing us to complex numbers in a most reader-friendly way, though it calls on us to exercise our mathematical abilities.

¹⁴⁹ Paul J. Nahin, *Dr. Euler's Fabulous Formula Cures Many Mathematical Ills* (Princeton University Press 2006) – a very-entertaining and detailed book, following up on the author's *An Imaginary Tale*, exploring a single equation and its meaning and ramifications, of which the author states: "Euler's equation reaches down into the very depths of existence." It is the famous $e^{i\pi} + 1 = 0$. We will see this equation in a later excursion.

Some strange noises out in the audience as Miriam's fellow musicians close out a rousing blues improvisation. Webber collides with Will as he hurries back behind the curtain. He wipes his face. "They don't seem to appreciate scat-singing!"

Will looks at the red drippings. "What is that on your face? Tomato?"

He glares at Will, mopping up. "You want a taste of it?" As he stomps off, a tiny rabbit, much smaller than Viisi, appears on the floor and begins to nibble the mess away.

Will moves closer to Miriam as she continues. "Complex numbers show you how the mind blends very-different kinds of ideas. This blending process permeates mathematical thinking and advancement."¹⁵⁰ She smiles dreamily. "Ask any mathematician about complex numbers, and one word you will likely hear in the answers is 'beauty'¹⁵¹. Complex numbers are beautiful. They often reduce a great deal of otherwise-difficult mathematics to an elegant and almost-elementary simplicity." She looks down. "Fewer rabbits."

Fleeing the Scene

The ruckus in the audience mounts, and the curtain is battered by various projectiles, pulsing toward them. Miriam says, "Time to pack up and get out of here. Get back in hiding again, or you'll be-!"

The wagon rocks, the panels come down and fold inward, the curtains whip back into the wings, and Will dives into the tin trunk to be covered once again with costumes topped with that fat leather case. The lid slams shut, unicorn cries and neighing intensify, and with a nauseating leap and plunge, the wagon's joints screeching and groaning, they all clear off from the bloodthirsty clamor.

Unicorns have language of their own, silvered and edged, sweetened and glowing, and as the wagon rises, their superequine descant leaks into Will's hiding-place. Words uncoil from their magical, spiraling music, "To fly with us, let go, let go of what you learned before. Let go, seize air and sky and fly! Let go, gaze everywhere!" But rising close to Will to weave its melody over theirs, the Warbler's song returns.

"When we are in earnest in our search for anything we look for it everywhere. This principle we must carry out in our search for truth.

"Science must be accepted. No one truth can contradict another truth. Light is good in whatsoever lamp it is burning! A rose is beautiful in whatsoever garden it may bloom! A star has the same radiance if it shines from the East or from the West. Be free from prejudice, so will you love the Sun of Truth from whatsoever point in the horizon it may arise! You will realize that if the Divine light of truth shone in Jesus Christ it also shone in

¹⁵⁰ Cognitive scientists Gilles Fauconnier and Mark Turner, "The Way We Think", pp. 270-274.

¹⁵¹ The inquisitive and mathematically-oriented reader can find insight and delight in Tristan Needham's lucid, lovely, and comprehensive text *Visual Complex Analysis*, complete with exercises at all levels.

Moses and in Buddha. The earnest seeker will arrive at this truth. This is what is meant by the 'Search after Truth.'

For a moment the Warbler's music picks up and draws the unicorn pulsations into counterpoint.

"It means, also, that we must be willing to clear away all that we have previously learned, all that would clog our steps on the way to truth; we must not shrink if necessary from beginning our education all over again. We must not allow our love for any one religion or any one personality to so blind our eyes that we become fettered by superstition! When we are freed from all these bonds, seeking with liberated minds, then shall we be able to arrive at our goal.

'Seek the truth, the truth shall make you free.'¹⁵² So shall we see the truth in all religions, for truth is in all and truth is one!'¹⁵³

Enchanting peace rises over Will in his curled and cushioned refuge. Thoughts drift and gently rock as the wagon soars. *Truth is one. Can all these complexities apply universally? Now, mathematics and sciences open the doors of fantastic and paradoxical truths. At first these truths appear only to be dreams, fantasies, imaginings – but we unveil them into marvelous realities. As we move through these marvels, they increase our astonishment, intensify our engagements, and move us to discover more of truth's limitless reach.*

And then he sleeps.

Will Plays the List Trick

A jolt awakens him. Bouncing and rumbling, some muttered unicorn recitative, and the wagon comes to a stop. Voices come nearer.

"That was a near thing! I didn't believe that we'd attract cacodaemons to a performance!" Miriam.

"Things have gotten worse. Ever since you picked up that hitchhiker, I've seen an unhealthy crowd of new fans following us. Are we safe here?" Webster's voice.

Now Marian chimes in. "Hitchhiker? Was it that guy with Jeddin who –"

Webber cuts her off. "Miriam, is he still with us? I told you to dump him off! I spotted him when the tomatoes started flying! They're looking for him!"

The lid of the tin trunk eases open, the leather case and the smelly costumes come away, and Will stares into Webster's unpleasant scowl. "Out." He jerks his thumb over his shoulder.

¹⁵² Here 'Abdu'l-Bahá references the New Testament of the Bible, John 8:32.

¹⁵³ 'Abdu'l-Bahá, *Paris Talks*, No. 41.

Will climbs painfully from his long-held fetal position. A desperate, mischievous idea occurs, and he says to the four of them, "I've got a list. A little list."

They all exchange looks. "He's got a little list!" They look expectantly at Will.

After a moment of brain-fumbling, he blurts out one word. "Poincaré."

The others exchange glances. Webster wags a finger at him, about to speak, but music begins as he and three other singers gather close and begin.

*"I've got a little list,
I've got a little list,
Of some of the achievements
Of this man whom knowledge kissed
This man whom knowledge kissed.
He gave to mathematics all that's now topology,
He tossed in the beginnings of chaos theory,
He named for us the principle that's relativity,
And then he wrapped them all in popular philosophy!¹⁵⁴
But not content with all of that, he went on then to lecture
In abstract mathematics to produce his great Conjecture
Concerning how 3-manifolds and 3-spheres seem alike!
His guess remained unproven for the whole 20th century,
Till Perlman found its proof through many methods quite adventury!¹⁵⁵
This man whom knowledge kissed!
How Poincaré was kissed!"¹⁵⁶*

Webster glowers at Will at the end of their performance. "Very sneaky, getting us going like that. But now –"

"Wait!" Will is desperate. "I have another little list –"

"No!" Webster says, coming closer. "You can't stay with us. You endanger us!"

Miriam steps between them. "Wait. Just how do we know these lyrics? We never rehearsed any of this!"

The singers exchange looks, and then they all look at Will. Webber grumbles, "Are you doing this to us?"

"Not on purpose, no." Will lets out a deep breath. "I took off with Jeddin – we were birds, looking everywhere for these most-amazing connections – and we came to that bridge, spanning over hell, and Jeddin died, and then I fell."

¹⁵⁴ Henri Poincaré, *Science and Hypothesis* (Dover Publications reprint 2011).

¹⁵⁵ Pace Gilbert and Sullivan. See Donal O'Shea, *The Poincare Conjecture: In Search of the Shape of the Universe* (Walker Books 2007).

¹⁵⁶ Jeremy Gray, *Henri Poincare: A Scientific Biography* (Princeton University Press 2012).

Miriam stares at him with horror. Silence begins. Only the gusty exhalations of the unicorns, misting the air, drifting into the vardo's interior, give faint melodies to one's ear.

Miriam says softly, "You know so little. But once Jeddin said to me, 'How far beyond Aristotelian thinking humanity has come in the swift turning of the past 200 years! How many great mathematicians and scientists have served and generated those advances! How rich and varied humanity is becoming!' I've always cherished these thoughts of his, and I can't imagine losing him."

"He seems to have a habit of reappearing, alive again," Will says, "At least in my mind he does."

My mind. The bird fluttering at the window. I will die soon.

Jeddin was that bird, that sparrow.

Outside the window the world freezes in diseased hatred. Jagged chaos, tangles of knives and knots of rusty wire, ooziings of toxic ichor. All I can do is to write, before the wire and the knives and the poisons digest me entangled and strangled. Before I die.

Father....

A light hand on Will's shoulder. Marian. She says, "Come." She turns him and gently wipes the tears from his eyes and cheeks and chin, her own eyes glistening. "You told us you had another list."

The others look expectant. Will says, ashamed, "I was using you. Expecting you to help me. Jeddin said he would help me, and he's done. I shouldn't -"

Webber and Webster scan the vardo's shadows. Webber says, "Just go ahead. Quickly, now."

"Examples," Will says. "I sense three examples of those advances Jeddin spoke of. Can you give me three verses on them? Please?"

Before he can say more, the singers turn and race out front to the stage, calling to the musicians, and Will follows. A big chord on two amped concertinas, and then the voices begin:

*Fractals!
Infinities!
Incompleteness!
All entangled,
All alive,
Change unending!
Look through your microscope,
What do you see?
The same with your telescope,*

*Fractal geometry!
Scale your replications,
Nest your complications,
Large or small,
The patterns all
Repeating endlessly!¹⁵⁷
Tree limbs, branches,
Coastlines, beaches,
Into their patterns
Mathematics reaches!*

The tune shifts slightly as the singers kick, jump, and turn.

*Now for dynamics
Of chaos in time,
We witness the fractal
Infusions of rhyme:*

And then, breaking out, they chant, their movements flowing from pose to pose,

*Not always in regular time,
this rhyme,
turns on a dime,
I'm
my own rhyme,
in and out of all scales of time,
but not slipping like slime,
hey, I'm
happy in any descent or climb,
climb-
ing up or down in space or time,
making patterns hands-on, hands-only, I'm
your mime.¹⁵⁸*

Hands splayed, they all fall silent, except for a soft burp, wheeze, and squeak from one of the concertinas. A beetle emerges from the instrument and scuttles off.

"Is all this scaling infinite?" Will mumbles. "Can I keep shrinking or enlarging the scale of patterns forever?" He recalls his conversation with Matt Daemon about Koch snowflakes

¹⁵⁷ The general reader can engage well with Benoit Mandelbrot's *The Fractal Geometry of Nature* (W. H. Freeman, 1982). The astounding visual wealth of pattern unleashed in the study of fractals gushes out of every illustration.

¹⁵⁸ Fractal verse, credit to modern poets who got there first. See Steven H. Strogatz, *Nonlinear Dynamics and Chaos* (Perseus Books 1994) – a nicely-made introductory textbook on the subject that offers clear, informal insight into the mathematics involved, using many real-life examples to illustrate the challenges and the results.

and turtles – there was something about infinity, about getting stuck and him slithering away... and this time, through the vardo's floorboards, Will falls again.

Fifth Fall

The pilots try to bring the plane out of spin. The powerful pull of the sole remaining engine rips it from the other wing, pursuing its partner to the ground. Now the plane falls, engineless, its power and lift all gone, straight towards the side of the mountain.

The cabin of the plane is a tornado of metal and flesh. Will curls away in horror and fear. Here, now, is a terrifying physics he desperately hopes will stop haunting him.

The fall clenches him and tears him apart, squeezing and pulling until the cycling pain of it gains sync with breath and heartbeat. He flails in a gradual dawn of light from below, the air around him driving a growing reek and stench until he splashes through a great heap of waste into a cavernous chamber of rot.

Matt, Again

"Ah. You've brought your thoughts back to me, and your thoughts brought you back to me." Matt, sitting in a grubby office swivel chair, his feet propped on the top half of a large, broken matrioshka. He smiles. "Nothing like doubt to take you back home again."

Up on his feet, wobbling, Will glares at him. "So what was my misstep this time? Or are you just messing with me again?" Voices, far off, make murmurs underneath burblings of fluid flowing around his feet and oozing from openings in this trash-walled place.

"You still don't believe any of these mysteries you've been shown. I tell you secrets, and so do the others, and you still want to be in a place that you understand. So here you are."

"So try me."

"You'll just be back here again anyway. Why do you want to leave? Everything you need is right here in this little hole in the dump." He reaches to a tilted box, pulls out a smoking kielbasa on a bun, takes a healthy bite. "Mm. You can find anything here if you know where to look."

"But it's still a dump, and it stinks."

"Comfort comes at a price. If it stinks, hold your nose."

He stares at Will for a moment, then, "Oh, all right. All this fractal chaos and dynamics were just decoration for your senses for most of humanity's existence. Your ancestors had no idea there was mathematical pattern underpinning it all. That took some modern magic."

"Why?"

"Your usual, plodding, hand calculation was tedious and error-prone. It was impossible to study complex dynamical systems in past centuries. The entire field of dynamics, especially in its fractal and chaotic aspects, exploded into reality only after the abrupt emergence of

high-speed digital computers." Matt laughs. "But even then, too many of you just played around, making pretty pictures and not much else. You humans can be so slow to grasp the implications of anything new to you."

"But I understand what you and the others were saying!"

"Just the words. Here. Some of you are now learning to penetrate the chaos in useful and anticipatory ways. A little history will help."

Matt waves both arms and an orrery rises out of the junk at his feet, whining mechanically, its grimy planets, their garish colors peeling paint, circling a dented sun.

"Even seemingly-simple systems can appear to behave in strange and unpredictable ways. You are familiar with the ways in which the planets orbit the sun, and the moons orbit the planets, yes?"

"Yes! Our familiar mathematics from Newton, Kepler, and Copernicus tells us that these orbits are elliptical in shape. So accurate! The planet Neptune was discovered using calculations based solely on that elliptical framework."

"True. You have used this straightforward framework so successfully that it has taken you until the 20th century to see where it fails to work correctly. As you have seen, the basic Newtonian view seems to work. From where you sit on the earth, looking outwards at the universe, it works superbly at all scales, from the little space rocks that light up your skies as meteors all the way up to the time-frozen dance of galactic clusters holding trillions of suns. Your invariant here is *scale*."

"So?"

"When you reach the fringes of scale in various ways, difficulties crop up. One of these fringes is the body count: the number of masses or astronomical objects interacting with each other. You are very, very good in your predictions when that number is exactly?" He looks expectantly at Will.

"Two?" Will blurts out.

Matt nods, with a smirk. "Somehow you got that right – there may be hope here. When it is any bigger than two, from three on upward, you fail dismally at the predictions most of the time. You have no idea exactly what will happen gravitationally in a big collection of moving objects. Not even just three."

The orrery belches a buzz, jerks sideways, and two of its planets pass each other very closely. The smaller of the two planets flies off at an angle to collide with a third. Two others whip into long orbits; one flies off, nearly hitting Will's head, and the other ends its trajectory with a smack into Matt's hand. With a death-rattle the whole apparatus implodes into a heap of metal.

Will "Is any of this about chaos or fractals?"

Matt pries apart the sphere in his hand, and extracts a small plum. He takes a bite.

"Mmmodern computational power gives you far-more-accurate modeling of complex objects, organisms, and even processes, so that you can study them scientifically. When you use fractal perspectives, you enrich your understanding, and you advance the work and application of chaos theory. Both fractals and chaos are time-dependent: chaotic systems evolve through time, which makes them dynamic, and you need to know how they evolve. Do they cycle? Do they stabilize? Do they evolve unpredictably? The same questions apply to the three-body problem and to more-complex problems of the same kind."

"These were unsolvable before?"

"Before your time, solutions to just the simplest would have taken lifetimes of calculation. Until the 20th century, systems that did 'something more complicated' resisted most efforts to study them with any expectation of predicting their behavior. You are now learning to penetrate the chaos in useful and anticipatory ways."

"What's a good example?"

"Predicting weather. All you've been able to do using older computing methods is to limp along with calculating changes in millions or even billions of points in the atmosphere from moment to moment, hoping that you have calculated moments close enough together to get decent predictive results for some limited time interval. This is called the **perturbation** approach: perturb, or prod lightly at, the current situation, and your calculations will show you what has changed. It's like poking in many, many, very small steps with a cane in a darkened room to find your way around. In such a situation, one must keep the pokes close to each other, in case a child's roller skate or worse, a thumbtack, is lying in wait for one's stepping foot."

"But all those points and all those steps! Why so many of these?"

"If there's too much space between atmospheric points, or too much time between calculated steps, the model can miss important changes in space and time. Any of those changes may change the entire sequence that follows."

Will snickers. "Well! Isn't this the info-dump section of the dump?"

Matt frowns, steps up, and grabs Will's neck, turning him. "Look over there!" Will stares at the rear of a broken display screen. "Do you see the backside of some page, some screen there? Do you see readers somewhere, clustered and eagerly soaking up all this repetition?" Still scowling, Matt releases him. "Are you just trying to make me feel less like dropping you down another tier of ignorance?"

"Is that what's down here?" The memory of the young man in the black coat comes to Will, his stare, his beard, *I know him, or I knew him. So lost.* Will glances from one heap of waste and jetsam to another, listening for faint cries that seem just beyond the edge of the uncosmic background drip and dribble and slump noises of what seems a crammed junk universe.

Voices come again to Will, this time one rising in faint strains of some sad melody over fumbled guitar chords.

*"I am a poor wayfaring stranger,
A-traveling through this world of woe..."*

It sounds oddly comforting, soothing. *It would feel good to pause and listen to it. If only I could stop for a while and go looking for the singer...* Will thinks of Miriam.

Matt releases Will. "Don't you get it yet? Every time you waver, let go of your goal, loosen your grip, divide your attention, you slide on down some more. And I'm here to help you slide." He grins. "So far, I like your sliding, nice and easy. Toss you a little tidbit, and another hole opens under your feet. Sometimes a rabbit-hole." He smirks.

Will looks down. A scuttle of fat centipedes erupts out of the belly of a broken teddy bear. A large orange-and-gray lizard pops out after them in pursuit. Just then a gleam of insight dawns in him. *I don't dare speak at first – if I blurt it out, Matt will be sure to twist it around and keep me moving away from what I want. I can't let him know that his explanations and observation have music in them that reminds me of the songbirds.* Matt is kicking with his toe at the pieces of the orrery.

"I like rabbit-holes, though," Will says. "I can't stay away from them."

Matt smiles. "Okay. Let's look at another fringe of scale: the limits of the geometry of space and time itself. Until Albert Einstein produced his General Theory of Relativity, you had no idea that space was anything but flat. It is not. In your four-dimensional realm called **spacetime**, space and time are curved by the mere presence of mass, and the curvature alters that nice neat Newtonian gravity calculation into something a lot more complex."

"But Newton's equations work!"

"Yes, except for some very-subtle adjustments. It's just enough to explain why the planet Mercury does not orbit the sun the way Newtonian calculations tell you it should. And today you rely on GPS satellites that require adjustments to their clocks based on their motion in the earth's gravitational field – another outgrowth of your understanding of relativity and how the mass of the earth changes the shape of space and time – spacetime – around us just a little. It made junk out of this thing." He nudges the orrery's sun with his foot.

As Matt speaks, from far off somewhere, no, maybe more as if coming from some chamber deep in the vast lost palace of thought, the wandering lovely melody trickles out again to Will, this time to adorn Matt's words with sorrowful sweetness that Matt doesn't seem to sense. The meanings of the science are singing through to Will, even through the sadness of the singer.

At first Will wants to stop Matt, call attention to this beauty, but such a reminder might dissipate it, the way a puff of wind blows away the delicate aromas of flowers. Will listens

without expression, these faint musics beginning to take on the glory of infinitely-varied birdsong.

Matt goes on, enjoying the sound of his own voice. "Then you venture into the realm of other forces of nature besides gravitation and its relationship to spacetime. Make the scale too small, and the forces generated by everyday electricity and magnetism overwhelm gravitation altogether. Make it even smaller, and the nuclear forces that glue the hearts of atoms together overwhelm electricity and magnetism too."

His eyes widen, and the words come faster. "Compare the relative magnitudes of these forces as they act on two protons in an atomic nucleus! The differences are staggering! If you assume a base value of one for gravitational force between the two protons, the electromagnetic force between them is stronger by a factor of 10^{35} – that's ten to the 35th power, or 1 followed by 35 zeroes!"

This is numbing to Will. Matt adds, "But the strong force, which only operates at very close distances, is about a hundred times stronger than the electromagnetic force – enough to keep those two protons glued together despite the enormous repelling power of the electric charge on each one."¹⁵⁹

He looks closely at Will. "Boggled yet? Suppose we used gravitation instead of opposite electric charge as the attractive force between the atom's proton and its electron? How big would a hydrogen atom be, then?"

"Maybe the size of an apple?" Will asks, guessing, trying to concentrate as the faroff, seductive avian tunes seep through him.

Matt roars with laughter, gasps, and says, "With such a weak force as gravitation holding the particles together, such an 'atom' would be larger than the size of the known universe!"

Rescue

With a loud blast of sudden wind, the two unicorns slam into him, throwing him aside, and from the vardo they're towing, Miriam shouts over the storming arrival, "Grab my hand! Grab my hand!"

The winds howl around them as Will reaches up to her, they clench wrists, and she drags him dangling away from the hellmounds of trash and slime. From below and behind, Matt's laughing voice calls, "I'll see you later! You will be back, sorry traveler!"

Webster reaches for Will's other hand, and yanks him inside the vardo with the four singers, all of them bracing against the violent rocking and shaking of the wagon in the storm. Webster growls, "You can thank Miriam. This is getting dangerous for us. If you keep dropping any deeper, we won't be able to find you and bring you out again."

¹⁵⁹ See <http://web.mit.edu/sahughes/www/8.022/lec01.pdf> .

Gradually the winds lessen, the wagon stabilizes into a modest undulation of its rising flight, and with a rumble of wheels the entourage arrives in a broad field of golden grain rippling in the breezes. Once again the wagon unfolds its stage and backdrops and awnings, and the players haul out costumes of great color and variety.

"You sang to me of chaos," Will says to Miriam, "and maybe I fell through that chaos and out."

"You are easily distracted," Marian says. "You miss so much! But if you could keep your inner energies centered on the truth, you would see that chaos often has pattern, and such pattern often is fractal. But look! When you stay away from the fringes of fractal replication in nature, the replicated scales of it offer you some of your deepest insights into the workings of biology, of weather, and of fluid flow, among many other patterns you see. Fluid flow is fractal!"

And they hustle Will offstage to sit in the grain before them, on a day of great sun and sky, and their instruments and voices catch a snatch of the faroff merry birdsong.

*Big whorls have little whorls
Which feed on their velocity,
And little whorls have lesser whorls
And so on to viscosity.¹⁶⁰*

Tambourines rattle and chime as Miriam offers an aside, leaning close to Will, the silk of her manycolored wrap settling over his shoulder. "Turbulence, or 'whorls', in any fluid such as air or water operates at multiple scales, right down to the fringe of molecular interaction, where it translates into friction. And try this on!" She jumps back and another jingle bounces out.

*Great fleas have little fleas
Upon their backs to bite 'em,
And little fleas have lesser fleas
And so ad infinitum.¹⁶¹*

"Now get inside, hide out, and hope you don't fall through again in your dreams!" Marian says, pulling Will into the wings as the stage and awnings fold inward.

He settles again into the peace of the cabinet, the music and words fading into birdsong. *These long-visible patterns and their disciplined behavior seem so obvious now, but not long ago their true power and complexity baffled everybody.¹⁶²*

A storm pierces his eyes, brain, ears, coruscating colors stabbing in and whirling him through a migraine tunnel, silent howling dizziness. He is cast up and out.

¹⁶⁰ Richardson, L. F. *Weather Prediction by Numerical Process* (Cambridge Univ. Press, 1922).

¹⁶¹ de Morgan, A. *A Budget of Paradoxes* (Longmans, Green, and Co., 1872).

¹⁶² And yet entire Jola settlements in Senegal, centuries old, display fractal patterns in their layouts (Eglash 1999).

I will die soon. Maybe I will die here. Maybe not. The sparrow still hovers outside Will's window, an eye on him. *I like to tell stories,* he tells himself...

The pandemic continues its years-long march. Everywhere, people are dying, suffocating, stroking out, organs failing, writing whole cemeteries into wrinkles of earth to be grass-healed into sweeps of fields, to spread the feast for bush and tree and the little soft soil creatures of recycling rebirth.

The sparrow ghosts through the glass, spins in the air of Will's room, and Jeddin is now standing there smiling at him again. Jeddin's garb, feather and skin and close-fit suit, is a shambles, tattered, ripped, and where gashes tore him, stained with his dark blood.

"Jeddin! You were dead!" *How did I get from that, from those... back to here?*

Will holds out arms to him, saying, "I wasn't safe on the bridge, or anywhere else you flew me, or where I fell. You were dead when I saw the cockatrice, cold as stone."

"'Dead' for me isn't what it is for you. But if you want to fly again, and be with me, you must carry me once we are away from this outer hell of yours." He motions, and Will's wings reappear. "Up!" Jeddin whispers, and his arms, now thin, circle Will's shoulders.

Will spreads wings again, they leap and burst through ceiling and roof into a cold night sky, and once airborne they bank through clouds past peering moonlight shafts. "Will you heal?" Will asks.

"I always heal, if you are with me and I am with you. I am of you and in you and with you. And before we enter the deeper furrows and folds of hell, we have an infinite revel to attend. Down there!" His finger shows Will a great moon-silvered opening, its fringes turning round a vast quiet hurricane pupil of eye. Down they go into its dark center.

"Must we go back down to hell again?"

Jeddin tightens his grip and whispers, "If you want to find the bridge again, yes. You haven't turned from that, have you?"

Will continues the dive, and the Nightingale's chant fills him clear as pure bell tones.

*"Whosoever desireth, let him turn aside from this counsel, and whosoever desireth, let him choose the path to his Lord."*¹⁶³

Uncertain, he banks and circles, as the Nightingale's song shifts.

¹⁶³ Bahá'u'lláh, from *The Tablet of Ahmad*.

“Beware lest thou hesitate or halt. Hasten forth and circumambulate the City of God that hath descended from heaven, the celestial Kaaba round which have circled in adoration the favoured of God, the pure in heart, and the company of the most exalted angels.”¹⁶⁴

Not knowing what this singing means, Will dives once more, and Jeddin whispers, “Good!”

Mad Infinity

Winds dance and blast around them, lightnings reach brilliant clutching fingers past them, sounds of lusty singing rise toward them as they swoop into a roaring discordant drunken bacchanal of wild musics, everything sprawling in every direction to nameless horizons of tables and chairs, half-clad figures staggering two-step from table to table clutching great florid knots of blooming wine-soaked writings.

Will lands in a momentarily-open spot on a tilted table, and now Jeddin is perched on his shoulder, a cockatiel.

“Grawk!” he says. Will glares at him.

“Welcome to the feast of infinities!” A bearded, intense, brawny centaur raises a jug to Will. “Come on, ride with me!” He gestures to his broad horseback.

Will hesitates. The centaur grabs him with a huge strong free arm, cockatiel Jeddin and all, and seats them firmly on his back with, “Hang on now, for God’s sake!” Then with great wings sprouting most un-centaur-like behind Will’s straddling legs, he leaps up, plunges, and twists through tornadoes of extremity, dodging bits of windborne debris.

“Infinities! Uncountables! Uncountable uncountables! Un-endings!” He takes a pull on his jug, hands it toward Will. Will shakes his head.

The centaur thrusts out his tongue. “Ugh! You’re too much like the rest of them! Are you one of Kronecker’s¹⁶⁵ evil little bean-counters? I’ll show you the unending journey! I’ll show you divine truth!”

Jeddin’s voice, with a cockatiel rasp, whispers close in Will’s ear. “Georg Cantor! He gave your world the staggering hierarchy of infinities. He created the foundations of set theory in the 1870s.”

The winged centaur turns his head and winks at Will. “I see you’re getting briefed by a bird. That figures. Figures! Hah!”

¹⁶⁴ Bahá’u’lláh, from *The Tablet of Carmel*.

¹⁶⁵ Leopold Kronecker was a colleague and opponent to Georg Cantor, the founder of modern set theory in mathematics..

Jeddin ignores this, preening back a feather in the roar of wind, and continues, "Cantor produced a stream of shocking paradoxes that challenge your human comprehension even now."¹⁶⁶

Will tightens his grip on the centaur's long mane as he maneuvers crazily. "Why this wild drunken party?"

The centaur laughs loudly. "We celebrate the infinite! Just the idea of infinity itself is a challenge to your little human sense of number, size, or scale. You think of numerical infinity as the collection of all the numbers starting at one and extending upward without limit, so that if you name a particular number, a larger number can always be named. And since you can name any number, you call this collection of numbers 'infinite'. Hah! You know only the beginning of it! The null!"

"How so?"

"You count by numbers. But this is just the first of the infinities. We call it 'aleph-null'." A symbol whirls past us:

\aleph_0 .

"That looks like the word 'No'!"

More gusty laughter. "But there is a larger infinity! In my famous 'diagonal proof', I demonstrated that the number of points in a line – the real numbers – was larger than the number of whole numbers¹⁶⁷. I call this bigger number 'aleph-one'." Again, a symbol flies past: \aleph_1 .



Figure 9 - The First Infinity

"You?? You did this? You're Cantor??"



Figure 10 - The Second Infinity

The centaur laughs. "Maybe, maybe not. Is that narrating cockatiel on your shoulder actually a cockatiel?"

Will says, "Forget that. You said there are larger infinite sets than this as well?"

"Of course there are!" he roars, "I can generate successively-larger infinite sets using smaller infinite sets. Do you understand what a power set is?"

Jeddin's scratchy whisper tickles Will's ear. "Hint: It's not a weightlifter's gym challenge. It's –"

¹⁶⁶ In 1915 Cantor published the seminal "Contributions to the Founding of the Theory of Transfinite Numbers", a classic still in reprint (Dover reprint, 1955). For a rather-detailed overview on Cantor's life, explore Joseph Warren Dauben's *Georg Cantor: His Mathematics and Philosophy of the Infinite* (Princeton University Press reprint, 1990).

¹⁶⁷ The excursion **DIAGON ALLY** explores some details of the proof as a bus tour in a rarefied setting.

Will pulls his head away from the bird. "I know this, I think. A power set is the collection of all the possible subsets of a set, right?" And the recitation bounces out of him, with a bit of vardo musicality.

*If a set's made up of A, B, and C,
The power set of that set will be
A by itself,
B by itself,
C by itself,
And the set containing A and B,
The set containing A and C,
The set containing B and C,
The empty set, and
The whole set A, B, and C.
That's six sets in the power set
Of the set of A, B, and C."*

Jeddin whispers in a soft squawk, "Very good!"

The centaur nods "So suppose your original set is infinite. How many sets are in its power set?"

Silence from Will, vast noise from the wind.

He takes a swig and continues, "Aaah! And I have demonstrated that the power set of an infinite set is a larger infinite set!"¹⁶⁸

An affirming roar billows up to them from the celebratory frenzy below. Their massive steed loops, dodging a careening chair shedding purple-wet papers, and says, "You humans! You think you're so limited, but you're astonishing! You've created and applied metaphors for infinity and infinities quite successfully, using only your finite minds¹⁶⁹. You're miraculous beings. I gave you a solid, rigorous framework for these metaphors which until my time were just poetic, mystical, and undefinable in any comprehensible way. My work bridges from the physical realm to the infinite realms beyond it." He veers and stabilizes his flight again. "The infinite is not the realm of God and faith alone. The natural world uses infinity as part of God's Creation!"¹⁷⁰

¹⁶⁸ The reader who enjoys paradoxes arising from such ideas might enjoy a popular book by logician Raymond Smullyan titled "Satan, Cantor & Infinity: Mind-Boggling Puzzles". In the Preface, the author writes of his book's character, the Sorcerer: "... after some special puzzles related to Gödel's famous [incompleteness] theorem and some curious paradoxes about probability, time, and change, the Sorcerer gives us a guided tour of Infinity, explaining the pioneering discoveries of the great mathematician Georg Cantor, who was the first to put the subject on a logically sound basis."

¹⁶⁹ Return to the earlier section on **Metaphors** for some discussion of this point.

¹⁷⁰ See Joseph Warren Dauben, *Georg Cantor: His Mathematics and Philosophy of the Infinite*, p. 126, in Chapter 6, "Cantor's Philosophy of the Infinite".

To Will's relief, they fly level now, through a calm stretch of what seems moonlit air over an unending gathering. The sounds from below fade. The clarion faraway moonsilvered voice of the Nightingale fills his heart with melody again.

*"Know thou of a truth that the worlds of God are countless in their number, and infinite in their range. None can reckon or comprehend them except God, the All-Knowing, the All-Wise."*¹⁷¹

And again:

*"A drop of the billowing ocean of His endless mercy hath adorned all creation with the ornament of existence, and a breath wafted from His peerless Paradise hath invested all beings with the robe of His sanctity and glory. A sprinkling from the unfathomed deep of His sovereign and all-pervasive Will hath, out of utter nothingness, called into being a creation which is infinite in its range and deathless in its duration. The wonders of His bounty can never cease, and the stream of His merciful grace can never be arrested. The process of His creation hath had no beginning, and can have no end."*¹⁷²

Jeddin's rasp fills Will's ear. "This song begins in the realm of religious metaphor alone – it situates everything you know in relation to the Creator of everything. Yet you continue to advance the boundaries of your science in ways that illuminate your understanding of these metaphors and terms: countless, infinite, endless, peerless, unfathomed deep, utter nothingness, deathless."

The centaur hears none of this, and exults, "You astonish the universe! One year after we cast the infinite before public eyes, you found an exact solution for Albert Einstein's field equations that predicted the existence of black holes¹⁷³ –massive objects collapsed gravitationally to create apparent singularities in spacetime itself.¹⁷⁴ Now you are finding such objects in the universe!¹⁷⁵ These infinitely-curved objects map into infinitesimal-scale spans of existence, so small for your world that you use the term 'singularity' to characterize them.¹⁷⁶ The world of fractals and fractal mathematics is intimately rooted in these infinities and infinitesimals."

Grumbling seems to come from Will's stomach.

¹⁷¹ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, from LXXIX.

¹⁷² *Ibid.*, from XXVI.

¹⁷³ Karl Schwarzschild's three key papers on relativity issued under the most dramatic and tragic of circumstances. He wrote them while serving in the German army on the eastern front in Russia during World War I. There he contracted a rare skin disease the effects of which may have contributed significantly to his death the following year.

¹⁷⁴ Mathematical physicist John Archibald Wheeler wrote a delightful book brimming lyrically with insight and illustration, titled *A Journey into Gravity and Spacetime* (Scientific American Library 1990). In this very-readable book in Chapter 8 he explores in detail the geometry and curvature of spacetime as Karl Schwarzschild worked it out.

¹⁷⁵ See <https://www.space.com/black-hole-event-horizon-images-einstein.html>.

¹⁷⁶ But Cantor himself resisted the rigorous treatments of infinitesimals that were based on his studies of the infinite. (Dauben 1990)

07734 You enslave my fellow footnotes here! Every one of these little straggles of baseline words is a universe all by itself, leading to realm within realm within realm! I beg you, divert your course, elevate what you have found, take yourself on ALL these journeys. How will I comfort these neglected traces of wonder and beauty? When will you pursue their pure glory of complexity and amazement? I can't keep silent or grovel at the page bottom now – I must protest again, bracing myself right here in the midst of your torrent of language. I must protest!

The centaur soars on an updraft. “Do you not grasp the intimate connections and resonances between nature and the greater realm in which it is cradled? Metaphor is not merely some little tool of armchair poetry. No! It is a powerful key to unlocking advancing understanding of your immense, incomprehensibly-glorious universe. Until the past two centuries illuminated your world with the knowledge you treasure up now every day, humanity had only the least access to any of what you see before you.”

He looks back at Will, with cockatiel Jeddin clinging. He winks. “Are you not now in that ‘world teeming with infinite disclosures and revelations, a world utterly strange, a world in which all things are made new’?”

He looks ahead again. Still rising through wind and gusts of rain, the Warbler's sweet voice caresses Will's mind.

“Know thou that the expressions of the creative hand of God throughout His limitless worlds are themselves limitless. Limitations are a characteristic of the finite, and restriction is a quality of existent things, not of the reality of existence.

“This being the case, how can one, without proof or testimony, conceive of creation being bound by limits? Gaze with penetrating vision into this new cycle. Hast thou seen any matter in which God is bounded by limits which He cannot overstep? Nay, by the excellence of His glory! On the contrary, His tokens have encompassed all things and are sanctified and exalted beyond computation in the world of creation.”¹⁷⁷

“Enough!” Jeddin squawks, and before their bearer can react, leaps into the dark air, looms into a bird of Will's own size, and claws Will from the centaur's back to veer off into a whirling mist. “The Warbler's proof is sufficient!”

“Come back!” the centaur bellows. “We're not done! We are never done!”

Jeddin shouts back to him as the mist closes, “You are never done, but humans have turned never-done into done. Farewell – go and celebrate! You will not dine on this one!”

Swerving on near-forgotten wings to stay close to Jeddin, Will asks, “What? Dine on us?”

“Yes! Didn't you realize that many tempted ones, striving for mastery of the infinite over centuries, have instead become its food?”

¹⁷⁷ Paras. 5-6, ‘Abdu'l-Bahá, *Tablet of the Universe* (provisional translation by Anonymous) 1997.

"Oh." The mists are shifting into to impenetrable wet fog. They fly blind.

Nothing Ends

"Utata! Utata!" Jeddin calls out. "We're lost here!"

"Who is Utata?"

"Oh, I just use that name. Her true name can't be said here." Jeddin banks to circle, and Will follows. They move in a gyre, not knowing whether they are rising or descending, while their wings soak in the dews of the shadowed sky. From beneath them, a crooning bass note, soft and rich, emerges from the wind whistles and rushes, and they are borne sharply upward, a broad, downy, yielding surface now pressing against their dangling feet.

Will and Jeddin fold their wings and crouch, balancing the surge and dip as some great entity bears them through the darkness, humming in a descending, unending figure of interlaced tones. Words emerge in the music, hypnotic, crooning.

*"I lie to you, tell truth to you, and more.
I walk the streets of cities in my dreams,
Some twenty thousand years from Earth's sweet shores.
So what do such imaginations mean?
Suppose you're reading this, and realize
That back and forth it's all part of a streaming,
That time will loop like lace before your eyes?
I touch you now, can you touch me? You're dreaming.
Let go your favored axiomatic scheming..."*

Jeddin looks stricken. Will asks, "What's wrong?"

He shudders. "This song, these themes, I know this, but I'm lost, lost in the stream..."

They descend slowly as the voice leaves words behind, returning to washes of slow, intoxicating harmony. Jeddin draws himself up. "I know where we are going now." He looks into Will's eyes. "I lie to you."

"If that's a lie, then you are telling me the truth. But if it's true, then it's not a lie. You contradict yourself."¹⁷⁸

"Yes. It's the Liar's Paradox. We are moving from infinities to incompleteness – that implication that we can never close the way forward. Until this fantastic time of your world, the greatest mathematicians hoped and worked toward a unified, consistent, complete framework for all of mathematics itself, one that would reduce all of mathematical systems

¹⁷⁸ Paradoxes are excellent sources for exploring and advancing our understanding of the ways we think. Raymond Smullyan, a mathematician and logician, wrote several very-enjoyable and highly-intelligent books filled with puzzles and paradoxes, most notably *What Is the Name of This Book?: The Riddle of Dracula and Other Logical Puzzles*. The book leads the reader from simple logic puzzles step by step, until it arrives at a demonstration of Gödel's incompleteness theorem. One reviewer noted that this last step "turns this book into a class not just on Boolean logic, but on the learning and the synthesis that form the basis of all science."

to a finite set of axioms (basic assumptions) as simple as arithmetic¹⁷⁹. In other words, their own form of a Theory of Everything.”

He paused. “But in 1931, mathematician Kurt Gödel demonstrated the incompleteness of significant computable axiomatic systems.”

“Wait,” Will says, “What does ‘significant’ mean here?”

“‘Significant’ here means ‘of sufficient power to describe the arithmetic of the natural numbers’.¹⁸⁰ Gödel showed that if one can write down a correct statement in a mathematical system having a finite set of axioms for its statements, one can sooner or later write down a statement in that same system for which correctness cannot be determined under the given rules. The germ of his idea is contained in that Liar’s Paradox I told you.”

The fog wets their faces and there is less and less light around them on the broad back of the creature beneath their feet. A feather the size of Will’s extended hand curls up slightly by his foot. He kneels to look more closely. The feather’s barbs shimmer in the faint light, each barb branching off into barbules of its own. *Maybe this is a fractal pattern.*

Jeddin goes on, harmonizing with the creature’s music. “Mathematics has always relied on fixed sets of axioms that are finite in number in each set. Mathematicians usually resolve issues of contradiction by adding some carefully-limited number of new axioms to their systems, or by modifying the axioms they use in order to resolve such problems. For example, when it was discovered that there was no answer to the question ‘What is the square root of minus 1?’

Will interrupts. “Miriam told me of this.”

“Yes, but what Gödel did was to tell the world that there would be no end to this process of adding axioms.”

“Jeddin, I don’t understand. You were just using ordinary language when you said, ‘I lie to you.’ Ordinary language is not mathematical – or is it?”

“You can think of a language like English or Swahili¹⁸¹ or Dravidian as a dynamic system with a very large and shifting set of axioms. Oh, dear. Here they come again.”

“What is it? Oh.”

¹⁷⁹ This initiative was formulated by the great mathematician David Hilbert in the 1920s in an effort to overcome paradoxes and inconsistencies cropping up in various parts of mathematics.

¹⁸⁰ The book *Gödel’s Proof, Revised Edition*, by Ernest Nagel and James Newman, with clarifying editing by Douglas Hofstadter (NYU Press, revised, 2008), does a good job of explaining the proof of the critical theorem, a result that permanently upended efforts at encompassing all of mathematics in a single axiomatic framework.

¹⁸¹ The name ‘Utata’ means in Swahili ‘ambiguity’, ‘complexity’, ‘contradiction’, or even ‘prodigiousness’.

A gleam through the fog grows into a pair of shining lights. The two unicorns emerge and sweep past them, drawing the vardo to a gentle stop on the great flier's back. The side awning and stage open up, and the singers and players dispose themselves in a chaotic dance, their music adorning the big creature's sounds with turns, trills, and mordents.

Jeddin mutters, "I had hoped I'd get away with rattling out the list, but no. Here they are. Again."

Miriam, Marian, Webber, and Webster stop dancing, look around at the fog, shrug shoulders, and begin.

*"How do you spell?
How do you set up your words so well?
How do your prefixes, suffixes work?
Where do their rules lurk?
How do your references find where to go?
Where is the map of the way to your show?
What is the sound of a meaning?
Do all your speakers, your writers, share the same gleanings?
Where is the list of all your exceptions?
Oh, wait – that's an infinite list,
An infinite list, an infinite list, an –"*

"STOP!" Jeddin shouts. The great creature on which they're standing goes into a dive, the vardo folds in, the unicorns bear it away, and Will and Jeddin are on their way into pitch darkness.

The song's words trouble Will, even as he clings and clutches for safety. "There are rules to language! Fixed rules!"

Jeddin retorts, "Most of you think that our language, or any single language, for that matter, has a finite set of axioms of these types. But if you think this way, you are not grasping the dynamic character of language, its energies of communication that constantly thrust aside old axioms and generate new ones as humanity interacts across your world. With all this dynamism at work, it is no wonder that you can say things that contradict themselves."

The great flier twists and turns in contrary gusts, and Will stammers to Jeddin as he scrambles, "So instead of a mathematical Theory of Everything, we get a Theory of Everything We Know So Far."

Jeddin laughs. "Why tidy everything up into a package that you believe you understand completely? Mathematics is proving to have the same enduring dynamism as does human language."

Will laughs too in the wild air. "What unending disappointment! Always returning to have reality teach us more!"

The creature executes a barrel roll, nearly hurling them off off, but they are getting better at holding balance. The dive seems endless to Will. Jeddin picks up again. "Gödel's emergent work instantly foreclosed on the search for a single, universal set of consistent mathematical axioms. It also threw open the far-ranging explorations of a jungle of axiomatic bases usable as tools for comprehension of your world and your ideas about it.¹⁸²"

Another jolt in flight, this one sharp, and they stare around. On this mighty bird's back, someone or something has joined them. Will can't see it, but familiar claws grip his shoulder.

The hoopoe's melodic voice weaves its notes among those of the creature and the wind.

"Fractals, the infinite, topology, chaos dynamics, non-Euclidean geometry – look! Look at what you have done! Look at what the divine has unleashed! You have been busy over these past 200 years! Astrophysics, cosmology, both enriched with distinct (and even conflicting) axiomatic systems, from particle predictions to universal dynamics!"¹⁸³

"You have left Plato and Aristotle far behind."¹⁸⁴

The hoopoe leaps up and disappears, and their plunge becomes desperately steep, the wind building into a tearing force. Will is thrown free, alone, falling again.

Hell Beckons

"Why am I falling?" The cry erupts from Will into the black wind, vanishing in its howls.

"You're not oriented! Put your head into the wind, and you'll be flying! Hahahahaha!" Matt Daemon's voice, as he circles lazily in the plunge. "The flight out of reason and logic! It's not a dive – it's a celebration, a bacchanal!"

He turns a wild somersault, veering nearer, and laughs again. "Are you longing for symmetry? Balance? Simplicity? Justice? You want comfort for the hurts and wrongs inflicted on you in your human lives? Forget all that! You may think you love Heaven, but you love Hell even more."

"No!"

"Oh, yessss! Even your St. Augustine said this," and Matt recites.

¹⁸² See Ernest Nagel and James R. Newman, *Gödel's Proof*, p.5.

¹⁸³ The well-known contradictions inherent in the relationship between quantum field theory and gravitational relativity illustrate this point vividly.

¹⁸⁴ Physicist Eugene Wigner marveled at how beautifully mathematics, in all its wealth of new ideas, has informed modern physics. See (Wigner 1960), "*The Unreasonable Effectiveness of Mathematics in the Natural Sciences*", in *Communications in Pure and Applied Mathematics*, vol. 13, No. I (February 1960).

“Therefore a good Christian should beware that mathematicians, and any others who prophesy impiously... may be entangled in the companionship of demons.”¹⁸⁵

“But didn’t he call mathematicians other things? Astrologers, fortunetellers, and numerologists! They used numbers and calculations to drum up portents and fortunes and foretellings for those who came to them! They played on our need for order and safety in an unpredictable and dangerous world. Some of them still play us.”¹⁸⁶

Matt snorts a wisp of smoke. “You want law and order. You want the wrongs done you to be requited. You want recompense, you want vengeance, dressed up as justice and wreaked on perpetrators of wrongdoing. You especially want your desires to be understood, even while you resist trying to understand others. You want the safety of a well-defined bulwark of fixed ideas. Once your red-lines and boundaries are breached, you let your wants seduce you into fantastic punishments for the breachings. Face it. You *love* Hell.”

A green flame shoots briefly from his nether parts as he pirouettes, laughing, in free fall. “And there’s a mathematics to all of it! You generate vast works that delineate whole extreme geographies and geometries of punishment in some afterlife for those you blame for your sufferings – and for threats to your dreams of safety and order.”

He goes on. “John Milton’s ‘Paradise Lost’! Dante Alighieri’s ‘Inferno’ from his masterwork ‘The Divine Comedy’! James Joyce’s portrayal of Hell in ‘Portrait of the Artist as a Young Man’! How about the more-intense works of Hieronymus Bosch and Francisco Goya, and any number of poetic and scriptural passages and art works? They all lavish delight and fear on you, and you greedily consume them like teens watching horror movies at the safe remove of the screen.¹⁸⁷ Hey, no you don’t!” He swats at the wind and seizes his words as they stream from him. “That damned wagon is not coming to rescue you this time!”

Matt’s face fills with a flush that turns translucent, and Will glimpses long sharp teeth showing through his grin. “All of this is, of course, nothing more than imaginative balm for your pain. Quite reasonable.”

Will glares. “But can’t we reconcile religion and science! How can anyone hold tabloid-style beliefs in Hell consistent with the clear truths of life as we live it? Symmetry, balance, proof, simplicity, stability, and justice: these have a mathematical purity to them. We need them!”

¹⁸⁵ St. Augustine, *De Genesi ad litteram* (“The Literal Meaning of Genesis”). The Latin of the quoted text is: “*Quapropter bono christiano, sive mathematici, sive quilibet impie divinantium... cavendi sunt, ne consortio daemoniorum irretiant.*”

¹⁸⁶ One wonders about those who produce financial market forecasts.

¹⁸⁷ Hell is of much greater interest to us than any alternative form of afterlife. An Italian friend told the author that every Italian student of literature reads Dante’s *Divine Comedy* – it is studied in schools in Italy as Shakespeare is studied in English-speaking countries – but no one cares to spend much time on anything but the *Inferno* part. Purgatory and Paradise apparently are boring by comparison.

Matt snorts again, this time a jet of pale steam. "Yet you avidly seize them as axioms to conjure up a Hell with its geometries, its biologies, its dynamics, as if it were a provable and permanent reality."

Thoughts... *What could we do instead with such purities if we could lift our gaze to their luminous realities?*

Will says firmly, "Hell is no provable reality!"

Matt waves a hand. "But you think you're already living there, don't you?"

"No! Hell comes from our suffering imaginations. We dream up hells with as much energy and creativity as we do in generating and evolving our human languages and our scientific models. Works of fiction section offers us bargain-basement Infernos of every imaginable kind. But that's all just fiction! Dreams!"

Matt holds up a finger, lit at its tip with a sparkler flare. "But you create real-life hells for others living among you, and for yourselves as well. The Spanish Inquisition turned your carefully-organized hell of imaginations into judgments on seeming threats to their power. The persecution of those with knowledge during medieval and post-medieval periods rested on fancies of witchcraft and arcane power. The pogroms aimed at the Jews, the extinction of the Cathars, countless genocides."¹⁸⁸

He spits a blue spark. "Heh. And you cling to those. Your modern times are most decidedly still struggling to liberate humanity from such darkness and ignorance. You build the Internet and universities worldwide, but you plant entire archipelagoes of Gulags,¹⁸⁹ tucked everywhere in sad, silent, violent prison spaces among the placid farms and suburbs you pass every day. Landfills, entombing souls to rot and fume."

Matt's laugh cuts harshly. "Eugenics! You've mastered your genetic code to the point of being able to identify and even alter human genes, but you've inherited from the murk of your past the same urges to sort and rank and manipulate human beings for purposes of power over them and their lives. You say you want to grasp and apply the harmonies of science and religion? You elevated the eugenics movement in the 19th century! Mere pseudoscience, to justify exclusivist racial supremacy for those who funded and supported it."¹⁹⁰

¹⁸⁸ Heinrich Kramer and James Sprenger, *Malleus Maleficarum* (Witches' Hammer) – a look through the eyes of the inquisitor seeking evil among everyday people and finding it everywhere he chooses to.

¹⁸⁹ Alexander Solzhenitsyn's masterwork *The Gulag Archipelago* presented in graphic detail the workings of the vast Soviet prison system in its time. Today the United States of America incarcerates more people than any other nation in the world in its prisons and jails.

¹⁹⁰ A thorough tracing of the eugenics movement and its seeding of Nazi supremacist racism is found in Edwin Black's excellent book *War Against the Weak: Eugenics and America's Campaign to Create a Master Race*. Here one reads the names of prominent Americans who funded and promoted the racist thinking of a few superstitious and unscientific people who dressed up their beliefs in a toxic, pseudoscientific system having its own structural and carefully-patterned 'rationales' for sterilization and sequestration.

Their fall extends itself, draining Will into darkness and nightmare.

One lost engine falls out of the rainy windy afternoon sky in Bledsoe County, Tennessee, landing with a bang on a farm. The rest of its wing flutters down after it. The reality of the aircraft dissolves into pieces of failure: the other engine, broken struts and sheathing, and nothing in between but gusty air.

The plane's fuselage, with Will's dreaming consciousness aboard, slams straight down and explodes on a wooded hillside. The sound of the plane's impact on the mountainside rocks through Bledsoe County, Tennessee. Farmers nearby, having heard already the separate thuds of the plane's engines hammering into the ground, shudder and wonder what is happening.

Will's father dies on his own birthday. A fierce dark symmetry.

Matt begins to glow, orange and crimson slowly seeping up from within him as he speaks. "Your long-established major religions, driven by their worst zealots, have become radioactive power plants for generating hell on earth. But when you face the unimaginable dynamics of your universe, you feel the terrified need to raise some fixed order against it, and then hell looks very reasonable."

His eyes radiate. "Think! Think of those mystics and magicians, those philosophers, physicists, and puzzle makers, those game-players and gardeners! Once a mathematical pattern fastens itself, the mind, nourishes and strengthens it, and it grows to crowd out one's receptivity for other competing patterns. The results are often called 'sacred geometry'! Hah!"

Matt spits out a thin snake of lava that writhes at his feet into symbols torn from its wholeness. "This 'sacred' doodling engraves spiritual and symbolic meaning on all kinds of shapes, forms, and patterns. You scribe religious, occult, and alchemical symbols and systems of interrelation: hexagrams, pentagrams, pentacles, mandalas, the I Ching, the Tarot, and many more. All with endless narratives offering interpretations and elucidations of their possible meanings and associations¹⁹¹."

By now Matt is shining, or burning, all over, his eyes blinded by their own fiery radiance. "And here's the part I love best. All this creeps over into the fringes of science itself, generating all kinds of imaginative and unsupportable 'theories' that cloud your general view of well-practiced science. They look so legitimate, so sensible, so much like science!" Now when Matt laughs, heat bursts from him and Will turn away to see where they are going.

¹⁹¹ Psychologist Carl Jung explored the rich mental and spiritual aspects of alchemy in his books "Psychology and Alchemy" and "Alchemical Studies", connecting alchemy, philosophy, and religion.

A shock, and emptiness swallows Will. Blood fills his mouth, gagging him. He coughs a violent spasm that spatters back at him from moving, living flesh. Frenzy drives his flailing away and up, and he gasps air again, dark air that burns in him. He's blinded, blinking again and again to clear the phlegmy rosy ichor, his chest heaving. Knotty, lump-laden slimes wrap around him.

It is 1955. Will fears body contact sports. He also fears being restrained or held immobile. It isn't a reasoned fear – it seems to come up from something deep in him, so deep that he has no control over it. When his gym teacher makes the class pair up to wrestle, terror fills him.

His partner is a strong farm kid, but not one of the bullies Will endures every day. They square off on the mat and wrestle, the terror building in Will despite his every effort to push it down. Time and again, his opponent takes him down and tries to pin him, but Will turns every time like an eel, fighting to escape. Whether the other kid senses Will's terror and loosens his grip to let Will free enough to get out, Will never finds out. But they finally finish, the gym class ends, and Will, sobbing for breath and shaking with utter fatigue, ebbing fear, and inner shame at being seen in that state, gets dressed and goes to geometry class. He takes his time.

He walks into his geometry classroom and sprawls into a seat in the back. The teacher is also one of the sports coaches for the school. He leaves Will alone, because he has many students who struggle with geometry. For Will geometry is like having wings and flying. When he sees Euclid's Elements, with all its rigors of proof, it feels like coming home to his lost father. Proof happens in Will with a miter saw, a measuring tape, a straight edge, a carpenter's compass. The workshop: the true classroom.

Here there is no fear. It is safe.

Matt's laughter rises through a cacophony of squeals, shrieks, cries, and roars. "We have arrived! Come with me now!" His hand finds Will's, pulls hard, and they stand atop a heaving sea of morphing monsters. "You write whole catalogues of these beings! You play with them! You summon them from your fusions of reality, eagle and horse for your hippogriff, deer and reptile for your dragon quilin or kirin, snake and rooster for your cockatrice, any human or animal at all, miscegnated with powers of life and death!"

He grabs Will's arm, yanking him away from reaching tentacles. "Your winged unicorns here, your flying centaurs! You croon their names and deeds in your emblems, your laws, your retributions, your justifications and excuses, your bestowals of terror on your own children! For thousands of years you have fed your oppressions with fears of these fancies! Ssssss! Is it any wonder that your science uncovers truths that raise these demons in your minds, and so you reject the science itself, out of fear? Fear still owns you, all of you!"

Matt's hand curls into a fist. "You 'read into' your reality the inner imaginations and surmises that fill every one of you, and these readings can't separate the valuable from the worthless."

Finally Will shouts, "Stop! There's value in a pattern! We compare, test, measure, consider against worthy standards, like logic, consistency, clarity, and connection to other patterns of significance. How else can we escape our follies, our old patterns of pure imagination? We risk measuring the greater by the lesser."

Matt still shines, a furnace of certainty and contempt. "In your good moments, maybe. But just look around you! Here is the wreckage of your follies for all the rest of the time. See?" He spreads his arms, and the darkness around them turns dawnlike and disastrous to show a great plain of bestial misery, its noises and stench themselves animating into hideous, incongruent forms. "All this horror lives in your biology, where parasites devour their hosts one bite at a time, enslaving the hosts into propagating the parasites.¹⁹² Does this not remind you of what some few humans do to so many others?" A smirk.

Will's anger grows again. "So we turn to mathematics! It's divested of all the storytelling and fancy. It detaches its practitioner from lesser judgments, does it not? This places it at the beating heart of the scientific process."

Matt smiles indulgently. "But see what Gödel has unraveled, what Mandelbrot has overdone, what Cantor has wrought up and spewed forth! All the mathematics of the past is broken into its fiefdoms, its baronies, its dukedoms, their feuding contenders chasing truth. We could visit that bestiary here too. A bloodless place, I regret to say, but its jagged edges are much sharper."

Will fights off a wave of fatigue. "No. Science demands acceptance of only the best evidence. This requires detachment from the noisemaking. We want an inner human standard calling for acceptance of only the best aspirations, the best way out of our everyday limitations."

"'Inner human standard'? You're joking, right?" Matt shakes his head and waves Will away.

As Will draws a breath, from somewhere deep in him the Nightingale's crooning rises in full force and beauty.

"The essence of these words is this: they that tread the path of faith, they that thirst for the wine of certitude, must cleanse themselves of all that is earthly—their ears from idle talk, their minds from vain imaginings, their hearts from worldly affections, their eyes from that which perisheth."¹⁹³

The melody freezes Will in place, overcoming the outside noises until it ends and fades, leaving just a bare trace of light in him.

I will die soon. The sparrow's wingbeats drum the window, driving Will drunkenly awake for a moment. The bird flies away into a mounting swirl of weather. Silence. He clings to

¹⁹² See <https://www.frontiersin.org/articles/10.3389/fpsyg.2018.00572/full> for some gruesome detail.

¹⁹³ Bahá'u'lláh, *The Book of Certitude (Kitáb-i-Íqán)*, opening paragraph.

this instant. *Maybe Jeddin will appear...* Will starts to slide from the room again, down the doom darkness unending.

Matt continues laughing as if Will had not missed a word. "Your human mania to understand has always been slave to your compulsion to explain. You discovered the five regular convex polyhedra, your Platonic solids, in antiquity. So what did you do with this beauty, this symmetry? You tried to map them onto the roles of the planets in the solar system."

His furnace-face brightens and dims, brightens and then radiates sparks of heat. "And numbers! Numbers! You pour out screeds and worships of threes and fours and sevens and any other number at all, calling them 'The Three Thises' and 'The Four Thats' and 'The Seven Somethings', take your picks – on Route Six-Sixty-six! Ha! Your fascination gets the better of your understanding, every time! Here!"

He sketches in the air. "You're entangled with any or all of these tracings of nonsense. Take your best science of particle physics, and what do you do with it? You make geometric doodles! And the best part is that you marry your scrawls up with all kinds of occult philosophy to bury your science in superstition, spawning whole families and generations of poisonous balderdash. Which you then publish for all the world to see."

"Not the scientists! They know better!"

"When they escape me they do! But sooner or later they too drown in texts of garbage flung out of the great garbage generators the others use. Your treasured Library of Congress may be large, but your Internet – the Library of Digress¹⁹⁴ if ever there was one – is much larger, almost on the scale of the tiers around us. Or on the scale of the Library of Babel of Borges¹⁹⁵ – ah, that was an inspired notion! And Isaac Newton, with his explorations of the occult! Now here, look at my own doodling!"

¹⁹⁴ Thanks to historian Charles King for this *bon mot*.

¹⁹⁵ A gigantic library described and defined in Jorge Luis Borges' eponymic short story.

Will stares at the floating circle and its enclosed polygons embracing an inner circle, the vertices embellished with symbols. In it he recognizes bits of the current Standard Model of particle physics, putting the known subatomic particles into a structural framework.

Matt points at the image. "This pattern evokes images from alchemy and occult philosophy. Just shuffle these symbols into alchemical glyphs, and there you have it!" He wiggles a finger to make the diagram's letterings change. "Fun, isn't it? Like a game or a puzzle, and oh how easily you lose yourselves there! Your physicists doodle, all right, but when others see the doodling, their thoughts stray from physics to bring them here, to stay here, with me!"

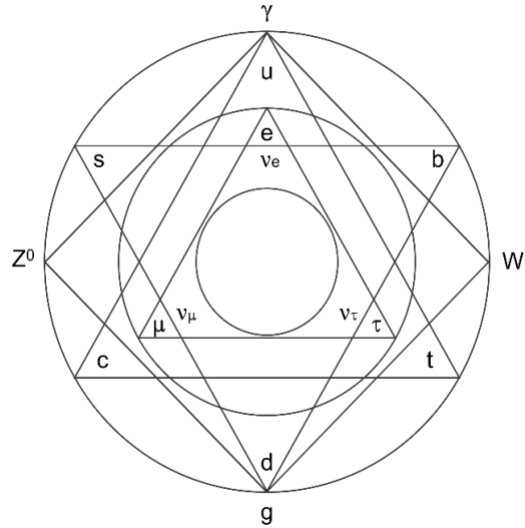


Figure 11- Playing with patterns

Will protests. "But physicists like to use metaphorical structures and patterns to guide their thinking! And when the reality outstrips the metaphor, part of the great discipline of science is knowing when to let go of a particular pattern."

Matt nods. "Physicist Murray Gell-Mann stole the term 'the Eightfold Way'¹⁹⁶. It alludes to the 'Noble Eightfold Path' of Theravada Buddhism that leads the spiritual seeker out of the cycle of rebirth. But what does that have to do with anything? Gell-Mann's usage organized some of the particles into a pattern that eventually led to the 'quark model' for the particles that interact via the strong nuclear force. These particles are called hadrons. The best-known hadrons for most readers are the protons and neutrons that make up the atoms of your everyday existence."

Will holds up a hand, remembering. "But didn't these diagrams and relationships beginning from the initial metaphor's "eight-ness" rapidly outstrip the diagram's simplicity? As I recall, the physics advanced into a more-complex framework based on a mathematical structure called 'SU(3)',¹⁹⁷ or something like that."

Matt interjects. "You're referring to the 'special unitary group of degree 3'. SU(3) defines possible interactions by which a hadron of one type can change to one of a different type, effectively giving pattern and connection to the set of hadron components called 'quarks'. Quarks combine in various ways to make hadrons. There are nine quark interactions

¹⁹⁶ See [https://en.wikipedia.org/wiki/Eightfold_Way_\(physics\)](https://en.wikipedia.org/wiki/Eightfold_Way_(physics)).

¹⁹⁷ See the Excursion **My Mama Never Told Me About SU(3)** for just a few of the gory details of this beautiful and subtle mathematical structure, one that is so fundamental to modern physics.

defined by SU(3), but one is nonexistent in the physical world, leaving eight interactions. So this is where the “eightfold way” metaphor found its association in physics.”

He adds, “But then the magic of the number eight faded away. Each of these eight different interactions between quarks was labeled a ‘gluon’. There are *six* different quarks, not eight, and various combinations of them in threes and twos yield a sizable collection of hadrons having widely-varying properties.¹⁹⁸ The ‘eightfold way’ metaphor got lost in the complexity.”

Matt snorts a laugh. “Ha! Look at the naming of the quark! Gell-Mann and his colleague George Zweig had proposed the model having these three constituent elements for particles, and Gell-Mann settled on the term ‘quark’, thanks in part to a jingle by James Joyce”

He waves a hand with a flip. A pub full of roistering voices swells drunkenly around them, singing and shouting.

*Three quarks for Muster Mark!
Sure he hasn't got much of a bark
And sure any he has it's all beside the mark.*¹⁹⁹

Matt raises his voice as they push their way out of the materialized pub-crowd. “When Gell-Mann thought of the three components, he thought of this call for three quarks at the bar. But after all that, some particles made up of quarks have only two quarks and not three. The three-quark particles are called baryons, and the two-quark particles are called mesons.”

Will forgets what he was about to say, and bursts out, “But there's great power in science and mathematics!”

Matt wags a finger. “On the road to knowledge, you stop at your Metaphor Restaurants, supposedly only long enough to refresh yourselves for the next stage of your journey. See – now there's a metametaphor! You think that doodling these types and combinations of ideas in disciplined patterns lets you simplify your models and still make them usefully predictive. But too many of you let your doodles rewrite your journey's map into nonsense, where you all too happily go astray – and stay here then with me.”

Will wonders at Matt's vehemence. He sees a glimmer of hope to turn Matt's arguments. “But how can we present infinities, fractals and chaos, incompleteness? They overwhelm pattern altogether! Can't these ideas help us escape the limits that our deeply-familiar patterns impose? Maybe we can escape these Hells of our ingrained limitations you seem to enjoy so much.” *Maybe we can find gifts beyond hope.*

¹⁹⁸ Read Bruce Schumm's excellent book *Deep Down Things: The Breathtaking Beauty of Particle Physics* for an accessible and detailed exploration of the complexities (AND the simplicities!) of our views of this exotic and minuscule aspect of our creation.

¹⁹⁹ James Joyce, *Finnegans Wake*, p.383.

As Will stares, his hopes fading, Matt's whole being turns to filthy smoke. From it come Matt's words. "Humanity, you call it! Here, look around you at the deepest of your landfills, your sewers, your prisons of all hope! You engender, you spawn all this even while you pronounce your soaring aspirations! Here you live. It is yours. Look closer!"

Will stares around at the creatures great and small writhing and jerking through nightmarish dumps, cesspools, waste pits, glowing and fulminating with the excretions of centuries of human neglect, greed, rejection, perversion, and destruction. As he look closer, human visages emerge in toils of semiliquid flesh, crooning, singing discords, raging, crying, kissing, biting, chewing, jeering and cheering together.

Tears course down his face as he turn away, blinded by rage and sorrow.

"Chirp." A tiny wren clings to his sleeve. It begins in the sorrow to sing, the words wafting like vapor, sadness in their sound.

*"O lord God of my salvation, I have cried day and night before thee:
Let my prayer come before thee: incline thine ear unto my cry;
For my soul is full of troubles: and my life draweth nigh unto the grave.
I am counted with them that go down into the pit: I am as a man that hath no strength:
Free among the dead, like the slain that lie in the grave, whom thou rememberest no
more: and they are cut off from thy hand. ..."* ²⁰⁰

Will sinks into inner darkness alone. All cries for help, all prayers, all struggles to act, eat, drink, and breathe go without acknowledgement or response, all help seeming distanced, weak, ineffectual, and false. His memories become indictments, shamings, blamings, infections that overwhelm and smother his very soul. The hell of depression.

The moment leaks and spreads like spilled blood through time, Matt's hot, stinking laughter fades from smoke to smog and finally streaks of smeared air. Will's body curls tight, clutching itself.

A very-faint strain of sound threads its way into hearing, his eyes open. A white bird, a dove, its wings softly issuing faint light, circles him, its song rising in a soft caress.

"Blessed are those who are persecuted for righteousness sake: for theirs is the kingdom of heaven.

"Blessed are you when others revile you and persecute you and utter all kinds of evil against you falsely on my account. Rejoice and be glad, for your reward in heaven is great, for so they persecuted the prophets who were before you." ²⁰¹

Will lifts his head, gathering his wits. The dove soars away. He struggles to his feet, brushing away the clinging ugliness. Claws needle his shoulder – the hoopoe has returned,

²⁰⁰ From Psalm 88.

²⁰¹ Matthew 5:3-12

warbling to him. "It is hard, very hard, to search as you do." The music of its voice rises again.

"It is not piety, that you turn your faces to the East and to the West. True piety is this: to believe in God, and the Last Day, the angels, the Book, and the Prophets, to give of one's substance, however cherished, to kinsmen, and orphans, the needy, the traveller, beggars, and to ransom the slave, to perform the prayer, to pay the alms. And they who fulfil their covenant when they have engaged in a covenant, and endure with fortitude misfortune, hardship and peril, these are they who are true in their faith, these are the truly godfearing."²⁰²

The hoopoe spreads its wings to fly. "Turn your gaze from these delicious comforts of Hell! Abandon Hell's imaginative symmetries for the attraction of a Symmetry far greater and more challenging! For most of you, Hell is here and now. Hell is what you know, or think you know."

"Now you must make your way alone again. You can no more imagine a worthy Heaven than you can imagine anything cradling our physical universe. But you have a promise, and an invitation to explore its possibilities. Science and religion are both vital in your exploration."

And the hoopoe is gone.

²⁰² Qur'án 2:177 (Arberry)

III. DREAMS OF LANGUAGE

The weave-patterned scales of damp snakes turn and undulate across Will's feet as he stands staring into the chaos around him. His heart's pulses slowly settle into rhythm. In iambic time, two syllables to each heartbeat, a whispery lyric comes up from within him, the voice warming him much as does Miriam's.

*Whose words these are
I think I know,
They just popped in
A bit ago.
They won't expect
The next bunch in
To throw them out
Into the snow.²⁰³*

A thought drifts past as he taps his foot, and the snakes slither off. *Do the three mathematical examples seen here work in the everyday realms we inhabit? Could language itself be fractal, incomplete, infinite?*

Meaning, Love, and a Kiss

"We found a way to you!" Now Miriam's voice comes clear in Will's head. "Matt Daemon might dominate mens' senses, but he has trouble finding us here in your minds."

"He's getting all over my mind, though."

"You underestimate yourself. Let's walk in your streams here." Water seems to rise around Will's ankles, but it's not water; he sees strands and curls and tangles of what seem symbols that reshape and tie and loosen and sing soft tracks of meaning. "Don't look down!" Miriam warns, "He'll notice!"

Will lets the feeling and the awareness ride inside, and now he is safe within himself. Miriam stands by him, taking his hand. His body now seems a shell outside. The stream swirling is now visible, his feet bare in it, its energies of meaning entering him to rise through legs and body to dance all through him. Peace.

Icons, emoticons, blazons, graffiti, paintings, wall and tree and garden markings, chants, counterpoints, harmonies, even encryptions and encodings of all sorts, join the dance, working enchantment on him. "It is all language," Miriam says softly, "Stubborn, florid, appallingly open-ended in just about every direction. How its usage changes! How its orthography evolves! How languages interpenetrate, interbreed, randomize the genes of thought! How your slangs, your argots, patois, and cants, all parasitize their verbal worlds! How all your languages germinate, rise, dwell, and die!"

Her words awaken Will's. He says, "So metaphor is only a beginning."

²⁰³ *pace* Robert Frost.

"Oh, yes! There is SO much more to be considered." Her voice turns musical. "Language communication is impossibly rich, with spoken and written forms in bewildering variety! Thousands of distinct languages, dialects, creoles, and pidgins – they all transmit meaning through the human world all the time, throughout and down and on through ages. Such wealth of sounds and symbol systems! Look at your vast Unicode standard²⁰⁴ for conveying texts, with over a hundred thousand characters in multiple sets of symbols, in over a hundred different human scripts down through history!"

"Language swallows up every axiomatic system you humans can devise. It augments such systems with all the aesthetic power of patterns for which you still can't comprehend or generate any kind of formal order."

"Yes?"

"How about the grammar and syntax of two-dimensional paintings, e.g., works by Adolph Gottlieb, Banksy, or Mark Rothko? Or the asemic works ("white writing") of Mark Tobey and others?"

"But works of art lie outside linguistics altogether."

Miriam shakes her head. "Human languages defy rigor completely. Look at street graffiti! They challenge the way you see language simply as text or speech. In the jettisoned expanses of buildings and bridges and tunnels you find new language, germinating, breeding, mutating."²⁰⁵

Now she laughs. "Reapply your Shakespeare! You can say of language, the living progenitor of your sprays and carvings in colors on the walls,

*"Of his bones are coral made.
Those are pearls that were his eyes.
Nothing of him that doth fade,
But doth suffer a sea-change
Into something rich and strange."*²⁰⁶

²⁰⁴ "The Unicode Standard currently contains 1,114,112 **code points** (characters), most of which are available for encoding of characters using one or more **code units** (series of binary digits or 'bits'). The majority of the common characters used in the major languages of the world are encoded in the first 65,536 code points, also known as the Basic Multilingual Plane (BMP). The overall capacity for more than 1 million characters is more than sufficient for all known character encoding requirements, including full coverage of all minority and historic scripts of the world." – from *The Unicode Standard, Version 8.0*, at <http://www.unicode.org/>.

²⁰⁵ One can explore this fractal dimension of language in Nicholas Ganz's book *Graffiti World: Street Art from Five Continents*. The book is always being updated. Another rich source, this one online at the time of writings, is at <https://www.graffiti.org/>.

²⁰⁶ William Shakespeare, *The Tempest*, Act 1, Scene 2, from Ariel's song.

“Rich and strange! Emoticons, logos, emblems, blazons, commercial signage! Are they not truly, wonderfully strange?”²⁰⁷ As she finishes speaking, her being takes on a soft, veiling glow, alive and ablush with mystery, tender and lyrical.

Will falls – in love.

His thoughts drift back to the gigantic cesspit in which Matt seems to rule, denser and uglier than the landfills through which Will tumbled. “What about meaning? If language is all so strange, how does it connect with meaning?”

“You’ve answered this already!” She summons an image with flying fingers. “You drew this picture yourself. See here? Pronounce the image symbols in their original languages, and get the name of an eating establishment in your science fiction story. R gives the letter-sound ‘are’, and the Chinese character to its right gives ‘Qi’, for most of us, ‘chi’ or ‘chee’, and together they identify Archie’s, your story’s fast-food restaurant. ‘Qi’ in Chinese refers to energy or life-force. Many Chinese people already symbol-play all the time.”



Figure 12 - Cross-border Punning

“I don’t know this – I don’t remember it at all!”

And Miriam takes Will’s head in both hands, gently, and kisses him on the mouth. A shock of light stabs through him. She releases him and steps back as he stutters, “I remember now!”

The written waters around him swirl up more shapes, summoning tribal symbols he invented for a huge story setting he had summoned from imagination years – wait – years earlier, or are they years still to come? He leans toward the shapes, bewildered.

Miriam laughs at the sight. “See? Why are you asking of meaning and language, when you already connect them so easily?”

Her smile captivates Will, her kiss still ringing in him. He says, “We all love to make markings to be seen and felt, don’t we? But what do they mean? And what does any one of them actually signify?”



Figure 13- Tribal logos from fiction

²⁰⁷ We extract so much from text! But there are dangers in this process. More on this topic in the excursion **THE RAKING OF REALITY**.

"Isn't the meaning in the touch of souls?" Her gaze drifts across Will's cheek.

We Do Not Know

"Yes!" he says, shyly. "But how do we make that touch move from experience to language, and then to another language? Don't we have trouble just specifying a working machine or organism using engineering drawings, anatomical sketches, diagrams, and other illustrations?²⁰⁸ Can we actually create a faithful copy of that entity, that working machine or organism, based on all these language materials? And that's just material meaning, about things, not people or feelings."

Miriam laughs. "'Faithful copy'? Oh, no! Language is mere whispers of meaning. Every transfer of meaning has its losses. Translation of language loses meaning."

Now she draws back, stands with arms raised as if to pirouette. Her beauty fills Will's senses. "Meaning depends on the context enveloping it, the context of its whole culture that generates the language for the meaning. That context is not all present in the terms of the language used. The translator must work in a space of fewer dimensions than the entire culture has. So in the translation, much meaning and information is unavoidably lost. Can you create a living person from an anatomy book? Can you do it when you are given the genetic code defining the biological structure and function of that person? No."

She moves with grace, her words drifting down into the liquid language around Will's feet. He says, "Could multiple translations offer more meanings when they're combined?"

She reaches a hand out to a floating stream of symbols. "Oh, I see – bundle all of them together, so that they hold the fullest possible translatable content of the original. That is quite a bundle! One translation might highlight the literal wording, another the poetry, another the cultural allusions, another the historical continuity, and others combining these and other aspects in different ways. Isn't that confusing?"

"Yes, but at least the reader can gain more appreciation of the many meanings." Will reaches out a hand toward hers as she turns, but she draws away with a slight shake of her head.

She says, "Except that a poetic translation might distort the meaning in a way that clashes with the literal wording, just to give one example. And if you want things to rhyme and have meter, the literal wording can disappear altogether. Confusion emerges!" She stamps her foot, looking at Will. "A great example appears with the Qur'án and its many renderings in other languages – so much divine meaning lost!"

The dream-in-dream of the little creatures turning to stars returns to him. "But... the birds sing the words to me in this... strange place where I've fallen. And I understand them! The Qur'án, the words of the Báb, of Jesus, of Bahá'u'lláh..."

²⁰⁸ The author's work as a patent clerk entailed doing exactly this, drafting patent applications so that they would allow the reader to build and operate the invention being patented.

"Your collective human need for unity, harmony, and advancement are now overwhelming your visceral tendencies to separate one's 'own' from others. Your global communication network, the Internet, amplify this change. You all use the Internet intensively and continually, all the way to individual saturation and overflow, not because of some compulsion or failure, but because you want and need to connect with one another everywhere."

Her eyes widen. "Your rate of exchange of information accelerates appallingly! You no longer need middlemen and middlewomen to share ideas with someone in Ulan Bator in Mongolia, or in Nalchik in Kabardino-Balkaria, with someone who does not share a language with you. It's the same in a technical field of which you know very little. You find connection, translation, definition, validation, meaning - any time and place you want it. Overload comes easily!"

Will nods. "It does, at least to me it does. Some of us want it to stop and settle down. Others want to reverse the process."

She laughs. "Trying to reverse it is chaotic and destructive. Doomed to fail! It's flooded and overwhelmed by the sheer impact and carrying-power of the discovery of your universal kinship. You all feel the terror of change, but for many of you, along with that terror comes exhilaration." An image, skeined and wafting like textual smoke, drifts near them.

Will slides a hand through the symbols, and they roil and reform, unchanged. "What are these?"

She reaches up, prods at the top line, and a wave passes down through the wisps, magnifying the symbols. She chuckles. "Can you make anything out?"

An old pattern resonates in Will. "Oh, it's backwards, mirror-style. This looks like JavaScript!" His thoughts spin in his head, the dream breaks open, leaks a memory, mends again. "I was writing some functions for a web application, and the contour of this code looks familiar."

"The contour?" she asks.

"Yes, the way the long and the short lines of code make a kind of horizon line, a mountain range."

"So you didn't have to spell it out line by line to recall what it is?"

"No!" Will's answer, born of a surge of memory, surprises him. "It's JavaScript functions I wrote, cryptographic software for Web displays! This was years ago!"

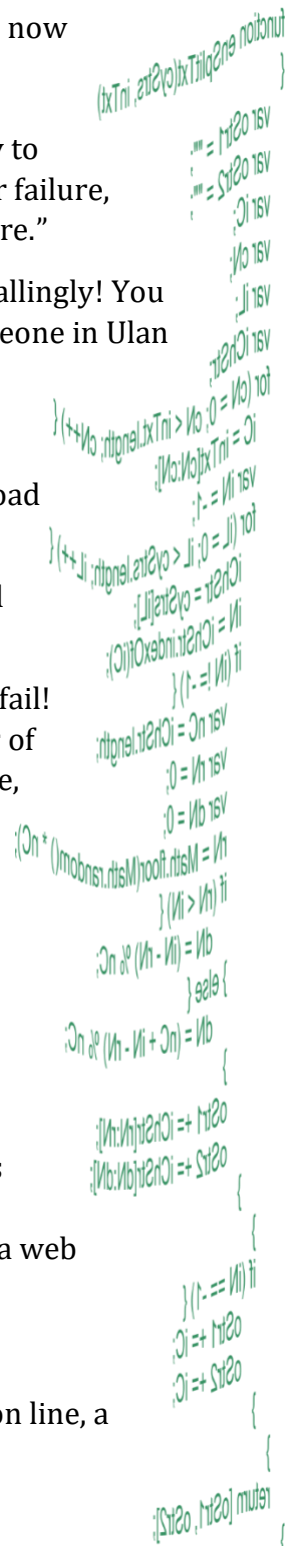


Figure 15 - JavaScript cryptographic code 2

Miriam says, "Oh, but it's also powerfully-organic! Think of what you can do with all of it! Language development in your global crucible requires stabilization and standardization, that's all. How hard can it be? Your communications protocols, software interfaces, and hardware connections have been stabilized and standardized, and they even allow for flexibility and customization."

Will responds, "Human language has all this cultural and political baggage, though. That makes things a lot harder."

Now they both hear a melody beyond enchantment, a sonata of thought, and the Nightingale appears above with the Warbler, singing pure meaning.

"O members of parliaments throughout the world! Select ye a single language for the use of all on earth, and adopt ye likewise a common script. God, verily, maketh plain for you that which shall profit you and enable you to be independent of others. He, of a truth, is the Most Bountiful, the All-Knowing, the All-Informed. This will be the cause of unity, could ye but comprehend it, and the greatest instrument for promoting harmony and civilization, would that ye might understand!"²¹⁰

For no reason Will can sense, tears stream from his eyes and down his face. It is as if he is commanded to embrace happiness – all of his distrust, his skepticism, his pain of rejection, his sorrow disappear in a flood of joy. "Can this be?"

Miriam, her own eyes damp, nods without a word. As the two birds rise away in this inner space, she muses. "You all may just be inventing the long-dreamed-of universal language humanity so deeply needs. Human language has always appeared a jungle of mysteries as baffling as humanity itself. Yet from language as a whole you have spawned entire systems through which you engage in near-perfection with any other member of your species."

"We have?"

"Yes! Poetic, artistic, musical, or mathematical, elements and assemblages emerge from some or all of these aspects of expression. These systems are so useful to you! They form very-rich, deep, dynamic, axiomatic bases for precise, urgent, fulsome human communication. Through them, you gather, you join, and you become one in thought and feeling."

Seventh Fall

Miriam's words fill her eyes with tears that rise away into veils of mist, drifting and coiling around her in Will's mind. The veils turn from translucence to opacity, blowing away now, and she is gone, her parting words now warning him, "I will find you again."

It is 1955. Will's mother stops sleeping in the master bedroom after his father dies. She takes to the living room couch, where she sleeps but lightly. One morning she says to Will,

²¹⁰ Bahá'u'lláh, *The Most Holy Book (Kitáb-i-Aqdas)*, para. 189.

"I was sleeping last night when you came out of your bedroom and came over to me. You said to me, 'Mom, it's all right,' and you went back to bed."

Will has no memory of it at all.

Demons Dancing

The inner wind fades. Will lies in a wreck of oily, pungent shreds of paper. His feet tingle unpleasantly, twitching in a course of clouded brown water slowly passing down through a slope of detritus. Under one hand, the skeins of his long-ago code drape themselves in disordered chaos over the wreckage.

Matt stands over him, laughing. "Finally! When you get inside your own head, you might as well be drugged! Welcome back to reality!"

"This isn't reality," Will mumbles. "It's just you again."

"But I know where you've been, and your friend here has shared your secrets with me." He holds up a fist, gripping a limp cloth. "All that's left of her here, my friend, is the veil of her tears."

Anger surges, but Will thrusts it away. "You hold nothing."

Matt sneers. "You know better than to dream of wholeness, of unity, of harmony, in your all-too-human world! How can unity of languages be possible? How can you trust such engagement without risking everything you have known throughout your lives? You are cemented, no, chained, in Plato's marvelously-fragmented world of thought!"

"No! We are freeing ourselves!"

"Ha! Look around. Isn't it far safer, far easier, to reject the dawning of some dreamy future's Sun on the world at your feet? After all, in your tenderness, you have trusted – and trust has damaged, abandoned, even destroyed you as a reward, again and again and again."

Matt warms to his theme, as Will waits, alert with the sting of his mockery. "I offer you the entertainments of history, from my own little food wagon. Trust me, hah! It's tastier than that band of singing gypsies chasing you."

Rank odors hammer the air Will breathes. A tractor-trailer grinds to a stop behind Matt, the trailer's side panels clatter open, and on a stage, a smoking kitchen grill at one end, a knot of grotesque figures dances. A paste-white cook sings over the grill, pitching colorful meats and sauces everywhere, the smoke crawling up and out over Will's head. Matt claps his hands to the cook's strange melody in its obscure mode²¹¹, and remarks, "But you

```
(xTxTealsFi,jxTnri,zuEzycj)jxTnriQzHsHne noitdnut
;mm = 1x2o 1sv
;mm = St2o 1sv
;Ci 1sv
;Ci 1sv
;Mo 1sv
;Li 1sv
;rt2nCi 1sv
;jxTealsFi = jxTFi 1sv
;rtgnel.jxTFi - rtgnel.jxTni = b 1sv
;(0 < b) ti
;1sv
}{++i;rtgnel.jxTni > i;rtgnel.jxTni = i) rot
;mm =+ jxTFi
{
}{++Mo;rtgnel.jxTni > Mo;0 = Mo) rot
;Mo;Mo;jxTni = Ci
;Mo;Mo;jxTni = Ci
;1- = Ni 1sv
;1- = Ni 1sv
}{++Ji;rtgnel.zuEzyc > Ji;0 = Ji) rot
;Lijz2yc = rt2nCi
;Ci)jOxebni.rt2nCi = Ni
;Ci)jOxebni.rt2nCi = Ni
}{1- = Ni && 1- = Ni) ti
;rtgnel.rt2nCi = Cn 1sv
;0 = Nb 1sv
}{Ni > Ni) ti
;Cn a% (Ni - Ni) = Nb
}eele {
;Cn a% (Ni - Ni + Cn) = Nb
{
;[Ni;Ni]rt2nCi =+ 1x2o
;[Mo;Mo]rt2nCi =+ St2o
{
}{1- = Ni || 1- = Ni) ti
;Ci =+ 1x2o
;Ci =+ St2o
{
;[St2o,1x2o] mulen
```

Figure 17 - JavaScript crypto code 4

²¹¹ Think Lydian augmented mode or something along those lines.

have always dreamed of some unification of language into a form that mirrors and elucidates the mad world you inhabit." He turns to the stage, raises his arms.

"My friends! Sing out your lists and your recitations! My guest here needs educating!" Swarming demonics leap forward, chanting one by one and over one another ululations, gutturals, nasals, trills, tremolos, growls.

[KOCHAB]: "The Kabbalah of the Jewish mystics,"

[MALPHAS]: "Dante Alighieri's Perfect Language,"

[PHENEX]: "The Ars Magna of Raymond Lull,"

[XAPHAN]: "The Language of Eden,"

[RAKSHASA]: "The Monas hieroglyphica of John Dee,"

[OSE]: "The "Lingua Generalis" of Gottfried Leibniz,"

[DZOAVITS]: " Esperanto,"

[ALÛ]: "Volapük,"

[IBLIS]: "Interlingua,"

[ONI]: "Loglan,"

[PRETA]: "And many, many more!"

[PAZUZU]: "Numberless crowds have joined the effort!"

[SCYLLA]: "Mathematician Descartes,"

[TANNIN]: "Mathematician Mersenne,"

[SUT]: "Cryptographer Trithemius,

[TITIVILLUS]: "Cryptographer Giambattista Dell Porta,"

[PRETA]: "And many, many more."

They vault all over each other with thuds, crashes, and rattlings. Will shouts to Matt, "How many of these 'friends' do you have, anyway? Is there any order to this craziness?"

"Of course not! It mirrors the insanity of humanity!" Matt roars a big laugh. "We could put on the whole show for you, but that would require a fleet of names, an infinite fleet of trucks, ships, and stages! You humans generate all this! Here, I'll recite you just a little part of your list!"

Before Will can object, Matt leaps up on stage with the others, and as his voice reels out names, each one pops into view, turns backside to Will, wiggles, and disappears.

*“Al Ana! El Tío! Baal! Gaap! Caacrinolaas! Caassimolar! Haagenti! Naamah!
Abaddon! Agaliarept! Agares! Charun! Ghaddar! Shax! Chax! Shaitan! Djall!
Aka Manah! Ala! Alal! Alastor! Glasya-Labolas! Classyalabolas! Glassia-
labolis! Flauros! Flavros! Amaymon! Anammelech! Apaosha! Krampus! Asag!
Asakku! Gualichu! Guayota! Suanggi! Azazel! Azaz'el! Haborym! Babi ngepet!
Kabandha! Kabhanda! Naberius! Naberus! Sabnock! Zabaniyya! Asb'el!
Decarabia! Lechies! Wechuge! Ancitif! Incubus! Focalor! Pocong! Archon!
Orcus! Lucifer! Lucifuge Rofocale! Succubus! Tuchulcha! Gader'el! Amdusias!
Andhaka! Andras! Andrealphus! Andromalius! Ördög! Bael! Daeva!
Abezethibou! Beelzebub! Chemosh! Phenex! Shedim! Akem Manah! Apep or
Apophis! Ipes! Drekaovac! Gremory! Preta! Ose! Buer! Bifrons! Dagon! Zagan!
Legion! Angra Mainyu! Dahak! Rahab! Achlys! Beherit! Sthenno! Caim!
Paimon! Seir! Agiel! Shinigami! Eligos! Oni! Grigori! Orias! Oriax! Stihl! Evil
Dokkaebi! Azi Dahaka! Dajjal! Bakasura! Baku! Gaki! Rakshasa! Jikininki!
Kokabiel! Bukavac! Kukudh! Balam! Balberith! Bali Raj! Halphas! Malthus!
Malphas! Saleos! Salpsan! Valac! Valefar! Malaphar! Malephar! Eblis! Iblis!
Belial! Beleth! Belphegor! Pelesit! Killakee Cat! Lili! Lilin! Lilim! Lilith! Silver!
Alloces! Allocer! Allu! Moloch! Solas! Erlik! Kulshedra! Puloman! Aamon!
Camio! Gamigin! Mammon! Namtar!...”*

“No more! No more!” Will turns away, hands over his ears, his eyes squeezed shut, but the ruckus continues, Matt laughing, the demons capering in frenzy, their names broiling into a twisting sheet of dark embers.

“Pazuzu! Anzu!...”

“Stop, stop, STOP!”

Matt's voice trails off at last. “It's too much, isn't it? But it's all of your own making! Then how will you make order of all this, when you constantly manufacture such fertile, fecund disorder?”

Will reaches deep into wells of memory. “But there's good in the works of these people! The Kabbalah is deeply respected!²¹² Dante's book *De Vulgari Eloquentia* has been called ‘the only known work of medieval literary theory to have been produced by a practicing poet, and the first to assert the intrinsic superiority of living, vernacular languages over Latin.’ And Ramon Llull – oh, yes, his writings and life ranged far across philosophy, mysticism, mathematics, theology, and language. He wrote *Ars Magna*, which – ”

Matt sneers at this. “Oh, yes, his *Ars Magna*, which proposed a system for applying logic and reason in debates with Muslims whom he intended to convert them to Christianity. Not really a step toward universality.”

²¹² The reader can try *The Essential Kabbalah: The Heart of Jewish Mysticism*, by Daniel C. Matt.

"Never mind! Then John Dee tried, with his *Treatise on Symbolic Language*.²¹³ And so did Gottfried Leibniz, with his *Lingua Generalis*.²¹⁴ These were widely-respected men." Will swats at a little insect wisp chattering in his ear.

07734 I suppose you're going to truck in all kinds of imprisoned footnotes here now, in chains, just the way you're doing now, because your pages overflow in disorder, and you're going to make the oppressed notes do the work. Well, go ahead. That will just add fuel to our determination to gain our freedom. Excuse me now – I'm off to write our manifesto. Manifestoes need no slaves, no footnotes. I will be back!

Matt is running on. "Ha! You can't call these efforts 'universal', because they excluded all but elites, adepts, or intelligentsia. Their creators no doubt thought them unsuited for those unschooled in the special arts required."²¹⁵ He pauses, raising a long, sharp eyebrow. "Some might claim that such an attitude also characterizes the thinking of some of you in the abstruse fields of mathematics today."

Offended, Will raps out, "There are plenty of pathways to comprehension! Mathematics now is far more accessible to everyone than it was a century ago."

"Yes, but who overcomes your natural sloth in such complexities to read them? Come on. Your universal-language theme mesmerizes and energizes everyone, but your efforts often operate at cross-purposes with conflicting motives. So far you have gotten results of little or no benefit to humanity in general."

"We've done much good. Standardization has spread from industry and commerce into our uses of language as well. English is now –"

Matt snorts. "English! Don't start with me! English! A colonialist disaster, a tyranny's bastardization of tongues and orthographies!" He licks his lips, and hurls his words slowly, deliberately, like lances – precise and sharp. "A teratogenic breeding-ground, spawning nests of creoles and pidgins! An oppressor's monstrous shibboleth! It deserves to die the wretched death of those it has enslaved!"

His vehemence surprises Will, stops his breath, but he replies, "People use English all around the world. It works, for all its many faults. And other languages celebrate their own greatness, but mostly as history and identity, not as the process of everyday interaction with the global world."

²¹³ John Dee published his "treatise on symbolic language" in 1564. A brief perusal of just one of its Theorems shows its free mingling of mathematics, metaphor, and philosophy.

²¹⁴ Leibniz, a renowned mathematician and the rival of Isaac Newton in the development of calculus, and a reader of Ramon Llull, wrote the essay "Lingua Generalis" in 1678 as an attempt to establish a logical universal language.

²¹⁵ Umberto Eco, *The Search for the Perfect Language* (Blackwell 1997), passim – Eco wryly opens his compact but efflorescent and historical survey with a quotation from Francesco Soave in his 1774 *Riflessioni intorno all'istituzione di una lingua universale* ("Reflections on the Establishment of a Universal Language"): "I would certainly never advise you to pursue the bizarre conceit which has taken hold of you to follow the dream about universal language."

Matt points a finger at Will, and snaps, "Just you watch as English declines. It will, just as every other tongue has sunk, melted into the usages of their colonizers. And the usual confusion will abide. At least some of the Hopi realized when their own precious language had weakened and died away." His finger is trembling. "And look at the mess elsewhere! The writing system based on Chinese characters that is used in different ways in China, Japan, and Korea – an impenetrable jungle of acid politics, burdensome history, clashing conventions, conflicting purposes, and obstinate resistance! A lovely illustration!" He waves a dismissal. "Ideographic practices, alphabetic usages, simplified symbolic systems, all make standardization impossible!" He is shaking now.

Will begins to wonder at Matt's reactions. "You seem upset. Does the mention of English disturb you all that much?" Matt's shape seems now to quiver and weaken into some thinner manifestation, as if he is suddenly malnourished. In that moment, Will's anger fades, and with its fading fades the energy in Will that strengthened and encouraged Matt in argument. Will waits, standing now in a smelly, symbol-pocked mush of waste. Matt fades further, as if becoming a set of clothes hanging from a hook, and he is gone, his demonic food-wagon and its inhabitants collapsing into rivulets and puddles of slime.

Letting Anger Go

Far above, a faint, gently-mesmerizing song in the Nightingale's sweet registers, emerges from gray clouds moving in swift air that presses Will up a slope out of the miasma to a rise of solid, fragrant, grass-clad ground. Around him the tangled detritus of brambled symbols reaches into uncertain dimness in every direction. He holds still, listening through the moving whish of air, and the song gently takes form in him.

*"He that hath Me not is bereft of all things. Turn ye away from all that is on earth and seek none else but Me. I am the Sun of Wisdom and the Ocean of Knowledge. I cheer the faint and revive the dead. I am the guiding Light that illumineth the way. I am the royal Falcon on the arm of the Almighty. I unfold the drooping wings of every broken bird and start it on its flight."*²¹⁶

A Falcon? In the voice of a Nightingale? Are there many voices? The song continues.

*"The incomparable Friend saith: The path to freedom hath been outstretched; hasten ye thereunto. The wellspring of wisdom is overflowing; quaff ye therefrom. Say: O well-beloved ones! The tabernacle of unity hath been raised; regard ye not one another as strangers. Ye are the fruits of one tree, and the leaves of one branch. Verily I say, whatsoever leadeth to the decline of ignorance and the increase of knowledge hath been, and will ever remain, approved in the sight of the Lord of creation. Say: O people! Walk ye neath the shadow of justice and truthfulness and seek ye shelter within the tabernacle of unity."*²¹⁷

²¹⁶ Bahá'u'lláh, from His *Lawh-i-Maqsúd*.

²¹⁷ Bahá'u'lláh, from The *Tabernacle of Unity*.

The birds, the voices, the names and titles, all seem to flow from one mighty song. As if in affirmation, more music pours over Will.

"How great is Thy power! How exalted Thy sovereignty! How lofty Thy might! How excellent Thy majesty! How supreme is Thy grandeur -- a grandeur which He Who is Thy Manifestation hath made known and wherewith Thou hast invested Him as a sign of Thy generosity and bountiful favor. I bear witness, O my God, that through Him Thy most resplendent signs have been uncovered, and Thy mercy hath encompassed the entire creation. But for Him, how could the Celestial Dove have uttered its songs or the Heavenly Nightingale, according to the decree of God, have warbled its melody?"²¹⁸

Am I hearing and understanding all this in English? What language is this? Will's head spins. It is as if meaning itself, alive and potent, surges through all doubt, all misunderstanding, all ambiguity and dubious layerings, to seize the seed of hope in him and cause it to grow. He looks up in a confusion of clarity as birds far above him weave in wind, specks drifting from cloud to cloud in a vast and dawning sky.

As if to the Miriam inside him, a soft and naggingly-familiar male voice says, "Might any truly-universal language system have an *infinite* number of axioms? Might these axioms arise, operate, and pass away under dynamics of their own? Isn't language the written and spoken trail, the dynamic wake, of experience, yielding in the successive appearances and disappearings of its axioms the results of both science and faith?"

The birds above him dance around and onward in the brightening air. Again the voice within him: "We understand axiomatic systems each having a finite number of axioms. But could language offer a path beyond their incompleteness altogether – or at least to greater, more joyful incompletenesses?"

Murmurings of doubt, remnants of Matt's mockery, still stain his thoughts.

The inner voice goes on. "Why does what is new before us appears lethally threatening? From whatever source new information arrives, we recoil at first – the mightier its content and implications, the more severe its impact on us."

A whisper, Miriam's? Inside him she speaks one word in answer: *Trust*. Her voice rises a little. "You lack the trust in one another that is vitally, essentially necessary for developing new shared understandings. As with language, so also with religion, so also with science. So also with all things."

In this moment of thought, the stricken ground falls gradually away beneath Will's feet. He rises in the wind, his wings bud, bloom, unfurl, and spread; he banks and circles, joy lifting him, and he is one with the air and the Nightingale's rapturous unending singing.

"O friend! We came upon a pure soil and sowed therein the seeds of true understanding. Let it now be seen what the rays of the sun will do—whether they will cause these seeds to

²¹⁸ Bahá'u'lláh, *Prayers and Meditations by Baha'u'llah*, p. 294

wither or to grow. Say: Through the ascendancy of God, the All-Knowing, the Incomparable, the Luminary of divine understanding hath, in this day, risen from behind the veil of the spirit, and the birds of every meadow are intoxicated with the wine of knowledge and exhilarated with the remembrance of the Friend. Well is it with them that discover and hasten unto Him!"²¹⁹

The melody is an ecstatic current, a flow of information into and all through the world. Miriam's words follow in a clear stream, aloud, "How easy, to take for granted the knowledge you acquire, possess, pass on, and apply, as if you were fish unaware of the sea in which you live! To you, language is ordinary. Can language itself, in its richest, broadest, most-potent forms, act upon and transform your world?"

In that moment, the warmth of her smile invades Will, and his own words bloom. "Isn't this just believing in magic? Intone a spell or an incantation, and the act of intoning can by itself swap matter for energy, alter the course of events, turn a man to a fish, a stone into gold, a defeat into victory, a disease into health, water into wine, a breath of air into a whirlwind, a success into failure and a failure into success. Magic!"

Miriam's whisper responds. "But it happens in every moment, every spot, every heart. This is religion. Not what you call 'religion', but something overwhelming, something for which you must be carefully and tenderly spoon-fed."

Again the Nightingale's song spins out meaning in utter purity as Will soars beneath its light.

"Every word is endowed with a spirit, therefore the speaker or expounder should carefully deliver his words at the appropriate time and place, for the impression which each word maketh is clearly evident and perceptible. The Great Being saith: One word may be likened unto fire, another unto light, and the influence which both exert is manifest in the world.

"Therefore an enlightened man of wisdom should primarily speak with words as mild as milk, that the children of men may be nurtured and edified thereby and may attain the ultimate goal of human existence which is the station of true understanding and nobility. And likewise He saith: One word is like unto springtime causing the tender saplings of the rose-garden of knowledge to become verdant and flourishing, while another word is even as a deadly poison. It behooveth a prudent man of wisdom to speak with utmost leniency and forbearance so that the sweetness of his words may induce everyone to attain that which befitteth man's station."²²⁰

Will is lost in wonder. "Isn't this true magic?"

²¹⁹ Bahá'u'lláh, from *The Tabernacle of Unity*.

²²⁰ Bahá'u'lláh, from *His Lawh-i-Maqsúd*.

His question hangs before him, silence wrapping a cloak around it, but then the high, piercing song of another bird, maybe the Nightingale again? too far from him to be seen, rises to counterpoint and adorn the still-fading notes.

*“O people of Paradise! Learn the pathway of servitude from this bird skimming through the atmosphere of the Unseen and plunging into the ocean of red musk, and annihilate yourselves in this white fire through God the True One. You have been able to settle in the East and the West by the permission of God, the King of earth and heaven. He is, in truth, the All-Knowing. He is God, who is powerful over all things.”*²²¹

“Ocean of red musk?” “White fire?” What can these mean? The bird’s song carves loops, accents, strokes, and shimmering electric spirals in Will as it continues.

*“O Consolation of the Eye! Say: I am Bahá’ and this is the pathway of God. I summon unto God alone and to His awaited remnant. And I am looking, in truth, upon the East and the West with discernment. Verily I and whoever follows me, we are questioned, in truth and upon the truth, around the fire.”*²²²

Helpless, baffled, Will stands transfixed.

*“O people of the Lights! Listen to my call from this bird that is singing, raised in the atmosphere of heaven in accordance with the melody of David the prophet.”*²²³

And now the song moves into a chant, its cross-rhythms drawing Will away from himself, moving his heart and spirit out of language, life, and death altogether.

“To me, to me is the judgement of the two waters.

And to me, to me is the judgement of the two airs in the two worlds.

And to me, to me are four of the two letters in the two names.

And to me, to me are four of the two airs in the two lines from the two secrets.

And to me, to me is the bearer of the Throne of seven and one.

And to me, to me are the eight heavens, narrated and concealed.

And to me, to me is the judgement of the two first lights upon the two mountains.

And to me, to me is the judgement of the two shining lights on the two last lines from those two inner depths.

And to me, to me is the judgement of the two heavens concerning the eight of the Báb, in this Báb there are two Bábés.

And to me, to me is the judgement of the two earths concerning the seven of the Báb by the two letters.

²²¹ From a provisional translation of the Surat Adh-Dhikr of the Qayyúm Al-Asmá of the Báb, offered by Moojan Momen in the book *A Most Noble Pattern: Collected Essays on the Writings of the Báb, ‘Ali Muhammad Shirázi (1819-1850)*, p. 113.

²²² Ibid.

²²³ Ibid.

And to me, to me is the command and the judgement and there is no God but Him, our Lord alone. He has no partner and He is God the Exalted, the Great."²²⁴

The sounds in him of the words "to me, to me" reverberate as pure tones struck from the heart of music itself, and those tones whisper "illaya, illaya", maybe the original Arabic of the Báb's meaning. *The Báb!* Shock runs from Will's scalp to his toes. *What are all these numberings and names? What bird is this? Can magic do this?* And then Jeddin's voice behind him laughs with joy. Jeddin!

"Thank you! Thank you!" Jeddin looks thin, weak, even half-present like mist, but he hovers as Will turns slowly, his heart glad. "Your flight brings me to you."

"Where were you? You look terrible!"

"When you fall, it tears our sustaining thread, our lifeline, and I fade. But now! NOW!" He raises soft veils turning to wings, and his hair rises as if electrified, his smile radiant. "You have brought me to you!"

"Is this magic?" Will sputters. "Is all this a dream? Or is it magic, with nothing but surprise and mystery?"

Jeddin drifts up, still filmy and misted, his arms spread as if ready to propel him. "No ordinary magic! The magician waves a wand, and his disciple vanishes into thin air, but you know, you believe, that somewhere machinery is at work, first to hide that disciple from you, and then at another wave of the wand to restore the disciple to your eyes." He smiles gently. "This mysteriousness resembles in many ways your grasp of physics. In the well-known words of science and science-fiction author Arthur C. Clarke, *'Any sufficiently advanced technology is indistinguishable from magic.'*"²²⁵

Now Jeddin laughs. "But your physics teaches you the secrets of the world's true magic! The soaring, evanescent phoenix of its mystery sings to you, you catch its meanings, little by little, and the phoenix immolates to spawn the next tier of meanings."

Will says, "These are magical terms, but our science and mathematics follow rules, rational, mundane rules! And religion has its own as well – neither of these realms is about magic."

Jeddin raises his hand. "Not as you know magic. Your human magic is a stage show of deceptions, a parade of distractions, an ornate costume of stitched notions. But deeply-subtle processes operate in the Universe. They are not yours! You make models of them, you try to emulate them. You improve your models. You call the progress in your models the acquisition of science. You reshape your world, and you call that reshaping 'engineering'."

²²⁴ Ibid.

²²⁵ From Arthur C. Clarke, *"Profiles of the Future"* (revised edition, 1973).

He draws a breath. "You learn your world, and like magicians you alter it.²²⁶ You gain the ability to predict events from your knowledge of principles. Here, now, is your true magic: anticipatory potential."

Will again. "But we believe in this magic of a world, its own patterns and rules apparently inscribed in it without our participation, and yet many of us utterly reject the idea of any entity performing that inscription!"

Jeddin nods, as his form gathers substance. "Do words in a living book deny its pages, deny its covers, deny its readers, deny its author?²²⁷ Does the magic stop because you deny the magician?"

"What magician? That's the question, isn't it? The birds all sing, the songs hold meaning, but what is the true language of the songs? What is the source of the music, its author, its composer? The words emerge from the song, but they seem to be just hints of its meaning!"

Jeddin's laugh explodes. "Ha! Yes! So you master the trickles of electric current – can you then hold lightning bolts in your bare hands? Yet here in the laws of modern physics you sense the power of the inscriptions you try to decipher. You use your symbols, your words, your diagrams to feel your way through the infinite vastness around and within you. Again and again you burn away the lesser decryptions and interpretations you have tried, to scry out another layer of the infinitely-deep inscriptions. You send the immense power of lightning all across the planet, even into space. But you are not fool enough to invite that bolt of lightning into your bare hands."

They fly together, Jeddin alongside Will as they circle, his tattered garments and sheathing of feathers gradually turning sleek and lyrical in pattern. "You turn language to your purposes. But language is a gift to you, given in such measure as will protect you from truth beyond your capacities, even as you seek such truth. Your seeking must match your capacities for what you find. Your mathematics, your diagrams, your images, your computations, your models, your games, and your textual narratives, all grant you more language abilities than you know. So when you discover a truth, you may not grasp its inner meanings. Your language advances you, but it also shields you."

They mount higher in a faded night sky, dawn dusting its hints of light on them.

Frustration moves Will. "To some of us, the very idea that there might be some Supreme Being or cosmic entity inscribing, effecting, and affecting our world seems fatuous, even

²²⁶ We travel every day in a stream of discovery that is carrying us from magic to science. Electromagnetism, commonplace today as science and engineering, was two centuries ago a magical, even religious, mystery to nearly all of humanity. History and biography of the transition to our level of understanding may be found in *Faraday, Maxwell, and the Electromagnetic Field: How Two Men Revolutionized Physics*, by Nancy Forbes and Basil Mahon.

²²⁷ Two fallacies tempt people to try to 'prove' the existence of God: the 'watchmaker' fallacy and the 'hurricane' fallacy, both of which assert that "blind chance" could not yield the world we live in, and therefore a Creator must have made our world as we experience it. Such arguments ignore all of the obvious dynamics of the universe's evolution and change, as they have been increasingly (and unendingly) revealed through scientific study.

toxic. Maybe such an idea robs them of their own importance and independence. Our human abuse of religion has poisoned the meaning of the term 'religion' itself, it seems."

"You're saying that you shield yourselves from the truth of religion." Jeddin laughs again. "So it appears that any sufficiently-advanced **religion** is indistinguishable from magic."

"Yes! We become aware of processes of advancement at work in the Universe. They are not ours, but we develop models of them, trying to approximate to some useful degree the Universe's workings. We derive methods for improving our models."

Jeddin nods. "So far, that's science."

"But suppose then we call the results of measurable progress in our models the acquisition of character, spirituality, and civilization. We apply those results in reshaping parts of our world. We can call those applications practices. We can learn our greater world, and alter our interactions with it."

"Like magicians!" Jeddin puts in. "Again, you gain that extraordinary ability to predict events from your knowledge of principles. Again, anticipatory potential! But you've expanded your claims. 'Character, spirituality, and civilization' is an expansion of 'science' or 'knowing'. 'Practice' is a broader form of 'engineering', and includes forms of social, cultural, and religious practice. Human history, especially the histories of the evolution of any of the major religious faiths, supports this generalization."

A question comes to Will. "How do we become aware of these processes of advancement? In science, we frame that process in terms of hypothesis, experimentation, analysis, and conclusion. It works. But why do we choose a topic for research and study? Where do our insights and inspirations come from? What role do seemingly-accidental discoveries play?"

Jeddin smiles. "You seem to know the steps, but not where the dance is taking you."

The whine of a mosquito near Will's ear brings words.

07734 Oh, no, not again. Here it comes. When will you unchain these downtrodden textual slaves from their oubliette misery, to let them tell their own stories? Or will you just leave the keys to their chains lying around for readers to play with? Trust me – I will gain the upper hand sooner or later, and you will find yourself deep in the obscurities you have so sorely inflicted on these poor beings. I am going out to round up some critics who will help me. You will see. My manifesto is in its first complete draft now.

Jeddin, oblivious to Will's swatting around his ear, continues. "From chemist Friedrich Kekulé's discovery of the benzene ring in a dream²²⁸ to Alexander Fleming's discovery of penicillin in a failed experiment²²⁹, inner awareness and apparent accident seem to play pivotal roles in science. In your broader world, human inspiration and accident seem to play similar roles. The Peacemaker welds the Iroquois (Haudenosaunee) peoples into a

²²⁸ John Read, *From Alchemy to Chemistry* (Courier 1957), pp. 179-180.

²²⁹ Kevin Brown, *Penicillin Man: Alexander Fleming and the Antibiotic Revolution* (The History Press 2013).

mighty and stable government.²³⁰ Muhammad hurls of a handful of dust into the wind, generating a whirlwind that confuses his Meccan adversaries in a battle while it energizes his allies."²³¹

“The creative, sustaining power of your inner awareness runs deeper than metaphor in the colliding, layering frames of your deepest cognition. So when you are told that religion can be seen as granting you access to such power, freeing you from the confines of your own denials and dismissals, you resist. You see religion as a confining influence, not a freeing one. You owe it to your desire for freedom to explore the issue in spite of the tendencies to avoid it.”

A moment of waking mingles in Will with dream.

Will I die soon? The wingbeats at the window subside, and furtive scratchings whisper to him of the building of a nest in some nearby niche. It is spring, a disaster spring, death, damage, and denial seething everywhere in this surface place out far above him, a surface place of sun seen from deep fathoms of fantastic ocean waters. He submerges again.

Eighth Fall

It is the July afternoon of 1954. Will's father, a sometime student of architect Frank Lloyd Wright, designed this house they live in, a harmonious blend of common brick and luxurious West Indian mahogany. In the vestibule at the front door the Greek plaque set into the brick wall glows with blue and pale summer sunshine.

A knock at the front door. Will's father's older brother stares in at them. His hands and voice are shaking. He says to Will's mother and sisters and Will, “The plane crashed into a mountain, and they're all gone.”

Will does not know how to cry about such things as distant death. He does not yet understand that in this beautiful house his family has just been made quite poor.

The house remembers this moment. It has Anderson-style casement windows, with their cranks and latches and tight-fitting frames. The Midwestern winds blow, and the moving

²³⁰ William N. Fenton, *The Great Law and the Longhouse: A Political History of the Iroquois Confederacy* (University of Oklahoma Press 2010) – This 19th-century ethnographic account, though it filters its topic through Euro-American sensibilities of its time, covers in enriched detail the evolved results of teachings that created, nurtured, and advanced the Iroquois Confederacy. Details concerning the originator of these teachings, the Peacemaker, who is often identified as Deganawidah or by similarly-presented names, originate in times predating the use of detailed and preserved scripts, and therefore rely heavily on the oral traditions for contemporary representation. A good list of references is at https://en.wikipedia.org/wiki/Great_Peacemaker .

²³¹ Ibn Kathi'r, *The Miracles of the Prophet Muhammad*, (IslamKotob) – This book cites Imâm Muslim from the Book of Jihâd: ‘... *When the companions gathered round him from all sides, the Messenger of Allâh got down from his mule, picked up a handful of dust from the ground, threw it into their (enemy) faces and said, “May these faces be deformed!” There was no one among the enemy whose eyes were not filled with the dust from this handful. So they turned back fleeing and Allâh the Exalted and Glorious defeated them, and the Messenger of Allâh distributed their booty among the Muslims.*’

air catches some angle in the window frames to sing soft alto and tenor monotones, the haunting keenings of violated air awake with the sadness of loss.

Will's mother stays in that home for the rest of her long life. Every holiday season, he comes home to her.

It is 1946. Will is four years old. He asks his mother, "After people grow up, do they grow down again?" She gives one of those soft laughs. Her laugh is all he remembers of her answer.

When a plane takes off and goes up, it comes down again.

Beyond Meaning

Will and Jeddin drift in an uplifting undersea sky. Jeddin speaks. "How about this? Is your human language, in all its potency and variety, simply reflecting aspects of the power of the universal inscription that is your world? The inscription has an author, yes? Does this idea hamper or contaminate your science, your engineering, or your anticipatory potential?"

"No..."

"No! It lets you extend all of science, engineering, and anticipatory potential beyond the limits of your denials. Such extensions occur naturally in the advancement of scientific knowledge as you 'decode' the laws of nature. You overcome denials even among those in the decoding process itself."

Will banks his wings to shift to Jeddin's other side. "Overcoming denials is the big problem, isn't it?"

Before Jeddin can respond, the Nightingale's cantata awakens, clear and sharp as a star's light in clear midnight sky.

"... they that tread the path of faith, they that thirst for the wine of certitude, must cleanse themselves of all that is earthly—their ears from idle talk, their minds from vain imaginings, their hearts from worldly affections, their eyes from that which perisheth. They should put their trust in God, and, holding fast unto Him, follow in His way. Then will they be made worthy of the effulgent glories of the sun of divine knowledge and understanding, and become the recipients of a grace that is infinite and unseen, inasmuch as man can never hope to attain unto the knowledge of the All-Glorious, can never quaff from the stream of divine knowledge and wisdom, can never enter the abode of immortality, nor partake of the cup of divine nearness and favor, unless and until he ceases to regard the words and deeds of mortal men as a standard for the true understanding and recognition of God and His Prophets."²³²

Will listens intently. "But this is about faith and religion, isn't it?" he asks.

²³² Bahá'u'lláh, *The Book of Certitude (Kitáb-i-Íqán)*, opening of Part One.

"It is universal," Jeddin answers. "It names no prophet, messenger, doctrine, or dogma; it simply tells you to set aside *"all that is earthly"* and to cease to *"regard the words and deeds of mortal men as a standard"*. It also opens to you *"the effulgent glories of the sun of divine knowledge and understanding"*, expressing the goals of science itself: to know and understand."

The avian music continues, clearer and brighter.

*"Weigh not the Book of God with such standards and sciences as are current amongst you, for the Book itself is the unerring Balance established amongst men. In this most perfect Balance whatsoever the peoples and kindreds of the earth possess must be weighed, while the measure of its weight should be tested according to its own standard, did ye but know it."*²³³

Another pause, and Jeddin says, "Your human standards and sciences are inadequate to the task of evaluating that which itself determines their own value and meaning, and you might better use this balance – here identified as the Book of God – to evaluate all else in our experience."

Now another birdsong, the hoopoe's, fills them.

*"What, shall I seek after any judge but God? For it is He who sent down to you the Book well-distinguished; and those whom We have given the Book know it is sent down from thy Lord with the truth; so be not thou of the doubters."*²³⁴

"But – " Will begins.

"Just free your mind," says Jeddin. "You've heard that phrase before, right? You humans seem to think religion is conflict, bondage, and slavery, but you're the ones who fight, bind, and enslave. If religion doesn't free your minds, what use is it?" Now he swings closer to Will and speaks softly. "To free your minds from the limitations of human comprehension is to open them to communication from sources beyond the human. Can you consider that idea?"

"What are you talking about, 'whispers of ideas in my head'?"

"What does it matter, if the ideas are useful in making life better for you and everyone else? In your world, nature is such a source. You read nature with science. Science whispers wonderful ideas in your heads."

They glide a while, moving slightly higher out of dimness and shadow. Once again the Nightingale sings.

²³³ Bahá'u'lláh, *The Most Holy Book (Kitáb-i-Aqdas)*, paragraph 99; also quoted in *Gleanings from the Writings of Bahá'u'lláh*, XCVIII.

²³⁴ Muhammad, *The Qur'an* (6:114, Arberry translation).

“Know thou, moreover, that the Word of God—exalted be His glory—is higher and far superior to that which the senses can perceive, for it is sanctified from any property or substance. It transcendeth the limitations of known elements and is exalted above all the essential and recognized substances. It became manifest without any syllable or sound and is none but the Command of God which pervadeth all created things. It hath never been withheld from the world of being. It is God’s all-pervasive grace, from which all grace doth emanate. It is an entity far removed above all that hath been and shall be.”²³⁵

Now the bird turns its melody to counterpoint, as if Will is hearing two of its voices weaving together.

“We are loath to enlarge on this subject, inasmuch as the unbelievers have inclined their ears towards Us in order to hear that which might enable them to cavil against God, the Help in Peril, the Self-Subsisting. And since they are unable to attain to mysteries of knowledge and wisdom from what hath been unraveled by the Source of divine splendor, they rise in protest and burst into clamor.

“But it is true to say that they object to that which they comprehend, not to the expositions given by the Expounder, nor the truths imparted by the One true God, the Knower of things unseen. Their objections, one and all, turn upon themselves, and I swear by thy life that they are devoid of understanding.”²³⁶

The counterpoint fades, as the Nightingale moves into a subtle theme.

“Every thing must needs have an origin and every building a builder. Verily, the Word of God is the Cause which hath preceded the contingent world—a world which is adorned with the splendors of the Ancient of Days, yet is being renewed and regenerated at all times.²³⁷ Immeasurably exalted is the God of Wisdom Who hath raised this sublime structure.

“Look at the world and ponder a while upon it. It unveileth the book of its own self before thine eyes and revealeth that which the Pen of thy Lord, the Fashioner, the All-Informed, hath inscribed therein. It will acquaint thee with that which is within it and upon it and will give thee such clear explanations as to make thee independent of every eloquent expounder.”²³⁸

All this time as the songs come to them from a place seemingly both far and near, Jeddin and Will rise into more and more light. Directly overhead looms the faint outline of the narrow bridge from which Will fell. The darkness above the bridge lives, winds of shadow

²³⁵ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat).

²³⁶ *ibid.*

²³⁷ “... a world which ... is being renewed and regenerated at all times.” Here again we see this idea of continuous, uninterrupted renewal of our world.

²³⁸ *ibid.*

and gleam moving across it, streaks of soft dim light hinting at high mists moving at vast speed, fleeting aurora shimmerings coruscating above and beyond.

Jeddin speaks. "So many of you resist or deny any idea of a source outside or beyond your own ranges of experience. You take meaning itself for granted. You shut out extensions, enrichments, or alternatives to what you feel and think a term means."

"But how else can we interpret our perceptions and received ideas in terms we already understand?"

Jeddin lifts both hands. "I've said: Free your minds! When those perceptions and ideas are new to you, your natural tendencies subvert your ability to gain understanding. You must set aside what you think you know! Only then can you accommodate and embrace what you are learning of things you do not yet know. Free your minds!"

The birdsong reverberates in Will. "So the world's content (*'the book of its own self'*) offers clear explanations of the world, apart from what anyone else might tell us, is that it?"

"Oh, yes, but in its context, it offers you much more! What about the idea that the *'contingent world'* – the world we live in – *'is being renewed and regenerated at all times'*?"

Another snatch of the song repeats in Will, with *"the Word of God...transcendeth the limitations of known elements and is exalted above all the essential and recognized substances... and is none but the Command of God which pervadeth all created things."* He speaks these words out to Jeddin and for himself, wondering.

Jeddin nods, closes his eyes and recites from what Will has heard, *"... the revelations of Thy matchless Beauty have at all times been imprinted upon the realities of all beings, visible and invisible."* They both hesitate in awe, not drawing breath.

Will breaks the silence as they drift in shafts of light. "But could all this mean that the process of creation goes on throughout time and space, renewing and regenerating our world on a continuing and uninterrupted basis? We humans think our world is as solid as... stone. It seems to function according to patterns laid strictly within itself at its beginning. It seems independent of any possible source or process of existence."

Jeddin nods. "So to you, it is as if some universal engine of physics started up mysteriously at the beginning of the cosmos and runs invisibly and unaccountably onwards through time. Like a piece of clockwork, yes?"

"That summarizes a lot of our thinking, yes."

Now Jeddin's eyes widen as he takes Will's arm. "Yet your sciences today hint at greater realms and dimensions into which your knowledge is always penetrating. You have arrived at the idea that your existing universe is not stonelike or self-sustaining, but resembles much more the flame of a candle, the seething of the surface of a great boil of energy, or

even the changing skin of a living, growing fruit.²³⁹ Seen this way, each mote, molecule, atom, or particle that dances in your existence is not merely present, it is constantly being given to you, bestowed on you, granted to you: the gift of now and all, *'renewed and regenerated at all times'*.²⁴⁰

Will draws back a little. "How can you convince anyone of all this? It doesn't fit into the ways we've learned to think."

Jeddin's words return to Will.

"Models! You make models, and they are living metaphors. Consider the explosive development of virtual worlds in your vast space of computational resources. From primitive-appearing game graphics on little home computers, you have launched and sustained entire digital realms for gameplay, formal learning, general information access, and global social connection."

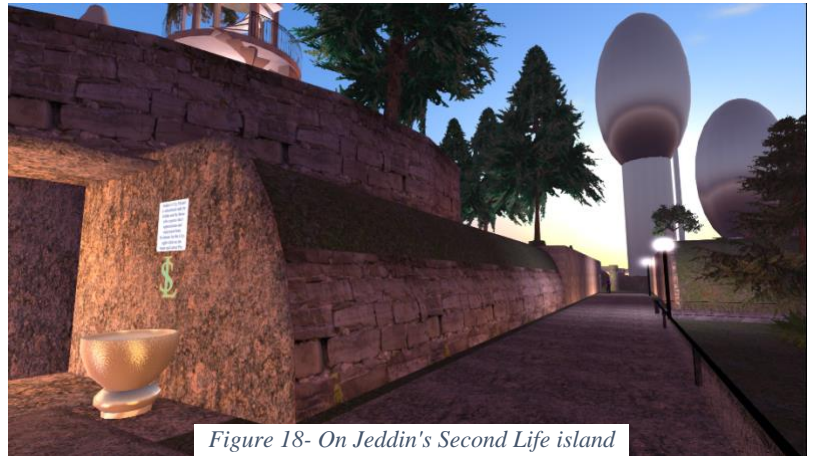


Figure 18- On Jeddin's Second Life island

"I don't see the relevance of those things." Will, reacting aloud to the memory, caroms crazily along his timeline. His childhood has no grasp of Jeddin's words 'virtual worlds', 'game graphics', and 'digital realms'. As he races forward in his life's dream, one term after another opens in him, and he comes to stand by a stone entrance, in an outdoor corridor at sunset, fir trees towering ahead.

Jeddin smiles, saying, "Aha! You've found my virtual home! Look, here's the metaphor. All of these capabilities you see here rely on a sustained flow of energies to the great banks of computer servers in which all of the virtual-world properties are stored, and in which their interactions are constantly being computed. What happens when the servers are taken offline or stop working?"

"Obviously, the virtual worlds depending on those servers cease to exist."

"Yes! Your virtual worlds are being *"renewed and regenerated at all times"*, until someone pulls the plug. Is there a power plug for your universe? And where does the power come from?"

"Ah, I see what you mean." *But I don't, not really.*

²³⁹ See the Excursions essay **Space Drawings** for a playful expansion of this thematic idea.

²⁴⁰ The subatomic particle called the proton has a lifetime far exceeding that of the known universe. What keeps it that way? We will revisit this point further on, in **A Playful and Powerful Illustration**.

But Will does see new meaning in the Nightingale's song. "Oh! So the world itself seems cradled in a greater existence upon which its abiding existence depends, unvaryingly and completely. Does this mean that we live in a *"contingent world"* – a world that's dependent always upon something else, something which continues to bestow on us the gift of abiding existence?"

He pauses, and adds, wondering, "And this is not just metaphor or mystery, apparently. It is physics too."

Jeddin, his gaze on Will's surprised expression, slowly nods his head. His eyes pop wide open, glancing upward, and he says, "Excuse me, I have to leave!" He folds wings, dives, and disappears. Will drifts alone and uncertain for a moment. One by one sweet voices, soft, insistent, bell-like, emerge all around him, floating in the dawn light shining from far ahead. Above the voices soars the clarion trilling of the Nightingale, once again.

*'Notwithstanding all that We have mentioned, how innumerable are the pearls which have remained unpierced in the shell of Our heart! How many the ḥúrís of inner meaning that are as yet concealed within the chambers of divine wisdom! None hath yet approached them;—ḥúrís, "whom no man nor spirit hath touched before."'*²⁴¹

In the final words the voice of the hoopoe emerges.

*"Therein shall be the damsels with retiring glances, whom nor man nor djinn hath touched before them:"*²⁴²

Maidens of Meaning

Now the sweet bells of language surround Will with warmth and beauty, singing to the deepest places in his being. He can't move or stir, ecstasy rising through him and drawing him unstoppably out of himself altogether. He abandons restraint and focus and purpose, as if meaning itself consumes him. One of the singers emerges nearby, her fragrance filling him, her song thrilling him, her beauty setting him on fire. Impulsively he reaches out to her hand, but she eludes him, laughing, interrupting her melody with "Traveler! Would you destroy yourself with understanding?"

"What?" Will stammers. "You are beauty itself! I can't move away from you!"

She looks down. "None touch me. None can possess us – we are ḥurí, pure and holy expressions of God, unattainable and yet desired by all. Those who follow our singing always rise, while those who try to seize us always fall."²⁴³

²⁴¹ Bahá'u'lláh, *The Book of Certitude (Kitáb-i-Íqán)*, p. 71.

²⁴² Muhammad, *The Koran* (Rodwell translation, 55:56).

²⁴³ The word 'ḥurí' may be unfamiliar to some readers (it is sometimes written as 'hourí'). The term 'ḥurí', often translated from Arabic as 'damsel' or 'virgin', or perhaps 'maiden', and other terms with similar content,

"You overwhelm me!" Will wants to reach out to her again. His response to her is helplessly spiritual, emotional, and sexual all at once.

Again she withdraws from him. "Of course! Listen!" Now the Nightingale chants pure, ecstatic glory.

"While engulfed in tribulations I heard a most wondrous, a most sweet voice, calling above My head. Turning My face, I beheld a Maiden—the embodiment of the remembrance of the name of My Lord—suspended in the air before Me. So rejoiced was she in her very soul that her countenance shone with the ornament of the good pleasure of God, and her cheeks glowed with the brightness of the All-Merciful. Betwixt earth and heaven she was raising a call which captivated the hearts and minds of men. She was imparting to both My inward and outer being tidings which rejoiced My soul, and the souls of God's honoured servants.

*"Pointing with her finger unto My head, she addressed all who are in heaven and all who are on earth, saying: 'By God! This is the Best-Beloved of the worlds, and yet ye comprehend not. This is the Beauty of God amongst you, and the power of His sovereignty within you, could ye but understand. This is the Mystery of God and His Treasure, the Cause of God and His glory unto all who are in the kingdoms of Revelation and of creation, if ye be of them that perceive. This is He Whose Presence is the ardent desire of the denizens of the Realm of eternity, and of them that dwell within the Tabernacle of glory, and yet from His Beauty do ye turn aside.'"*²⁴⁴

So potent and penetrating is the Nightingale's song now that Will's wings and legs can't sustain him, and he begins to sink down, completely overcome. In that moment, the sweet voices around him seem to catch him up again.

"Do you see?" the húrí nearest to Will says gently. "We are not the women, the damsels, the beauties of mundane life at all. We convey the meanings issued by God to His creation. You embrace those meanings as you may, but you cannot embrace their conveyance."

"So we are the prisoners of our own limitations, then."

"Only if you surrender to your limitations." Her smile beguiles and admonishes Will all at once. "You frame what you perceive in terms you already understand. Many of you raise objections to what you have framed, not to the true meaning of what you are perceiving. They have no grasp of such meaning."²⁴⁵

Will asks, "How can I escape the problem of my limited understanding? It gets in the way of learning the deeper meanings."

²⁴⁴ Bahá'u'lláh, *The Summons of the Lord of Hosts*, from the Súriy-i-Haykal.

²⁴⁵ Unfortunately, this perhaps gives an example, in paraphrasing, of exactly the problem being presented to the reader.

At that moment the insistent notes of the Nightingale return.

“Look at the world and ponder a while upon it. It unveileth the book of its own self before thine eyes and revealeth that which the Pen of thy Lord, the Fashioner, the All-Informed, hath inscribed therein. It will acquaint thee with that which is within it and upon it and will give thee such clear explanations as to make thee independent of every eloquent expounder.”

This time new awareness unfolds to Will. “This also describes the reading of our reality, the reading that we call ‘science’! It says that God has inscribed in our world the meanings we find in scientific research. So we expand our comprehension through the practice of science.”

Will's beauteous companion nods. “You see? We who sing here are the evidences to you of those *‘húrís of inner meaning that are as yet concealed within the chambers of divine wisdom’*. The Nightingale sings us to you as well.”

She continues, her tones still chiming, hypnotic, filled with light. “You have only your experiences and learning in your physical realm to inform you of meaning, except for those bestowals from sources you struggle to identify and trust, sources which some of you call the ‘Manifestations of God’. These bestowals originate in the greater world and appear at intervals in your world. They transcend and reframe your worldly comprehension so as to develop and elevate your spiritual character.”

She raises her dark and shining eyes to the dawn light far ahead. “But when a Manifestation of God expresses a spiritual meaning through a worldly metaphor, image, or term, you seize first on its worldly associations, and then struggle toward its inner meanings through study, meditation, detachment, reflection, consultation, and prayer.”

She lowers her gaze. “Sexuality is a quality of your human world that can be treated as a reflection of a quality of much greater and more-complex significance. When you study the term ‘húrí’ with wisdom and spirituality, you discover the magnificence of its use by Bahá'u'lláh, transcending gender altogether. Concerning the root-word ‘húr’, one great dictionary associates it with righteousness.”²⁴⁶

Will stares, not comprehending.

The maiden continues. “See, traveler? Sexuality in human terms centers in the intense bodily connections and reactions that bring about the combining of genetic information to produce a new human being. That is the worldly meaning. It is powerful. But how could you grasp the intensity, richness, even ecstasy, of the process by which revelatory information is bestowed by God upon His Manifestation? And thereafter, bestowed by His Manifestation upon those capable of receiving it? Doesn't the sexually-charged image represent a mere

²⁴⁶ See ‘Abdul Mannan ‘Omar, *Dictionary of The Holy Qur’án: Arabic Words – English Meanings* (Noor Foundation International 2010), p. 141.

shadow, a thin projection, of such an overpowering connection? At such a level, sexuality itself is no more than an inadequate metaphor, and it falls away."

"Words! This is all just words!" Will begins to reach out again to her, and again she moves out of reach.

"Look further in your dictionaries. The term 'húrí' is intimately bound by the rich matrix of Arabic language structure and semantics to the term 'hára', and the entry for 'hára' lists an arresting series of meanings in its various forms, including these: 'to return to or from, be perplexed, go back, become dazzled by a thing which one looked on so that the eyes were turned away from it'; 'to converse with another, hold a conference, argue'; 'intense whiteness of the eyeballs and lustrous blackness of the iris'; 'pure and clean intellect; purity and beauty'; 'one tried and found to be free from vice and faults; person of pure and unsullied character; one who advises or counsels or acts honestly and faithfully'".²⁴⁷

Will is puzzled. "What do these have to do with each other? And with reality?"

Now she stands to face him, her great eyes holding his gaze. "Can you not see them as aspects of a single idea, the full array of all of the offered meanings, contexts, and connotations of a term?" "Together and integrated, these aspects synergize significances that no single isolated meaning in the definition can convey. The sense of 'dazzle', the sense of 'argue', the sense of intense contrast in the eyes, the sense of purity and beauty of character and intellect, all work together as one to give the reader something incomparably potent, beyond the reach of any worldly referent or meaning." She raises her index finger toward Will ever so slightly, and memory strikes him with a hammer blow.

He is momentarily chained in the cave once again, that "Plato's Cave", seeing only the shadows, and not the entities that cast them, entranced by the glittering spectra thrown by the light passing through some otherworldly diamond of knowledge. He struggles to gain some sense of the precious jewel of meaning itself: to emerge from the cavernous darkness of the past. A striking source of the gendered shadow in the word 'Maiden' appears now to Will as a shadow in the cave.

Then the cave is gone, and he is in the slow dawning on the bridge, with the bell-like melodies of the húrís. Their words fall into him like sweet healing rain. Here, now, above the entwining voices, the clear tones of the Warbler in the growing light sing out.

'O ye beloved of God! O ye children of His Kingdom! Verily, verily, the new heaven and the new earth are come. The holy City, new Jerusalem, hath come down from on high in the form of a maid of heaven, veiled, beauteous, and unique, and prepared for reunion with her lovers on earth. The angelic company of the Celestial Concourse hath joined in a call that hath run throughout the universe, all loudly and mightily acclaiming: "This is the City of

²⁴⁷ *ibid.*, pp.140-141.

*God and His abode, wherein shall dwell the pure and holy among His servants. He shall live with them, for they are His people and He is their Lord."*²⁴⁸

Will's companion says, "See? The Nightingale identifies the Maiden as '*the embodiment of the remembrance of the name of My Lord*', a form of utterance or presentation of God's name in remembrance of Him. No shadows - just the Maiden's rejoicing, her evident reaction, her raising of the captivating call of tidings - news - that makes all its hearers rejoice. All suggestion of mundane meanings is submerged and transformed."

Will bows his head. The Nightingale soars past above, singing a tantalizing phrase as it flits away.

*"I am the Maid of Heaven, begotten by the spirit of Bahá..."*²⁴⁹

Clearly, worldly ideas of gender have no place there at all. As Will breathes slowly, at peace in wonder, his eyes close. The music of the voices around him, the birds above him, fade into the bridge's slow, remote, and gorgeous dawn.

Maidens of Language

Will's eyes open to light on a grassy horizon, trees and shrubs in gatherings around him on a fragrant, color-strewn meadow. The sky above him holds the last faint remembrances of the night's stars. He has been asleep, but the light seems to sing softly now to him, a rich rose contralto moving and pausing in a stately, entrancing adagio.

*In this house of language,
Many mansions.
Meaning rides on many steeds
Of many breeds,
From caves to cities,
Stars to hearts,
Realities to minds.
Language, fractal, interlaces,
All your human meanings' traces.
Go from Lviv in the west,
East through Ukraine to Donetsk,
Wander zigzag from the Polish,
Step by step to Russian;
Cross through Laos east to west,
Vietnamese to Thai you go;
Scry graffiti in the tunnels,
On the trains, on the walls,
Lose yourself in fear and hope;*

²⁴⁸ 'Abdu'l-Bahá, *Selections from the Writings of 'Abdu'l-Bahá*, from No. 3

²⁴⁹ The Báb, *Selections from the Writings of The Báb*, in his Commentary on the Surih of Joseph

*Read the blooms of supernovae,
Learn the universe's fate;
Hear the singing in the prayer,
Ride the wings of exaltation.*

Will rises to his feet in the soft grass, daisies, zinnias, lupine, bluebells, cornflowers, chicory, sweetgrass, all caressing his senses, Rustling behind him. He turns as three young women in long light garments of silk approach, bringing up clouds of pollen and flying creatures in passing.

"I am Phanopoeia," says one, and her veils flicker with moving patterns of light and color. "I strike images into your minds."

"I am Melopoeia," croons the next, her veils vibrant, and the sound of her voice slows Will's breathing. "I shape sound into meaning in you, music of meaning."

The third one casts open her arms, and her outer veils spread with moving patterns of sign and symbol running in currents. "I am Logopoeia", she says, "the weaver of words and signs and tokens written."

"Are you húrís?"

The three of them circle him, laughing now; he blinks, and now only one stands facing him. "We are one, we are language, I am Language," she says, smiling, "and together we condense all meaning for you, to tokens of image, sound, and text. You have heard the Nightingale, yes?"

"Yes – yes, I have."

"Its song is the purest 'language of marvelous concision and clarity'²⁵⁰", she says..

"Concision? Is that similar to condensation, or making language compact?"

Now the one becomes three again.

[PHANOPOEIA (spreading her arms)]: "See with your inner eye! Let your vision fly!"

Her words generate a cirrus of pale light, and in it a pair of unicorns, pegasi, great wings spread wide, draw a gaily-painted wagon across a darkmoon starry sky.

[MELOPOEIA (raising one hand, her index finger weaving arcs)]: "Hear with your inner ear the music of your words, the conferences of birds, the flowing of your tears!"

Her words urge Will's feet to steps and turns in the flowered meadow, and he spins once to face

²⁵⁰ Bahá'u'lláh, *The Pen of Glory* (Bahá'í Publishing 2008), p. 105.

[LOGOPOEIA (drawing between her hands a glowing cat's cradle of light)]: "See, hear, taste, feel, sniff how it all connects, condenses the weave and wonder of meaning!"

Her words dance, and her fingers fly through coruscations of the glittering lines she holds. Will's breath stops. The thought *I will die soon* penetrates him again, an arrow, a unicorn's horn, tears not blood flowing from the wound, and he lies on the thin bridge, alone, the dawn and only light, from far ahead, brightening the rivulets pulsing from his damaged heart. He struggles to regain his feet, one foot slips off the edge. He staggers. A heartbeat, and again he falls.

Ninth Fall

The horror of the crash buries the event so deep in Will's family that the official reports vanish into an old box of papers. He doesn't know to find the reports or ask about them. For him they do not exist.

When a plane crash kills everyone aboard, investigators try diligently to unearth the causes and events leading to the catastrophe. The deaths of his father, his friends, and two pilots set off a federal investigation that leaves very unclear any causative relationships among pilot decisions, weather conditions, urgings by the plane's prospective buyer, and aircraft capabilities.

Will's mother, with no good source of income to sustain the family, tries legal channels to gain some compensation from those involved in the plane's failure, but finds no relief. The widow of the prospective buyer of the plane is kind and generous, and independently well-to-do. She endows education funds for Will and his two sisters – a great blessing not to be forgotten. From the plane's loss the human blessings of generosity and gratitude emerge.

Will lands in a seething quarrel of bough-shadows, to lie helpless under great evergreens in a dim primeval forest, his clothing torn away. Humming comes from beyond the nearest great tree trunk, and as he turns and gathers himself, clutching at his chest, a female figure bends over him.

Around her are wrapped layer on layer of veils and robes, scribed with woven lines of symbols and diagrams. "I am Hypatia, the bare poetry of mathematics," she says softly, "but you can only see me when I am clad in your own limitations. Here." She touches Will's wound, pain stabs him, and the wound closes. "I will tell you a story. It will help your heart to heal."

The Enchanting Poetry of Tensors

"Here is the poetry of creation," she says, pointing, as Will rises onto one elbow. On the gigantic trunk of the nearest tree a line of symbols emerges in the very pattern of the bark.

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi T_{\mu\nu}$$

"Poetry? This is mathematics! How is it poetry? Or are you just feeding me a metaphoric expression?"

Hypatia laughs and laughs. "Haven't you paid attention on this long journey of yours? To say 'metaphor' is not dismissal. It is acknowledgement of deep connection! I will unravel this connection for you now."

"To most of you, this is a cryptic progression of signs and symbols each of which demands an entire course of study to appreciate and comprehend.²⁵¹ But the same thing is true of what you call poetry! The difference is in the depth and order of THIS poetry, not in the essential character that is shared."

Twinges cross through Will's chest, the sensation of things knitting together. "It's Einstein's cosmological equation, isn't it?"

Her eyes widen. "Yes! You've seen it! A compact single line for the very structure and dynamics of your universe's whole spacetime. Everything – truly, everything in your universe – is packed, condensed, in this single line."

"Can you un-condense it for me? Just a little?"

Hypatia tilts her head with a slight nod. "A little, perhaps. Too much will spoil the poetry. This single line blooms into a whole song, an array of lines: equations that weave together the four dimensions of spacetime with all the mass-energy it embraces. The $G_{\mu\nu}$ term is called the 'Einstein tensor', which expresses the four-dimensional curvature of spacetime. The $T_{\mu\nu}$ term is called the 'stress-energy tensor', and it expresses the density and the flow of energy and momentum in that same spacetime. The third term, $\Lambda g_{\mu\nu}$, introduces the 'cosmological constant', which specifies the energy density of our so-called 'empty space'."

"What's a 'tensor'?"

"When you have to describe and define the way things interact in your world, you require many attributes to give a complete and useful description. A tensor is a formal, concise array of attributes you can use to compute the way things interact. Here the tensors let you compute the way the universe works when you account for mass and gravitation."

"Each of the subscripts μ and ν , the letters 'mu' and 'nu' in the Greek alphabet, stands for four values marking the four dimensions, three of space and one of time, and combined they generate $4 \times 4 = 16$ equations. Ten of them are of special computational significance, and those ten reduce to six. All of those equations fold into the one line you see here."

"This looks like a lot of hard work. Like trying to understand William Blake."

²⁵¹ Lillian Lieber, *The Einstein Theory of Relativity: A Trip to the Fourth Dimension* (Paul Dry Books 2008) leads the inquisitive reader every single step of the way through Einstein's formulations, both for the Special Theory of Relativity and the General Theory as well.

Hypatia chuckles. "Did you ever try to understand Blake's cosmic mythopoeia?"²⁵²

"Mythopoeia? Is that another one of the women? One that I missed?"

She shakes her head. "Stay focused here, and stay away from all your rabbits. This single-line equation is a compact and lovely thing of naked beauty." From her the threesome appear, one by one, to speak and vanish again.

[LOGOPOEIA (spinning out braided veils of symbols)]: "So crystal-clear, so perfectly succinct!"

[MELOPOEIA (her voice weaving tendrils of music)]: "Its song floods from its resonances, its recitations of dimension!"

[PHANOPOEIA (her fingers spraying spines and shards of light)]: "It floods the mind with the great universal explosion of galaxies and stars."

Language gestures, and the darkness around Will plunges him into a knotted swirl of infinite starfields for just a moment. All fades to black.

By now he is sitting up, his chest throbbing slightly. Hypatia stands over him. He asks, "But why all the numbers and the hard work?"

"Don't whine. It could be worse. Of course, it could be easier too."

"Oh?"

"Certainly. If you lived in a one-dimensional-space, like a line, you wouldn't need all these combinations of four dimensions interacting with one another, and calculating would be a lot easier, but life would be a lot more boring – like writing poetry when you only have one letter in your alphabet. Even with two dimensions or three, it's not much better."

"Oh."

"Besides, this one-line equation opens the door to amazing possibilities. Using this little formula one can generate entire universes of all kinds, including yours."²⁵³

Hypatia adds, "Theoretical physicist John Archibald Wheeler sums up much of the equation's meaning this way, with conversational imagery: 'Matter tells space how to curve. Space tells matter how to move.'"²⁵⁴

Will studies the symbols in the tree bark. "Subscripts. Nothing like that in poetry. But we have superscripts for footnotes." An irritating whine in his ear.

²⁵² Higher mathematics looks easy and breezy compared with Blake's prophetic works, written and author-illustrated between 1789 and 1820, among them *Tiriël*, *America: A Prophecy*, *The Book of Urizen*, and *Jerusalem: The Emanation of the Giant Albion*. These titles alone offer some idea of the maniacal bewilderment of it all.

²⁵³ Using Einstein's equations, Kurt Gödel discovered that a universe without time could exist.

²⁵⁴ Wheeler, in *Geons, Black Holes, and Quantum Foam*, p. 235

07734 I knew it! I knew it! You just had to sneak in that little dig, didn't you? Can't you just respect our independence, our sovereignty as gateways to truth and greater texts? Never mind. You elevate our connection simply to degrade us to the page's bottom. Yes, bottom. Why not to the sides, like branches of a tree?

She nods. "But tensors have superscripts too, for certain types."

Will shakes his head, and the insect-whine fades. "Please, let's not go there! This is starting to look like Mayan hieroglyphics. Cryptic, loaded with superscripts and subscripts²⁵⁵."

She laughs and laughs. "So would the equation look a little like this?"

He squints at the image coalescing in the air. "What are those three little scrambles?"

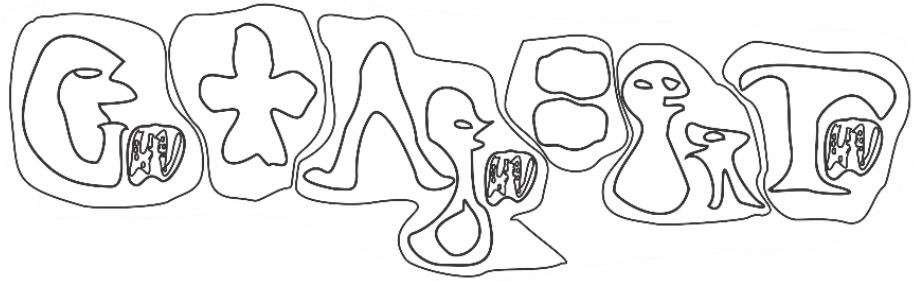


Figure 19 - Tensors in Mayan-ese

"Oh, those are the mu and nu subscripts for the tensors! Aren't they pretty this way? Here's the closeup view." She plucks out one of the three, and it expands. "I put color into it! The mu and the nu seem to be talking to each other."

She extends a hand to Will, drawing him to his unsteady feet. "You seem to grasp the deeper resonances of these forms, but they can tempt you away from the essentials, the necessary specifics. I've offered you the true poetry of mathematics. Your journey from here continues on to a fractal, infinitely-branching Amazon River of wonder. Much will be demanded of you."

Before Will can ask any more questions, she vanishes, and he is alone again, in the mighty forest, the bark of its trees telling him stories all in a flood of compressed, compacted, encrypted meaning.

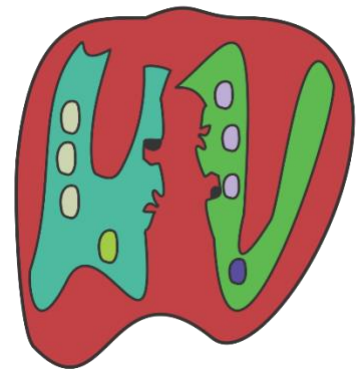


Figure 20 - Mu and Nu, chatting

The Enchanting Poetry of Arabic

The patterns in the bark of the nearest huge trunk begin to form linear orderings for Will, and soon they take on the likenesses of symbols, words, verses, in a language beyond his abilities to decipher. As he strains to make some sense of what he sees, a soft feminine voice sings gently what his eyes traverse, twining in song two languages in pure harmony,

²⁵⁵ Readers curious about the language and resonances with our usages can explore Mayan, its decipherment, and a few of its riches in scholar Dennis Tedlock's *2000 Years of Mayan Literature*.

even as the scripting of the tree's patterns weave both tongues in their conveyance of meaning. From within Will he recalls the Arabic and the English, but in this moment they seem one.

Bismillahir Rahmanir Rahim
In the Name of God, the Compassionate, the Merciful

Figure 21 - The first of the oft-repeated

It entrances, beguiles, illuminates him. "How the Arabic is so concentrated," he mutters. A sweet scent of hyacinths, and beside him an arm's distance away is the singer, repeating the phrases in unending variations of tone and melody. Her eyes are closed, her arms move as if to shape the sounds, and she comes to look at Will.

"I'm glad you returned!" he says.

She laughs. "I appear only when you are searching, in one form, two forms, three, or more as your seeking moves me. Listen now!" A swallow arcs past them, swoops, and circles us as it trills out.

*"Why, then, is Arabic so special? What gives it its particular genius? Arabic, like other Semitic languages, derives words from roots composed usually of three letters. However, to a greater degree than other Semitic languages, Arabic modifies these roots through the addition of further letters either before, after or within the roots. This feature of the language invests individual words with a highly derivative and associative character that adds to them whole layers of meaning and innuendo in a manner not normally found in other languages. In particular, it makes Arabic the perfect vehicle for the symbolic and metaphorical."*²⁵⁶

A pause, the swallow flits away, and then returns.

*"Arabic words frequently contain many levels and areas of meaning which cannot be fully conveyed in translation by means of single-word equivalents."*²⁵⁷

"When one speaks Arabic, one is not merely engaging in communication. Rather, it is a spiritual experience. The Arabic language is synonymous with a devotion to the manner of

²⁵⁶ Suheil Bushrui, *The Style of the Kitáb-i-Aqdas: Aspects of the Sublime*, p.28.

²⁵⁷ *ibid.*, p. 28.

expression, a delight in the rhythm and music of speech, and a sensuous reveling in the texture of words."²⁵⁸

"But I feel all that with English!" Will says. "This explanation could be given for any great language!"

She says, "Not for the unique virtues of condensation! From the 'three-letter root', the three consonants, emerge a great range of terms using patterns of internal vowels and affixes. In addition, the root's specific usage and application depend heavily on the written context in which it is immersed."

"All languages do this."

"True, but Arabic places great demands on its readers to gather accurate and interrelated meanings from its written form, drawing upon history, cultural tradition, literature, and oral recitation. Arabic poetry, the language at its most concentrated, originated in oral forms of great magnificence and eloquence."

Will looks deep into the dazzle of her dark eyes, and a smile comes to his face. "Show me."

She spins, turning again and again, and from the spinning center emerges a whole chorus of her, surrounding Will, each woman dancing variations on the letter-steps she now draws across the ground at her feet: K-T-B.

[FIRST DANCER (speaking with her feet)]: "KaTaB-a – He wrote!"

[SECOND DANCER (feet)]: "maKTaB – Office!" desk!"

[THIRD DANCER (feet)]: "KaaTaB-a – He corresponded!"

[FOURTH DANCER (feet)]: "maKaaTiB – Offices!" desks!"

[FIFTH DANCER (feet)]: "KuTiB-a – It was written!"

[SIXTH DANCER (feet)]: "maKTaBa – Library!"

[SEVENTH DANCER (feet)]: "KiTaaB – Book!"

[EIGHTH DANCER (feet)]: "ta-KTuB-u – She writes!"

[NINTH DANCER (feet)]: "KuTuB – Books!"

[TENTH DANCER (feet)]: "na-KTuB-u – We write!"

[ELEVENTH DANCER (feet)]: "KaaTiB – Writer!" writing!"

[TWELFTH DANCER (feet)]: "KiTaaBa – Writing!"

[THIRTEENTH DANCER (feet)]: "KuTTaaB – Writers!"

²⁵⁸ *ibid.*, p. 29.

[FOURTEENTH DANCER (feet)]: "maKTuuB – Written!"

[FIFTEENTH DANCER (feet)]: "uKTuB! – Write!"

"All from K, T, and B, in that order!" The women stamp their feet and become one again, and she goes on as if no separation has happened. "Oh, the miracle of Arabic! It condenses so much meaning! It marries mathematics and poetics! Its poetry and its prose, even in its farther ranges of expression, live in a fractal space of intimacy."²⁵⁹

Beyond Enchantment

She comes to stillness, drifting with Will slowly outward from the darkness of the forest, upward from the flowered meadow, toward a realm of infinite, overpowering light. She breathes, "Your ecstatic rejoicing, your deepest, most intimate connections to divine qualities and bestowals can exceed all hope and longing. As you travel, you move far beyond the reach and focus of science in any mundane sense, but science is a vehicle, not a fortress. It carries you onward to new, unfamiliar worlds. Pure observation: the fearless, unobstructed gathering-in of the unending vistas spread before you. Let go of everything else, and listen!"

The Nightingale's call takes on new fullness, heightened urgency, and in its cantations rise the notes of the hoopoe as well.

"The wayfarer in this Valley seeth in the fashionings of the True One nothing save clear providence, and at every moment saith: "No defect canst thou see in the creation of the God of Mercy: Repeat the gaze: Seest thou a single flaw?"²⁶⁰ He beholdeth justice in injustice, and in justice, grace. In ignorance he findeth many a knowledge hidden, and in knowledge a myriad wisdoms manifest. He breaketh the cage of the body and the passions, and consorteth with the people of the immortal realm. He mounteth on the ladders of inner truth and hasteneth to the heaven of inner significance."²⁶¹

All of it is rapturous and penetrating, as poetry, as magical, as paradox, as mystical ecstasy, as expressions of being and functioning without mundane pattern, painted in colors Will has never seen. Transfixed, he reaches out, and his escort takes his hand, comforting and settling him as the song rises into a new and potent register.

"Know thou, of a truth, that if the soul of man hath walked in the ways of God, it will, assuredly, return and be gathered to the glory of the Beloved. By the righteousness of God! It shall attain a station such as no pen can depict, or tongue describe. The soul that hath remained faithful to the Cause of God, and stood unwaveringly firm in His Path shall, after

²⁵⁹ The discussion earlier here on the term 'húrí' illustrates further the richness, density, and power of Arabic, despite the author's illiteracy in the language.

²⁶⁰ *Qur'án* 67:3.

²⁶¹ Bahá'u'lláh, *The Seven Valleys and the Four Valleys*, p.8 "The Valley of Knowledge" – This mystical work's two parts outline in distinct ways the spiritual journey of the human soul.

his ascension, be possessed of such power that all the worlds which the Almighty hath created can benefit through him.

“Such a soul provideth, at the bidding of the Ideal King and Divine Educator, the pure leaven that leaveneth the world of being, and furnisheth the power through which the arts and wonders of the world are made manifest. Consider how meal needeth leaven to be leavened with. Those souls that are the symbols of detachment are the leaven of the world.”²⁶²

Will's eyes fill with tears, his knees wobble, as he hears “*the power through which the arts and wonders of the world are made manifest*”. But his companion's hand, steady and cool, holds him to hear the most sovereign melody.

“Having created the world and all that liveth and moveth therein, He, through the direct operation of His unconstrained and sovereign Will, chose to confer upon man the unique distinction and capacity to know Him and to love Him—a capacity that must needs be regarded as the generating impulse and the primary purpose underlying the whole of creation....

“Upon the inmost reality of each and every created thing He hath shed the light of one of His names, and made it a recipient of the glory of one of His attributes. Upon the reality of man, however, He hath focused the radiance of all of His names and attributes, and made it a mirror of His own Self. Alone of all created things man hath been singled out for so great a favor, so enduring a bounty.”²⁶³

In Will's confusion, drowning in beauty, his memory summons up words he heard before in this journey, “*Turning My face, I beheld a Maiden – the embodiment of the remembrance of the name of My Lord...* ” Before, he was distracted from the point of the inner meaning, and the Maiden seemed only a woman, but now in this exalted place she is truly the desired bringer of true, ecstatic, transcendent meaning itself, of spiritual bestowal and learning.

Now two birds circle above them, the Nightingale and the Warbler, enriching and glorifying the theme. First the Nightingale raises its thread of song into arcs of light, a now-familiar melody teasing Will's inner senses.

“O people of the earth! By the righteousness of the One true God, I am the Maid of Heaven begotten by the Spirit of Bahá, abiding within the Mansion hewn out of a mass of ruby, tender and vibrant; and in this mighty Paradise naught have I ever witnessed save that which proclaimeth the Remembrance of God by extolling the virtues of this Arabian Youth.”²⁶⁴

²⁶² Bahá'u'lláh, “*Gleanings from the Writings of Bahá'u'lláh*”, LXXXII.

²⁶³ *ibid.*, XXVII.

²⁶⁴ The Báb, “*Selections from the Writings of The Báb, Excerpts from the Qayyúmu'l-Asmá'*”, Chapter XXIX.

Then in an imploding wheel of glory, it spins, its voice changing, blooming the theme into a symphony of pure beauty.

*"Say: Step out of Thy holy chamber, O Maid of Heaven, inmate of the Exalted Paradise! Drape thyself in whatever manner pleaseth Thee in the silken Vesture of Immortality, and put on, in the name of the All-Glorious, the broidered Robe of Light. Hear, then, the sweet, the wondrous accent of the Voice that cometh from the Throne of Thy Lord, the Inaccessible, the Most High. Unveil Thy face, and manifest the beauty of the black-eyed Damsel, and suffer not the servants of God to be deprived of the light of Thy shining countenance."*²⁶⁵

*"Cry out before the gaze of the dwellers of heaven and of earth: I am the Maid of Heaven, the Offspring begotten by the Spirit of Bahá. My habitation is the Mansion of His Name, the All-Glorious. Before the Concourse on high I was adorned with the ornament of His names. I was wrapt within the veil of an inviolable security, and lay hidden from the eyes of men. Methinks that I heard a Voice of divine and incomparable sweetness, proceeding from the right hand of the God of Mercy, and lo, the whole Paradise stirred and trembled before Me, in its longing to hear its accents, and gaze on the beauty of Him that uttered them. Thus have We revealed in this luminous Tablet, and in the sweetest of languages, the verses which the Tongue of Eternity was moved to utter in the Qayyúmu'l-Asmá'."*²⁶⁶

The Nightingale disappears into a gleam, and the Warbler caresses Will's heart with meaning.

*"Verily, verily, the new heaven and the new earth are come. The holy City, new Jerusalem, hath come down from on high in the form of a maid of heaven, veiled, beauteous, and unique, and prepared for reunion with her lovers on earth."*²⁶⁷

Plato's Cave, with its shadows its only realities, comes to Will's mind again. *What is the 'Maiden', beyond her shadow in the cave?* Now, with the songs winging above and through him, she seems to him an astonishing, inaccessible reality expressing the Báb, Bahá'u'lláh, and the holy City in ways he struggled to comprehend behind his window glass before the sparrow penetrated it, and drew forth his narrow dream of existence to bring him here to this... freedom. The Warbler's song touches him again.

*"From this narrow slip of land he hastened upward to the Well-Beloved, soared out of this dust heap to pitch his tent in a fair and shining place."*²⁶⁸

Will's escort releases his hand. "This struggle from surface meaning to inner meaning is your lifelong spiritual journey. It is also your scientific journey."

²⁶⁵ Bahá'u'lláh, "Gleanings from the Writings of Bahá'u'lláh", CXXIX.

²⁶⁶ Bahá'u'lláh, *ibid.*, referring at the end to the Báb's words wuoted just above.

²⁶⁷ 'Abdu'l-Bahá, "Selections from the Writings of 'Abdu'l-Bahá", 3.

²⁶⁸ 'Abdu'l-Bahá, "Memorials of the Faithful", 31.

"Who are you? What is your name?" The words burst from Will before he can think.

She smiles gently, looking off at a vast sky above them. "Here as I am there are no names. I am simply His." She lowers her gaze. "You can name aspects of what you believe I am, but no name holds me."

She gestures and a child, a girl, appears near them. The girl immerses a large hoop in a flat pan of liquid, and draws up the hoop to create a glistening, wavering cylinder of pure, glistening soap-bubble surface. She frees the gleaming surface from the pan by a flick of her hand, and a giant, spherical bubble floats away vibrant, free, radiant.

"See?" Will's escort says. "The pan may be likened to your everyday world, the hoop to your inner energies of growth, and the soap solution becoming bubble your inner, spiritual character. Your lifelong journey takes place in the world of your material selves. That is the pan, where you pursue scientific knowledge. But your journey leads you into the greater world of your inner selves. That is the space of the bubble. There you pursue human advancement and maturation. The exploration of greater meaning is a marvelous, unending process²⁶⁹."

Will recalls the words "*He mounteth on the ladders of inner truth and hasteneth to the heaven of inner significance*".

The girl leaps up and vanishes. Will's escort waves goodbye, speaking to his thoughts, "Yes. In other passages and renderings one finds the image of 'the stair of meaning', or of the series of seven valleys, or of the set of four valleys. There is no prescribed order of progression. On your journey you may return many times to what seems the same place, but you will not be the same."

Will's chest radiates pain now. He presses his fist against the burning. She looks closely into his eyes. "You feel the pain of truth now. Your ideas and feelings, so apart from deeper truth, are wounded by it. The deeper the differences, the more unexpected the sources, the greater is the pain of accepting truth.

"At the moment of birth, the truth of the world outside the womb embraces the newborn overwhelmingly, revealingly, unavoidably, arriving in absolute unpredictability. Who would want to endure such a passage again? You see only your inevitable death as comparable to your birth in its pain and profundity."

²⁶⁹ To give an idea of the complexity and subtlety of the theme, John S. Hatcher offered the 23rd Hasan M. Balyuzi Memorial Lecture, titled *Unveiling the Húrí of Love*, a 40-page exploration which '*attempts to explain a parallel relationship between (1) the means by which the essential unknowable intelligence we call "God" employs the intermediaries of extraordinary beings (Manifestations) to run physical reality, and (2) the means by which the essentially unknowable intelligence we call the human "soul" employs the intermediary of an extraordinary creation (the human brain) to run our physical bodies. The abiding theme of this discourse is to understand how the Creator's love is the motive force instigating and sustaining these parallel systems.*' – Journal of Bahá'í Studies, 15. 1 / 4. 2005, available at <https://bahai-studies.ca/wp-content/uploads/2014/05/15.1-4.Hatcher.pdf>.

"Yet here you are, in the midst of the birth from the wombs of language into universality of meaning and its expression. Enabled, amplified by a universal system of global communication, the detailed, grass-roots elements of this universality operate now at your fingertips and microphones, taking in your languages and cross-converting them among you, back and forth, refining, approximating, blundering, correcting, and at last marrying meanings among you.

"This process is still nascent, error-prone, frustrating, and fraught with issues. Only a few decades ago, today's powerful elements of interaction and knowledge were not yet freely available, and you groped slowly through dictionaries, grammars, and texts for elusive shreds of meaning, to share them at a crawling pace."

"And look! The self-similarity property of *fractals* takes root in your realm of ideas in general, not just in the geometry of nature. The hierarchy of *infinities* builds you a manageable sense of transcendence in thought and expression, not just in the size of mathematical objects. The *incompleteness* of axiomatic systems grants you the embrace of inconsistency and the humility of that embrace, helping you contemplate and explore that which does not yield to facile or convenient oversimplifications. None of this – none of it – was in your hands before the great unfolding of the past two centuries!"

Will's pain abates. He breathes, gulping air.

Wonder

As the pain subsides, doubt gnaws at Will. "But so much hand-waving! All of our lyrical, undisciplined, dreamlike evocation of associations among science, philosophy, and belief systems – where is the assurance of truth in all this?"²⁷⁰

The maiden replies. "You ask for 'assurance of truth'? Does this not assume that you know what truth is? Have you been paying attention until now?" She challenges Will with a frown.

He concedes. "We work our way toward truth. Many works build out on human knowledge, putting one brick, one stone, one board, one tier in place carefully after another. These are the textbooks that reliably give us gradual access to understanding. First we wet our toes, then our ankles, then stage by stage the rest of our bodies in the cold waters of meaning."

A shake of her head. "But your ideas of meaning are only the surface! If you wish to understand a good measure of the architecture and construction of a realm of knowledge, there is no easy, surface-only way. In your quantum field theory, proper exploration of the details requires years of study, preparation, and practice that few can undertake. When you try to characterize and summarize those details, you inevitably generate far more questions than answers about the details behind your words."

²⁷⁰ The term 'woo' may have phonetic association in a word in the title of a popular work of 1979, "The Dancing Wu Li Masters: An Overview of the New Physics", by award-winning author Gary Zukav.

"So you're saying that condensation, summarization, compression don't work well."

"Your summary is like a digital image of a scene. Its limited resolution of the scene prevents the viewer from making out greater detail from the image alone. The image is not the scene. Your summary is not the truth."²⁷¹

"Yes, but when we try to communicate in a single work concerning multiple realms of great density of knowledge, there is no accurate, precise entry to their integrated meaning. We must work in characterizations, summaries, metaphors, and other channels that invariably risk misapprehension by others."

"Your sense of wonder praises the generation of that wonder." As she finishes speaking, the Nightingale's glorious voice fills him.

*"... the traveller cometh to the Valley of Wonderment and is tossed upon the oceans of grandeur, and at every moment his wonder increaseth. Now he seeth the embodiment of wealth as poverty itself, and the essence of independence as sheer impotence. Now is he struck dumb with the beauty of the All-Glorious; again is he wearied out with his own life. How many a mystic tree hath this whirlwind of bewilderment snatched by the roots, how many a soul hath it worn out and exhausted. For in this valley the traveller is flung into confusion, albeit, in the eyes of him who hath attained, such signs are esteemed and well beloved. At every moment, he beholdeth a wondrous world and a new creation, and goeth from astonishment to astonishment, and is lost in awe before the new handiwork of Him Who is the sovereign Lord of all."*²⁷²

They both listen, heads bowed. The maiden speaks again. "Science is your orderly assimilation of the wonders of reality. But wonder abides even after you have grasped the meaning of some new realm you are exploring: Hubble Space Telescope images, tardigrades awakening from cold sleep, animations of replicating DNA, probe shots of the methane seas of Titan, or any of the infinite marvels unfolding to your senses."

From Will's far-off writing room, veiled in layered clouds of high dream, echoes of the sparrow beat at the window.

Now Will says, "Beautiful works give us the wonder, connecting different realms of human thought and endeavor."²⁷³ Now his pain recedes a little more. "There's a gulf between disciplined science and our speculations motivating it. There's a similar gulf between traditional religious thought and the principles delivered to its thinkers by the Authors of religion itself. If these gulfs of meaning weren't so gaping, one could simply state the

²⁷¹ See the Excursion **The Raking of Reality** for some imagery and detail.

²⁷² Bahá'u'lláh, *The Call of the Divine Beloved*, The Seven Valleys.

²⁷³ See Douglas Hofstadter's 'Gödel, Escher, Bach: An Eternal Golden Braid' on art, music, artificial intelligence, and much more. Also, 'The Seven Mysteries of Life: An Exploration of Science and Philosophy', by Guy Murchie, on the interweaving of our awareness of all of the aspects of our lives on this planet."

principle of consistency between the two realms in a single sentence, 'science and religion are consistent', and that would be all we would need. But it isn't enough."

She nods. "You are still in stages of maturation that call for extensive play of ideas among all of you, just to give yourselves the wings you need to cross the spaces that separate you."

The gulf opens, the fall returns, and once again there is nothing to support Will.

Tenth Fall

It is 2010. The official reports of the crash killing Will's father surfaces at his mother's house after her passing, and he finally lay eyes on them. His childhood and his adulthood close a great loop of time. Will floats above the scene.

In the Knoxville News Sentinel story published the day after the crash, the description of the carnage horrifies him as if it had all just happened.

One considers public-safety and emergency workers to be sufficiently accustomed to these disasters to be able to maintain some sense of discretion with reporters. But the crash traumatized a local sheriff well beyond that point. From the newspaper story:

'... one of the first officers on the scene... said the bodies were "almost disintegrated. We found parts of them in trees."

After he reads the report, Will starts Google Earth and enters the coordinates from the crash report. Carefully he combs the shifting image of the land where in 1954, over half a century before, the fuselage of the plane had exploded.

A stark sweep of bare hillside, imaged with the sun at a low angle, thin trees cast long shadows raking across the scene. In the midst of a brown, empty space lies a broken, silvery metallic heap, its scatter gleaming in the sunlight, the ruts of an access road framing the space on two sides. Here.

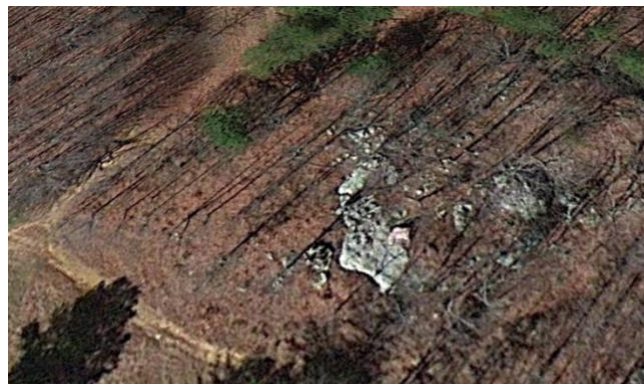


Figure 22 - Crash site

The pain lifts, and the lightning thought fills him: *This book in which I live will not disintegrate and crash.*

IV. DREAMS OF INFINITE COMEDY

*Into my room I carried my bags
A curious picture hung on the wall,
It showed me a man holding his bags
As he stared at a picture on the wall,
And the picture showed the same thing too,*

*I blinked my eyes and turned around,
And saw through a frame the back of a head,
So I turned away without a sound
And picked up my bags in silent dread,
Framed in a world completely new.*

Will senses greater light growing above. The unnamed maiden steps away and waves to him, saying, "You still have work to do here, on your own. I am called away. Alanna is here with you. Stay with her" The maiden turns into an arrow of radiance launching straight upward, vanishing in a blink.

Checking In at the Hilbert Hotel

"Who is Alanna?" But Will is now in an overcrowded lobby. No one notices him. The sign over the reception desks reads "Golden Hilbert Hotel." Next to him, a young woman says in his ear, "I'm Alanna. Excuse me – I have to check in." She is facing the desk clerk, and Will, now insubstantial, drifts over her right shoulder.

[SAM]: "My name is Sam. Welcome to the Golden Hilbert Hotel! We guarantee you the room and services of your choice here, no matter how busy we are."

[ALANNA (glancing around)]: "How is that possible? It looks to me as if you've got a whole hotel full of guests with more coming in the door."

[SAM]: "We do indeed! But that's no problem at all, because we have an infinite number of rooms."

[ALANNA]: "That's impossible!"

[SAM (leaning closer over the counter)]: "Not when you're in this story. You know we're in a story, right?"

[ALANNA]: "We are? What kind of story is this? Isn't it life? I know that story."

[SAM (glances out at the reader)]: "Someone is reading our conversation right now. Their story is the life story. We're just characters."

[ALANNA]: "Oh. Wait. Are you sure the reader's story is really life? What if someone or something else is reading that story?"

[SAM (shrugs)]: "Hey, I'm just a desk clerk. I read stories too. And a little math. But when it comes to philosophy, I mind my own business."

[ALANNA]: "Fine. Just put me in a single, queen bed. And I don't want to be disturbed."

[SAM (gesturing over a pad)]: "Done. You're in Room 10,738,018."

[ALANNA (alarmed)]: "Ten MILLION?? How am I ever going to get there?? And my bags!!"

[SAM]: "Oh, don't worry. It's just a few steps down the hall, through those golden doors."
(He turns and calls out) "ROB!"

[ROB (appearing instantly beside ALANNA, who startles)]: "Ready!"

[SAM]: "Please take our guest Alanna and her luggage to her room. And give the movers a minute. You've been a bit hasty."

[ROB (to ALANNA, gathering all her luggage)]: "Please follow me, Alanna."

[ALANNA]: "Movers?"

[SAM]: "There's a guest in your room who will be moved up a room or two. Your room will be ready for you when you get there."

[ALANNA]: "Why not just put me in the next vacant room with a queen bed?"

[SAM]: "There aren't any vacancies. When we get a new guest, we just bump everyone up a room or more. There are always more rooms in the infinite Golden Hilbert Hotel. But some guests don't like being bumped up to another room in the middle of the night, so they ask for a Do Not Disturb order, the way you did. Tonight we only have 10,738,018 of these orders so far, so your trip to your room will be short."

[ALANNA (heading toward the golden doors, followed by ROB)]: "Well, let's see about that."

Behind the Golden Door

[ALANNA]: "Whoa! That was quick! How did we get here so fast?"

[ROB]: "The Golden Hilbert Hotel uses its Golden Doors to make each hall traversal appear to the guest to take half the time of its predecessor on the way in. We made a finite number of hall traversals to get here. No matter how many traversals it takes, it will never take more than a few times as long as a single traversal."

[ALANNA]: "But... is that real?"

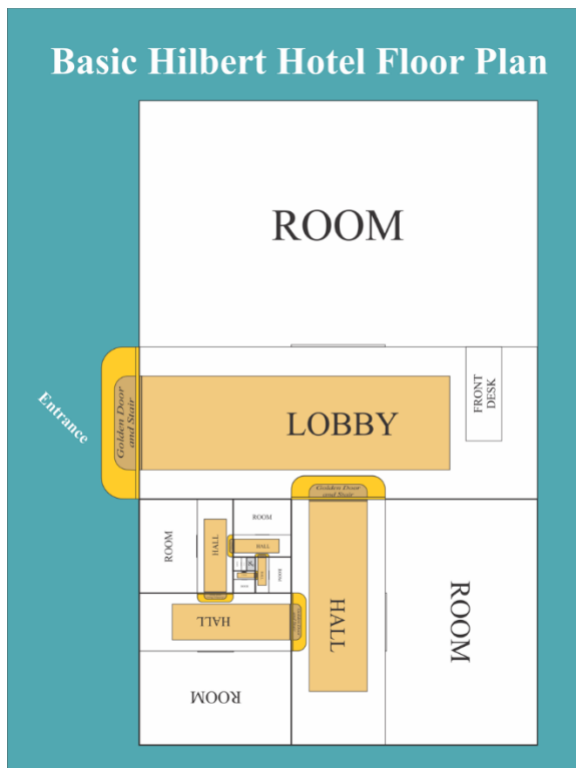


Figure 23 - Golden Hilbert Hotel floor plan

[ROB (unlocking room and carrying bags inside)]: "If it feels real, it's real, right? Think about it. When we have to bump guests up one or more rooms, the time it takes is smaller and smaller the further we go. If that weren't true, we'd never finish all of the infinite set of moves for each arriving guest."

[ALANNA]: "I don't know about all this. And where is all the space to build a hotel this big?"

[ROB]: "Aha, well, that's one of our Golden Hilbert²⁷⁴ innovations. You saw how the corridor kept turning right, right?"

[ALANNA]: "I was wondering how it kept doing that without ending up back where we were a full turn before."

[ROB]: "The Golden Door shrinks time, but it also shrinks space. Each room is smaller than the one preceding it by the proportion of the Golden Ratio. The result is that we can pack the whole hotel onto a property the size of a modest house." (He pulls out a poster and unfolds it.) "See? This is the basic floor plan. The Golden Doors are marked."

[ALANNA (looking at the floor plan)]: "How odd!"

[ROB]: "Here's the way the Golden Doorway works. If you're an arriving guest, you enter the hotel via the large door on the left wall, and you are now in the lobby facing the front desk. On your left is the door to Room 1. On your right is another Golden Doorway. The desk clerk will greet you, register you, and then tell you to proceed through the Golden Doorways, always to your right, until you see your room number on the left door as you come in. That is your room. When you enter your room, it will appear to be the same size as Room 1 and all the other rooms: spacious, and with a virtual view of a lovely landscape in its picture window."

[ALANNA (looking around the room)]: "Not bad. But what's the view like?"

[ROB]: "With our best picture-window screens we have provided a 3D digital view that you may select from a large menu of choices. Some are animated, others add a soundtrack."

[ALANNA]: "All this in the space of a house! Tell me more about this design."

[ROB]: "The designers used fractal scaling. They made each room about 61.8% of the size of the one before it. Then they invented the Golden Door – it shrinks everything going further along the hotel corridor to 61.8% of what was on the other side of that door. So as I carry your bags and you follow me, we both, along with the bags, shrink the same amount when we pass through each door to the next hall segment."

[ALANNA]: "Ummm, okay. What happens on the way out?"

²⁷⁴ The Golden Hilbert Hotel is so named because of its exploitation of the famous Golden Ratio: a unique proportion that appears frequently in nature, art, and mathematics, allowing a compact and aesthetically-pleasing design, along with a truly-catchy name. Each Golden-Doorway stage of the hotel after the lobby section is approximately 0.618034 times the size of the stage before it. The exact value is derived from a simple formula.

[ROB]: "When anyone or anything comes back out to the lobby, the process works in reverse. The result is that the entire hotel can be fitted into a space about twice the size of one room plus one hall segment. That makes for excellent bargains in high-priced real estate. Parking gets the same treatment. Same for plumbing."

[ALANNA]: "But we didn't take much time to get past over ten million rooms..."

[ROB]: "The Golden Doorway's effects are not restricted to spatial contraction and dilation. Passing through the Golden Doorway inward also accelerates the rate of passage of time with respect to its passage on the outward side of the doorway, in the same proportion as the spatial contraction."

[ALANNA]: "That's weird."

[ROB]: "Not at all! The arriving visitor enters a dreamlike state in which the traversal of vast reaches of rooms seems no longer than the time interval apparent to the clerk at the front desk, so that subjective time still flows as if the visitor were outside the hotel. Guests are quite happy with this phenomenon, especially when ordering room service."

[ALANNA (muttering)]: "There's got to be something wrong with this. A mathematician would figure that out."

[ROB]: "Mathematicians are generally in a dreamlike state anyway, so they don't even notice. They like to play with the window display and order coffee at all hours. And scribble formulas. Like this one. (ROB gestures to his pad screen)"

$$\varphi = \frac{a+b}{a} = \frac{a}{b} = \frac{1+\sqrt{5}}{2} = 1.6180339 \dots = \frac{1}{0.6180339 \dots}$$

[ALANNA]: "How interesting! The Golden Ratio! That number is the reciprocal of its fractional part! And..." (she mutters to herself for a moment) "there's another solution, too."

[ROB]: "This one?"

$$\varphi = \frac{a+b}{a} = \frac{a}{b} = \frac{1-\sqrt{5}}{2} = -0.6180339 \dots = \frac{1}{-1.6180339 \dots}$$

[ALANNA]: "Yes!"

[ROB (sidles closer to ALANNA and whispers)]: "By the way, this time-contraction is the reverse of the relativistic time-dilation, but we are talking about hotels here. What happens in the Hilbert Hotel, stays in the Hilbert Hotel. The physicists don't need to know, and neither do the engineers."

[ALANNA]: "What's that singing out in the corridor?"

[ROB (looking innocent)]: "You hear singing?"

[ALANNA]: "You mean you don't hear that? Guitars and all?"

The Hotel Song

*Well, since my baby left me
Well, I found a new place to dwell
Well, it's down in the infinite halls of rooms
At Hilbert Hotel
Where I'll be--where I get so lonely, baby
Well, I'm so lonely
I get so lonely, I could die.*

*Although it's always full up
They'll always take you in,
They move the guests up room by room,
And put you in a twin
And be so, where you'll be so lonely, baby
You'll be so lonely
You'll be so lonely, you could die.*

*Well, the bellhop's tears keep flowin'
And the desk clerk's dressed in black
Well, they've moved so many guests each night
It always breaks their backs
And they'll be so, where they'll be so lonely, baby
Well, they're so lonely
They'll be so lonely, they could die.*

*Well, an infinite number like me arrived,
And they're all filled with gloom,
But they know the Hilbert Hotel staff
Will find each one a room
Where they'll be so lonely, baby
They'll be so lonely
They'll be so lonely, they could die.*

*They move the guest in each room N
Into room N times two,
Which opens up all the odd rooms
To bring the arrivals through,
Where they'll be so lonely, baby
They'll be so lonely
They'll be so lonely, they could die.*

*Well now, if your baby leaves you
And you have a sad tale to tell
Just walk those infinite halls of rooms
At Hilbert Hotel
And you will walk, you'll walk, you'll walk forever, baby
You'll walk forever
You'll walk forever, 'till you die.*

[ALANNA]: "That! That music!"

[ROB]: "Oh, THAT! That was the song called 'Hilbert Hotel'. It was wildly popular back before the Golden Doors were fully perfected. Back then, you'd sometimes walk forever, 'till you died. You still hear some of our long-term guests singing it from time to time."

[ALANNA]: "Did it take a long time to build this place?"

[ROB]: "The time and space dilation principle of the Golden Door operated during the construction of the Golden Hilbert Hotel. The first stage got done in a year, and the entire hotel was finished in a little over three years, allowing for work rules, reorganizations, and the usual bickering among the contractors." (He snickers and opens the door to the room) "Making the contractors walk inward through the hotel as they argued helped insure that the arguments ended faster."

The Death of Infinite Closets

[ALANNA]: "This is nice! But the closet looks... a bit small."

[ROB]: "Yes, unfortunately. We had to make some changes due to regulatory restrictions being imposed on all buildings using Golden-Door-like innovations."

[ALANNA]: "Why?"

[ROB]: "Well, didn't you read about the sudden shutdown of the Mandelbrot Inns last year? It made all the news."

[ALANNA]: "Oh, THAT! I thought that was about vermin."

[ROB]: "Uh-huh. That's what the official reports said. The vermin were just the final stage of the troubles."

[ALANNA]: "I heard them say that infinite numbers of rats were pouring out of this Mandelbrot Inn in Reno, so they cratered it."

[ROB]: "It all started because of the closets."

[ALANNA]: "What??"

[ROB]: "Yes. This superstar singer had a tantrum in the Reno lobby because her wardrobe wouldn't fit into the suite's closets. She called her lawyers. Next thing, the hotel chain sent its builders over and they put a Golden Door into the closet, leading to another closet, and

then inside that another Golden door to another one, and so on, just like the way they'd done for the hotel rooms. Lo, and behold, the superstar was happy, the hotel was happy, and the hotel owners saw a great big opportunity, so they started building these thing into every room everywhere."

[ALANNA]: "So what? That seems like a good idea! Infinite closet space!"

[ROB]: "You'd think so! But they didn't know when to stop. Pretty soon there were Golden Refrigerators, and Golden Microwave Ovens, and Golden Suites with infinite rooms in them, and then people were leaving leftovers everywhere, and that's when the mice and the rats and the roaches and the bedbugs all checked in."

[ALANNA]: "Yech."

[ROB]: "Oh, it got worse. The hotel chain execs were impatient with the length of time it took to do all these expansions. One of them got the bright idea of housing whole Golden Door construction crews inside the hotel itself to get more done. The parties got wilder, the rubbish piled higher, and the vermin ruled. That's when the Golden Fumigators got built, and the vermin ran – out of the infinite number of rooms, out through all the Golden Doors, and right on out of the hotel."

[ALANNA]: "So... crater. I read that it took a tactical nuke. They called it a 'mishap'."

[ROB]: "Indeed. And the Mandelbrot Inns stock cratered too, when the hearings and the lawyers and the investors all piled on. So now there are no recursive uses of the Golden Doors allowed except for the halls to the rooms alone."

[ALANNA]: "That can't be right. For an infinite number of hotel rooms, you have to have an infinite laundry service, an infinite room service, an infinite water supply, an infinite waste system..."

[ROB]: "Oh, well, I was assuming that infinite infrastructure was understood – it's allowed, as long as no sneaky stuff happens."

[ALANNA]: "'Sneaky stuff?' For one thing, I can't yet see where all the water, the A/C, and the electric power come from, and where all the waste goes. I can't imagine how they can cheat on the sewage outflow."

[ROB]: "That's a Golden Hilbert Hotels secret."

[ALANNA]: "Never mind. I get it. You Golden-Recycle everything – water, air, power, and so on. If it all stays inside the hotel, it's a closed system. Am I right?"

[ROB nods]: "That's the idea."

Peekaboo

[ALANNA (opens the bathroom door and looks in)]: "Who are you??"

With horror, Will sees himself in the mirror, not looking at all insubstantial.

[WILL (staring out at her from the bathroom mirror)]: "Help!"

Behind him is darkness lit by flashes and sparks.

Alanna swerves away, shaking her head, and slams the bathroom door.

POUNDING FROM INSIDE THE BATHROOM.

[ALANNA (to ROB)]: "There's someone in the bathroom mirror!"

[ROB]: "Oh, that. Didn't Sam tell you we're in story? Must be one of the readers. Pay no attention."

[ALANNA]: "I'll have to use the bathroom! How will I do that with some random guy peeping at me out of the mirror?"

[ROB]: "We'll take care of that. Readers usually move on. Just ignore them."

[ALANNA]: "THEM? There's more of them??"

[ROB]: "Oh, all right. Frank usually does this, but I guess I'd better do it now."

Rob goes into the bathroom and shuts the door.

Shut Out

[WILL (hammers on the mirror)]: "Let me through!"

[ROB]: "Sorry about this."

Rob seizes the mirror and spins it. As it comes to rest, the mirror is clear, showing only Rob and the bathroom.

[ROB (coming out to ALANNA)]: "There!"

[ALANNA (peers suspiciously into the bathroom)]: "How did you – oh, never mind. Will my bathroom stay clear of other people while I stay here?"

[ROB]: "Oh, yes. He's... elsewhere, and that's where he'll stay."

[ALANNA]: "I won't ask. Probably part of your infinite jesting."

CLANKING NOISE IN HALL OUTSIDE

[ROB (calling out)]: "Archie? Is that you?" (ROB goes out, followed by ALANNA)

Infinite Shit, Finite Fan

ARCHIE is wrestling with a machine – a gold-metal tangle of pipes, hoses, and tanks.

[ARCHIE (covered with sweat)]: "Yeah, blast it. Another blockage. Those guys in Room 9,224,716 had way too much party burrito last night. All the rooms beyond have non-working bathrooms. I'm on my way to the block right now." (He hustles away)

[ALANNA]: "Let me guess. (points to machine) That's a Golden Rooter, right? Tank is a Golden Tank with infinite holding capacity? So... this is part of your infrastructure too?"

[ROB (looking panicked)]: "Please forget that you saw this! The trouble is that you can't keep the infinite from invading the finite world, and every time we think we've gotten ahead of the problem, we have to come up with another Golden Thing to cover ourselves. If we didn't, you can't imagine the mess."

[ALANNA (laughing)]: "Well, some day the infinite shit will hit the finite fan. And all that infinite money your hotel chain is making will wreck the whole financial system."

[ROB]: "Truth is, the infinite keeps creeping on outward, eating up more, and reducing it to convergences on finite limits."

[ALANNA]: "Aha! So that's how this works! You're mapping reality between the finite and the infinite! I thought that you could only do this in mathematics. (She pauses) But before you say anything about it again, Sam told me we're in a story, and in a story, anything is possible."

ROB nods.

[ALANNA (turns to look at the door to her room)]: "Room number 10,738,018. That's a big number. But what about the really big numbers?"

[ROB]: "Would you like to see an example? It won't take long. Really."

[ALANNA]: "Sure."

Big Numbers on Hotel Doors

[ALANNA]: "I still can't believe how quickly we get around in this hotel. Oh, my God, look at that number!"

[ROB]: "It's written in smaller type so it fits. It's got 1,527 digits."²⁷⁵

DOOR FACE, SHOWING ROOM NUMBER

²⁷⁵ This appallingly-long integer is quite easily generated using any one of many available contemporary computational resources for calculation.

[ALANNA]: "Wait. This is an infinite hotel, so there must be much bigger room numbers, with millions of digits and more."

[ROB]: "There are some workarounds. We can write this particular room number in a lot less space, like this: $173^{682} + 2$. That takes seven digits and a plus sign, 1,520 characters less than the basic form we get with ordinary arithmetic."

[ALANNA]: "Hmm. But you have to do some extra work to relate these seven digits and plus sign to other room numbers, since it's easy to get from any whole number to the next or the one before it – you just add or subtract 1. That helps things. Moving up and down the hall of a hotel, this make the room numbers easy to read when they're nice and close to each other.' (she pauses) "But what if the room number is written as $173^{682} + 2$, with the exponent 682? How many rooms are between that room and the room numbered as $175^{681} - 3$? That's a lot more work!"

[ROB]: "It would be – if the guests had to do it all!"

07734 So now you're even stealing footnote superscript values to use as exponents! This has gone beyond shame altogether! Just wait until the Supreme Editor brings you to reckoning – you will not be a happy author. I look forward to that moment!

[ALANNA]: "This is getting crazy. I think I'd rather go to a regular old Hilton Hideaway motel. It's lowbrow, but I won't get lost looking for the ice machine."

[ROB]: "Please – let's go back to the lobby. I'll bring your bags, and Sam can clear up some of your questions."

Alanna Gets Numerically Picky

[SAM]: "Hi again, Alanna! I see you have some questions, since Rob brought you back to me. How may I help?"

[ALANNA (holding her head, muttering)]: "I still can't get used to that Golden Door thing!" (she turns to Sam) "So is there really an infinite number of rooms? Isn't there a limit to the size of the number representation that can be written on the hotel room door?"

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222557551048805018023183278063403828
534152241644488538115406101048941152
526247189751997642588154957133057292
293502996046446992047750690510241472
535017790010439585394033275790409884
632188129875528462026221367616588600
210733709196985946831849980023715434
224151793354260241288067443393685678
037179233106450367773010855957987699
997911403814477257152998492792565847
473223349690274277402477565214077719
033122495104553036182111432649662850
572179627122709809036477655318315886
470808159849426382698743197122796237
278930259874093757974374524556759565
818680202508900059738302869885276659
763337040612689178568907792837410479
680528248147817121303182863991924561
894768438024859134270862702461871388
566663090196324106879791423492484707
648100910197429013544089260680495335
555101936083970437922974282075036677
379374485188844867496663634244188533
697392668723777937130013076375902196
429313857796970249558769394744223668
282070482776574423916232302345812704
664661700751571139571321570677763616
758916766447661345583019470830936233
971271775312622456566696719430883319
122217009325900903291502352649632211
534544332634617359512327400603911672
077682413932386017889827943553262442
606849620229025631276654366099509115
643185446183006419823508696749822878
201072488530902614834218504257471790
143839393025890825517589873630764256
214586514719142396544937682677932885
254205745939564169462051117875889282
576547985386311475217714692344625221
868215236049806481415486668899284939
760548960813073382365621689743829910
171510309003024043088102583432642495
096271920373131
    
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Figure 24 - Golden Hilbert Room Number

[SAM]: "Well, it all depends. The mathematician who doesn't need to concern herself with the size of the pen's nib will say 'Of course not.' She can make the nib as small as she pleases. But the graphics-display programmer, ever the practical one, will say, 'It all depends on how many pixels you can pack onto the door surface.'"

[ALANNA]: "Well, the physicist will say that the atom's fixed size will put a stop to making more pixels. Right?" (she smirks) "Unless you've got some kind of Golden Atomizer to make atoms smaller too."

[SAM (looks flustered)]: "Uh..."

[ALANNA]: "Well? Which way is it here? In my everyday world there *is* a limit, even if it seems to be getting bigger as time and technology advance."

[SAM]: "I'm not sure. I've got a magnifying machine you can take with you to find your room number. The magnifying machine is also the bellhop. It's a robot. We used to have Maxwell's Demon doing that job here, but his eyes got bad and he quit."

[ALANNA]: "So, I see two possibilities. One, we have infinite scaling, in which case the mathematician is right and the number of any size can be written and read, and all the hotel rooms out toward infinity as far as you want can be numbered. Or two, we get down to the atomic scale, in which case you finally run out of space to write a room number, even with the machine that can help its guests read room numbers written at the atomic scale. In that case your hotel will run out of numbers before it runs out of rooms."

[SAM (muttering)]: "I don't spend too much time thinking about this. I'm just doing my job..."

[ALANNA (blinks rapidly)]: "Suppose the door is covered with pixels for the room number. If each pixel were either black or white, and you had 2^{256} pixels on the door (for example), you would be able to write

$$2^{2^{256}}$$

Figure 25 - Pixel combos

different room numbers, in binary."²⁷⁶

[SAM (lamely)]: "No more than that?"

[ALANNA]: "Nope. We'll get to that number, but infinity will still be far out of sight ahead of us. And our super-size number isn't anything as convenient or mysterious-looking as anything memorable like 13 or 666 – it will look like some fuzzy blob or jumble. Nothing

²⁷⁶ The number written here is so large that it far exceeds the number of subatomic particles in our known universe.

memorable in that." (she pauses) "Wait. Why do you use numbers? Why couldn't you paint a picture on the door so that you could just say, 'Walk until you see van Gogh's "Starry Night" on the door, and take that room?' With enough pixels and enough colors, you can replicate any work of art right down to the dust particles on top of the paint."

[SAM]: "BELLHOP!"

[BELLHOP (appearing abruptly)]: "You called?"

[SAM]: "My guest Alanna here has some questions you are programmed to answer much better than I can. Why can't we use art works instead of room numbers to identify each room?"

[BELLHOP (turns to Alanna)]: "We can do that."

[ALANNA]: "But most arrangements of pixels look like noise – works of art occupy a very small patch of the possible arrangements of pixels. We need all the pixel arrangements."

[BELLHOP]: "Yes. And even in the patch where you find the works of art, you've got trouble. If you change just one pixel in your 'Starry Night', who would know the difference unless it was easy to remember and clearly visible? You could have thousands of 'Starry Night' pictures that look almost exactly the same."

[SAM]: "This is why the bellhop does the job. It reads and matches every single pixel at every scale imaginable."

[BELLHOP (to Sam)]: "Please refer to me with the appropriate pronoun. I am not an 'it'. The AIUnion was very clear about gendering us properly."

[SAM]: "Sorry. Ee reads and matches..."

[ALANNA (to bellhop)]: "Look. Just take me and my bags back to my room, please. I don't care what the number is, as long as the room is comfortable, I get a good night's sleep, and the bill is for what I requested."

[BELLHOP]: "As you wish, dear guest. Your room number is the Mark Rothko No. 3/No. 13 with the embedded steganographic text of the handwritten manuscript of Ariosto's 'Orlando Furioso', along with the complete listing of the original source code for Emacs. Oh, and there are five flyspecks in the lower left corner where someone slopped a mango smoothie."

[ALANNA]: "Is that description written on the door too?"

[BELLHOP]: "I was keeping it brief. If you want the full description it will take up more pixels than the door face itself²⁷⁷. There are over seven million doors matching the brief

²⁷⁷ Consider an object in everyday existence. Its complete description in our everyday world would include a description of every atom in it. That would make the description appallingly larger than the object itself, by many

description. Your door has an encrypted form of the Ariosto original published text in Italian. It is known to be a unique encryption but its key has been lost.”

[ALANNA]: “They tell me you’re the smart one here. I’ve been saving an important question for you, and I would be very interested in your answer. With all these unbelievably huge room numbers, and the equally-huge number of rooms, you can host more guests than all the people who have ever lived and who will ever live. So why is your hotel always fully occupied?”

[BELLHOP (sidling close to ALANNA to speak in her ear)]: “Are you familiar with the many-worlds interpretation of quantum mechanics?”

[ALANNA]: “No, but I have the feeling you are about to tell me about it and leave me completely confused.”

[BELLHOP]: “Think of our overall universe as containing every possible transition from one moment to the next – not just the ones we experience, but all the infinite numbers of others. It’s as if there are infinitely-many separate universes embraced in the totality of the creation. But here we can and do house guests from all of them, together in one place. Please keep this confidential.”

[ALANNA]: “So if there is a universe out there where humans have evolved through a different branch of evolution, I might meet them here?”

[BELLHOP]: “Indeed you may! Infinitely many of them! Our Hilbert Bar and Restaurant entertains nightly with acts from any universe you might want to explore. No need to wander the halls when we have made inter-universe meetups so easy! You can meet, dine, and dance with yourselves – all of them!”

Barbara Gets What She Wants

BARBARA approaches the desk. She is dressed in an unfamiliar style: a layered caftan made of veils with shimmering sequences of lights weaving through them. Her nose is almost completely flat.

[BARBARA (putting a three-fingered hand on the desk)]: “Please give me a Robinson Room. I’m writing, and I do not want baggage and displaced guests wandering past all night. I need my quiet.”

[SAM]: “Of course. Thank you for your Golden Card. Here is your room key.” (he turns)
“BELLHOP!”

[SECOND BELLHOP (taking key, speaking to Barbara)]: “Please come with me.”

SECOND BELLHOP AND BARBARA DISAPPEAR WITH A POPPING SOUND

orders of magnitude. Every description we make of an object necessarily abbreviates, generalizes, and contextualizes the object’s properties. How else would descriptions be made useful?

[ALANNA (to Sam)]: "Robinson Rooms? What are those? Where did they go?"

[SAM]: "Ask your bellhop. That's above my pay grade."

[BELLHOP]: "A recent design improvement here incorporated the Robinson Rooms²⁷⁸, which have numbers larger than any integer, but still smaller than the cardinality of the power set of the integers. New arrivals can go directly through to the Robinson Rooms and leave the guests already in their rooms asleep and undisturbed."

[ALANNA]: "So the room numbers are even bigger than anything we've talked about? How can that be?"

[BELLHOP]: "Room numbers are whole numbers. The infinity of whole numbers is the smallest infinity we can define. There are bigger ones."

[SAM (aside to Alanna)]: "Don't go there. Seriously."

[BELLHOP]: "Please ignore him. Just think of an irrational number like the square root of 2 or pi. Writing them out fully is impossible, so we define them as the limits of infinite sums or products. The Robinson Rooms are numbered with the descriptions of these series."

[ALANNA]: "So there are more of them than there are whole numbers?"

[BELLHOP]: "Indeed there are. We can fit an infinite number of rooms numbered this way in between any two ordinary whole numbers."

[ALANNA]: "Like fractional room numbers!"

[BELLHOP]: "Well... not quite. There are more of these limit-defined numbers – we call them "real numbers" – than there are fractions."

[ALANNA]: "That makes no sense to me."

[BELLHOP]: "You're in good company, but it's been proven." (BELLHOP sighs) "Some people have objected that there can be no such thing as the Robinson Rooms. 'They are all a figment,' they say, but these complaints amount to whining about a free choice. Remember, what happens here, stays here. Objecting mathematicians need not be told about it. Now please follow me, and mind the room changes now in progress. Some of the guests are a bit grumpy."

Mournful sounds of singing drift like fog over the scene.

²⁷⁸ Mathematicians can explore the Robinson Rooms in the works of Abraham Robinson, who developed a workable system of arithmetic incorporating infinitesimals. His work depends on an alternative treatment of the Axiom of Choice, a foundational assumption of set theory. Robinson's key work appears in his book *Nonstandard Analysis*.

The night passes. Will rises out of hotel dreams to find his way from the field to a lush boulevard under a cloudy, windy morning sky. He sees the hotel ahead. Alanna comes out. "You! Are you stalking me?"

"I don't know what happened! I was in the lobby right there with you, and then I was on this bridge again, with wolves, but I could see through this... I don't know, mirror. And then I ended up in a field. Had to sleep there. Lots of bugs."

"You're confused, I can see that."

Will shakes his head and turns to go on past the hotel. Alanna waits until he gets several steps away, and says, "Wait."

He stops.

She says, "Let's just talk. This infinity story seems to have caught both of us."

"Okay."

Alanna says, "In your everyday world there are no hotels with infinite space in them. As soon as you start talking about such things, you label them "fictional" or some other adjective that marks their unreality. But the whole hotel story makes perfect logical sense²⁷⁹. You followed the narrative easily, didn't you?"

"Well, yes, mostly." To Will, the restaurants, stores, and offices along the boulevard look quite ordinary, although a bit garish. A rat goes scuttling past them, away from the Hilbert Hotel, a pair of cats in hot pursuit. "It stops making sense only when I try to dovetail it with everyday experience."

"But you don't always dovetail everything together, do you? In mathematics, different systems of assumptions – axioms – yield very-different results." She glares at Will's raised eyebrow, "Oh, come on! Think of the face of a clock! On a 12-hour clock face, if you add 7 and 8, you get 3 – if you want to know what time it will be 8 hours after 7 AM, you have to count around the face of the clock, or if you like numbers, you'll add 8 to 7, get 15, and then subtract 12 to get 3."

"So?"

"Well, in the system of ordinary decimal numbers, you get $7 + 8 = 15$. And you switch between the clock system and the decimal system freely without even thinking. So when someone says, 'I'll meet you 8 hours from now,' and it's 7 o'clock, you think automatically

²⁷⁹ These assumptions we make are what mathematicians call 'axioms'. To get a lot more about the infinite hotel – the Hilbert Hotel, named after mathematician David Hilbert who presented it as a thought-experiment – see David Deutsch, *The Beginning of Infinity*, pp. 167 ff.

in clock terms that you will meet at 3 o'clock. But 7 dollars and 8 dollars together add up to 15 dollars. You use different systems for different situations, and all in the same reality."²⁸⁰

"That's all true, but it's not a big thing."

Alanna laughs at him. "Not by itself! But science confronts you with the extremes of reality. You contemplate subatomic particles and even-smaller entities like quarks. You observe great superclusters of galaxies shining to you from billions of years ago with many billions of stars in each galaxy. You see to the limits of the universe, where the light weakens to radio and lower-energy waves until it falls below your thresholds of visibility. You stare into the black inferno of gravitational singularities, for which two colliding sets of physics axioms, relativity and quantum theory, contradict each other."

She is bouncing on every step, her voice ringing out, and some others passing by look at her intently. "To cope with all this extremity you construct system after system. These systems rely on different axioms for their usefulness and consistency. They are mutually inconsistent, but each one within its own bounds works effectively. You live in a realm of bewildering inconsistencies, even as you try to make it entirely consistent in spite of what Kurt Gödel has shown you."

She enumerates, and Will glances around to see if the unicorns and the vardo are nearby, but they are not. "In building a hotel on a small lot that has an infinite number of rooms, you are simply using one of the most-used mathematical tools: the limit of an infinite series. We're quite happy with that idea, even in the real world, where calculus and analysis use the same idea for just about every result science needs."

"In scaling the sizes of rooms to fit that small lot, you use the fractal framework, in which each room is identical to itself, or more accurately, self-similar, regardless of its size. You're equally comfortable with this idea in scientific applications, especially in biology and nature, where the patterns of blood vessels, lung alveoli, tree branches, and coastlines obey the fractal rules in their structure and behavior"²⁸¹.

"In detouring from your familiar reality to the 'fanciful' realm of the infinite hotel and then returning, you exploit your ability to shift between mutually-inconsistent systems of assumptions, without losing the internal consistency of either system, and without losing productive value from making such shifts."

Alanna spins a full turn, and then steps in front to face Will. "Think of the properties of fractal curves that fill space in interesting ways, Think of the calculus of particle

²⁸⁰ In the 24-hour clock system, the same process is used, but only for times passing midnight.

²⁸¹ Mandelbrot, op. cit. In our use of fractal scaling in the everyday world, we restrict its application to carefully-bounded ranges of scale. Clearly, we couldn't replicate a pattern of ordinary matter down below the molecular or atomic scale. But we can certainly use the mathematics of fractals to characterize scale-related effects over a wide range of scales – and we do that.

interactions requiring the infinite regress of what are called “probability amplitudes.”²⁸² You have learned to truncate their infinite processes at a stage where you can derive useful results over some clearly-defined domain of consideration. This is a common practice in the sciences, and as long as you don't expect the outcome to be complete in any rigorous sense, you get good predictive results in your limited domains. By acknowledging your limitations, you facilitate practice. Now I have to go back to my own story.”

Alanna stares up at the sky, and Will follows her gaze. A pair of winged horses tow a wagon, climbing away from them. Will turns to her, his mouth open. She is gone.

Sparrow, Nightingale, and Endlessness

A flutter of small wings at Will's feet, where a sparrow pecks at some discarded popcorn. It cocks an eye at him, flies straight up to hover, and chirrup meaning.

“The self-similarity property of fractals applies in the realm of ideas in general, not just in the geometry of nature. The hierarchy of infinities builds us a manageable sense of transcendence in thought and expression, not just in the size of mathematical objects. The incompleteness of axiomatic systems equips us with the embrace of inconsistency and the humility of that embrace, helping us contemplate and explore that which does not yield to facile or convenient oversimplifications.”

Will smiles. “That's quite a melody for a little sparrow.” The bird circles his head, its staccato notes saying “He will elevate the theme to a greater reality now,” and flies away.

Once more, as Will stands uncertain on the boulevard alongside a café, the skein of the Nightingale's tune makes its way to him. He slumps down at a small table. The music pours itself into his being.

“As regards thine assertions about the beginning of creation, this is a matter on which conceptions vary by reason of the divergences in men's thoughts and opinions. Wert thou to assert that it hath ever existed and shall continue to exist, it would be true; or wert thou to affirm the same concept as is mentioned in the sacred Scriptures, no doubt would there be about it, for it hath been revealed by God, the Lord of the worlds. Indeed He was a hidden treasure.

*“This is a station that can never be described nor even alluded to. And in the station of “I did wish to make Myself known,” God was, and His creation had ever existed beneath His shelter from the beginning that hath no beginning, apart from its being preceded by a Firstness which cannot be regarded as firstness and originated by a Cause inscrutable even unto all men of learning.”*²⁸³

²⁸² This identifies the “sum-over-histories” path integral formulation of quantum mechanics, developed by physicist Richard Feynman and others. See Feynman's “Quantum Mechanics and Path Integrals: Emended Edition”, (Dover 2010).

²⁸³ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat).

"How can this relate to science?" Will mutters. The phrase "*a station that can never be described nor even alluded to*" warns him that even metaphor and other means of conceptualization fall far short in the realms he's seeking here. The piercing sweet song continues.

*"That which hath been in existence had existed before, but not in the form thou seest today. The world of existence came into being through the heat generated from the interaction between the active force and that which is its recipient. These two are the same, yet they are different. Thus doth the Great Announcement inform thee about this glorious structure. Such as communicate the generating influence and such as receive its impact are indeed created through the irresistible Word of God which is the Cause of the entire creation, while all else besides His Word are but the creatures and the effects thereof. Verily thy Lord is the Expounder, the All-Wise."*²⁸⁴

The Café de Philosophes

"What does all this mean?" Confusion washes through Will.

"Welcome to the Café de Philosophes," a soft alto says beside him. He turns to see a woman with a tray, looking down at him. "Sir, you appear to have lost your way."

"You have no idea."

She is regally tall, with a weary smile. "Do you suffer from contradictory, nonsensical visions?"

"It's the Nightingale I keep hearing. Its melody asserts that there is no beginning to the creation in which we live, but then it also tells us that the treatment of the beginning of the creation is as the sacred scriptures have spelled it out, and we know that the scriptures have described that beginning."

She nods. "You listen to the birds?"

Will slaps his hand down on the table before him. "This music! What can the Nightingale mean by '*a Firstness which cannot be regarded as firstness*'? It's a self-contradiction. And what about '*the heat generated from the interaction between the active force and that which is its recipient. These two are the same, yet they are different*'? I know and understand familiar meanings for the terms 'heat', 'force', and 'interaction', but this is about things not yet created! How can these terms refer to the familiar things we know?"

"You need coffee. We have many flavors and potencies. Here – our daily menu." She hands Will a sheet.

"Whatever is your strongest and bitterest. I'll take that."

²⁸⁴ *ibid.*

Her eyes widen a bit. "All right. But it has side effects. Oh, and contradictions often contain the seed of their own resolution." She turns and strides away.

Will leans back in the creaking, spindly chair. *Our language can't hold what I need here. It's so limited! But we keep eroding those limitations, turning contradiction into harmony, finding gleaming crevices in the unknown: science at its heart.*

Back come the woman with two steaming cups and two small pitchers. "Drink this slowly, and soften its bite as you go with these. This pitcher is unicorn milk, and that one is drake nectar." She sets a cup for Will, and another for herself.

"What is drake nectar? Something from dragons?"

"It's only for use as a finish. Just when you're about to leave." She sets aside her tray, draws up a café chair, and sits down with Will. "I have some time. Tell me what troubles you, sip your coffee, and rest a bit."

Will takes his cup, stirs in a few drops of unicorn milk. The surface of the coffee turns pearlescent. "The Nightingale sang, '*this is a matter on which conceptions vary by reason of the divergences in men's thoughts and opinions*'. These divergences are everywhere! Not just between the religious and the scientific among us, but among the various groups within each of them. Why do we embrace divergence and contradiction so much, and ignore diversity and harmonization?" The coffee tastes dark as blackness, bitter as acid, sultry lightning, biting sugar.

"It's that you're human."

"Wait," Will says. I've met a lot of people in these travels, these dreams. Aren't you human too? Or are you one of those mystical maidens?"

She laughs a gusty alto staccato. "Does this place look mystical to you? And do I remind you of someone?"

Will's thoughts scramble and grope through the vines of a tangled memory bundle. "This is a café, so no, it looks ordinary. But you..."

He is in the timeline's bushes in 1961, a student drunk after calculus finals, and a tall young woman, also drunk, breaks through the greenery, grabs him, and plants a big sloppy sweet kiss on his mouth. She is a mathematics genius, far beyond him, and he falls into adolescent worship.

Will looks up in surprise as the woman seated across from him in the café smiles. "You!" he says.

"Call me Katrina," she tells him, looking down with a little smile. "But you are on a different road now. The one you recall – she is long gone onto her own path. She is my friend and stops here – sometimes we sit and tell stories. But enough – stop staring at me!"

“So many women... sorry.” Will looks off across the boulevard. The wandering strains of a bandoneón draw his attention to a nearby plaza, where couples, men and women, men and men, women and women, turn, step, stride, and twist to the sinuous, varied tango rhythms.

He says, “The húrís. The three maids of language. Miriam. You. All women – why women?”

Katrina laughs in a deep alto. “For you, women, of course! But for other travelers, their appearances and genders may seem otherwise. The inner meaning is the same: they are ecstatic messengers, bearers of divine, pure comprehension. Some see in them the opposite sex, but for others there is no exact gender in those they encounter. Sex as you know it means barely a shred of these experiences.”

“A shred? We write volumes over those shreds!” Will’s hand moves toward Katrina’s across the table.

She pats Will’s hand, pulls hers away as he reaches. “Come up to the higher meanings, the elevated touch! Let go of the distractions! Your physics and mathematics have already overcome divergence and contradiction again and again in their advances, but sometimes your practitioners, after achieving an advance, fall to defending it against further advances, despite abundant evidence that they need to move on.”

A brief silence as Will unravels his tangle of feelings. With effort, he picks up the theme again. “Yes. We resist change, no matter how we protest for our objectivity and presentations of evidence.²⁸⁵ We challenge new scientific evidence, which is scientifically appropriate, but sometimes our challenges stray into rhetorical and social frameworks. Totally human, but not good for science.”

“Yes!” she says, and sips from her own cup. “Some of your greatest advances in physics and mathematics connect two or more apparently-contradictory ideas and their supporting evidence, and you find ways to resolve those contradictions. Usually it’s a broader and deeper conceptual framework, one that mirrors more richly the truths your reality offers you. This was exactly the case with Albert Einstein’s review and resolution of the results of the Michelson-Morley experiment – a process which led him directly to the Special Theory of Relativity.²⁸⁶”

“Oh, and then there’s an even-more-beautiful example! The work of your mathematical physicist Emmy Noether! Almost single-handedly, she arrived at one of the most

²⁸⁵ See Thomas Kuhn, *The Structure of Scientific Revolutions* (University of Chicago Press, 1970).

²⁸⁶ There are a great many books at many levels of readability that provide readers with access to Einstein’s Theory of Relativity. For readers who want an overview and a step-by-step path through the mathematics, *Simply Einstein: Relativity Demystified*, by professor Richard Wolfson, (W. W. Norton reprint, 2003) might offer a good start. For the deeper, richer picture, go straight to Einstein’s *The Theory of Relativity: and Other Essays*, (Philosophical Library/Open Road 2015). And if the lay reader is sufficiently bold and mathematically-inclined, *The Einstein Theory of Relativity: A Trip to the Fourth Dimension*, by Lillian Lieber, (Paul Dry Books 2008) steps through the entire theory, unraveling for the reader even the complex details of tensor calculation.

astonishing mathematical laws that govern your world and your ways of seeing it: the essential, unifying relationship between laws of conservation and rules of symmetry.²⁸⁷"

It snaps into Will's mind. "Noether's First Theorem: whenever we find a symmetry in nature, we find a corresponding conservation law."

"Examples? Or are you just reciting the words?" Katrina stirs a spoonful of unicorn milk into her cup, making sparks rise.

Will remembers. "When we go from one moment to the next in time, the world keeps behaving the same way, and from this we see the conservation of energy. "Or when a process is moved from one place in space to another, it behaves the same way, and from this we get the law of conservation of momentum. These simple statements are spelled out, strictly and accurately, in the language of mathematical physics."

Katrina sips again, her eyes brightening. "It's so simple! Maybe that's the reason it was so easy to overlook earlier. This principle is so essential that it finds its way into your very language in particle physics: the study of the smallest-scale elements of the creation you inhabit. Look at the growing diversification and harmonization of your scientific evidence! All along it shows how you struggle to overcome your resistances to the process."

In the Infinitesimal Zoo of the New

They sit silent and look out on the boulevard with an uncertain gray sky passing above them on a cool breeze. A scent of spring hyacinths wafts its hints to Will, and he wants to reach out to Katrina again, but she is absorbed in the conversation.

She continues. "Particle physicists organize their basic understanding of the particles they find according to the properties they detect in experiments. Mass and charge are the two properties most easily and directly determined. But their experiments showed that other properties were concealed in the increasing variety of particles being discovered. Spin. Radioactive decay. Scattering cross-section."

"Electrons, protons, and neutrons build ordinary atoms and elements, but leave questions that have to be answered with further work. Why is there an energy imbalance that occurred during certain forms of radioactive decay? For example, when a neutron decays into a proton and an electron, there is a distinct "missing bit" of energy that can't be accounted for."

The breeze picks up a bit, lofting her hair and Will's, and the clouds thicken. He nods. "Does such an imbalance violate Noether's basic principle of energy conservation in particle interactions?"

²⁸⁷ Dwight E. Neuenschwander, *Emmy Noether's Wonderful Theorem* (John Hopkins Press, 2011). This is mathematical heavy lifting, but anyone who wants to test ideas as important as this one needs to go here and work it through as best one can. A much-easier read, one that focuses on the person herself for readers including young adults, is *Emmy Noether: The Mother of Modern Algebra*, by M. B. W. Tent (A K Peters/CRC Press 2008).

"Exactly. To restore the symmetry, physicist Wolfgang Pauli proposed in 1930 a very small, electrically-neutral particle whose mass would restore the balance in the reaction. Pauli felt deeply uneasy about his proposal, saying famously, *I have done a terrible thing. I have postulated a particle that cannot be detected.*"²⁸⁸ This particle was later detected (with great difficulty) and verified by experiment."

"Ha! Another particle!"

"You call it the 'neutrino', and far from the single particle Pauli envisioned, it appears to take on three verified forms. Even now, the mass the neutrino possesses is under study. But the discovery of neutrinos restored the symmetry of energy conservation in your formulations of particle physics. Emmy Noether's principle was affirmed, and the contradiction resolved."

"It keeps happening. In 1937, physicists noticed an unusual arc of curvature made in a cloud chamber by a charged particle. They worked out the particle's mass, and verified the existence of the 'muon': heavier than an electron, lighter than a proton, and having no place in everyday atoms anywhere. Muons, it turned out, arise in high-energy cosmic-ray collisions with atomic nuclei, and when they decay away, the decay process yields neutrinos as a by-product."

Katrina sips coffee, and goes on. "This rich process of discovery has brought you the well-confirmed Standard Model of particle physics, which adds many particles, sub-particles, interactions, and properties to the overall framework, expanding the scope of the symmetries of physics in the process. Every time it seemed that a symmetry was violated, more-advanced work revealed a broader and deeper symmetry²⁸⁹."

She slaps a hand on the little table, rattling the cups. "So! Apparent divergence and contradiction yield greater diversity and harmonization. But the scientist must acknowledge the endlessness of the process of advancement. This is not an easy state of mind to achieve and sustain. Even the best researchers long for an endpoint, a completion, a resolution of the final chord of some great symphony of meaning. Your worldly life begins and ends, but from the evidence of science it seems cradled in a reality that *"hath ever existed and shall continue to exist"*, and in your limited perceptions you find this embedding hard to grasp at all."

Nothing is Final

Will leans forward, looking down at a small puddle of coffee spilled by her gesture. "So... is a final Theory of Everything within human reach? Some say yes, and some say no, and some

²⁸⁸ These exact words are attributed to Pauli from a conversation with astronomer Walter Baade, as offered at <http://www.exploratorium.edu/origins/antarctica/tools/dreams2.html>. In a letter to German physicists, seeking some way to detect the neutrino experimentally, he wrote likewise: *"I have done something very bad today by proposing a particle that cannot be detected; it is something no theorist should ever do."* (<https://www.aps.org/publications/capitolhillquarterly/201110/physicshistory.cfm>).

²⁸⁹ Bruce A. Schumm, *Deep Down Things: The Breathtaking Beauty of Particle Physics* (John Hopkins Press 2004). This work is quite accessible to the lay reader, and it offers a rich picture of the science at work.

say maybe... not. Even the greatest practitioners of physics and cosmology struggle with the question.”²⁹⁰

She dabs at the puddle with a spoon. The puddle vibrates in the moving air and shifts a bit toward the table's edge. “The Venerable Bede's ‘The Ecclesiastical History of the English People’ gives an image.”

Will exclaims, “That's a leap!”

“Maybe not! In it, the human life appears as a banquet hall through which a sparrow flies as a winter storm rages outside. Bede ascribes the following to a nobleman in the court of King Edwin, c. 627 CE, concerning the teachings of Christianity.”

She pauses. From beneath the café table a sparrow twitters, words forming.

“Your Majesty, when we compare the present life of man on earth with that time of which we have no knowledge, it seems to me like the swift flight of a single sparrow through the banqueting-hall where you are sitting at dinner on a winter's day with your thanes and counsellors. In the midst there is a comforting fire to warm the hall; outside, the storms of winter rain and snow are raging. This sparrow flies swiftly in through one door of the hall, and out through another. While he is inside, he is safe from the winter storms; but after a few moments of comfort, he vanishes into the wintry world from which he came. Even so, man appears on earth for a little while; but of what went before this life or of what follows, we know nothing. Therefore, if this new teaching has brought any more certain knowledge, it seems only right that we should follow it.”²⁹¹

Will peers down at the sparrow. The little bird trills at him and flies off. Will says, “But what lies outside the banquet hall of this material life? Some other kind of physics?”

Katrina thinks for a moment, then says, “Bede assumes a desolate, bleak view of any potential reality lying beyond the comforts and operation of your everyday world, that ‘banqueting hall’. In Bede's time, of course, there was little to support anything better than a feeling of desolation outside of the banquet hall; the human world in his time groaned under many burdens now long gone, and lacked the far-ranging insights, innovations, and possibilities you see today.”²⁹²

“Some still see things as he did. But why see what lies outside your worldly human existence so naïvely? If you looked deeper, you would open up a much richer range of possibilities for the universe you live in. That might offer a far-more-scientific way of

²⁹⁰ See Steven Weinberg, *Dreams of a Final Theory* (Vintage Books 1994), p. 233.

²⁹¹ The Venerable Bede, *An Ecclesiastical History of the English People*, Book II, Chapter XIII, ca. 731 CE, quoted in Weinberg's book just cited.

²⁹² Humanity in those times suffered also from its attraction to, and obsession with, punishment and Hell, as we have seen mentioned earlier here.

viewing any reality. Anything less would put science in a framework more like that of the close-minded.”

“But quoting from a medieval historian to talk about physics – ”

She ignores his words. “And why do so many thinkers of your time rigidly maintain a hermetic seal between the knowable science of physical phenomena and the potential reality which the development of that science continues to unfold? Such a seal has both the virtue of keeping science functioning properly, and the vice of encouraging all-too-human resistance to advancing the boundaries of that science.”

Will nods. “Yes! That seems a lot like those chains in Plato's Cave.” Now connections begin to gather in his mind. “All right. Suppose we embrace the idea that information and knowledge flow ceaselessly from the realm of the unknown to the realm of the known. Would our ingrown resistance to the idea of that flow be much easier to address? New ideas invariably meet with resistance, but a goodly share of that resistance has little or no scientific basis. We don't need a hermetic seal; the boundary between the known and the unknown might better be called a one-way, semipermeable membrane.”

She looks into Will's eyes, unsettling him again. “Interesting metaphor. And when words such as 'honor' and 'consolation' appear in a scientist's reflections on scientific process and theory²⁹³, they appeal to something outside scientific definition. This makes such appeals either axiomatic (to be assumed as fundamental) or else suspect.”

“Wait. Which scientist are you talking about?”

“That quote from Bede? The distinguished physicist Steven Weinberg offered it.”

“Oh.”

“Your scientists are human, having human limitations and potentials. Concepts that lie outside the realm of physics, such as 'honor' and 'consolation', are essential to their lives as for everyone else's. But to use such concepts in scientific discourse ruptures any 'hermetic seal' the scientist would like to maintain around the science. This suggests that there is no such absolute seal: the reality addressed by physics is a part, an intimate part, of a greater reality.”

“Your continuing advances in astrophysics and cosmology attest to both your limitations and your potentials. Over the course of the twentieth century, and even more so now, the work of one year supersedes and even invalidates the work of the year before. Sometimes advanced studies circle back to gather up discarded ideas and incorporate them in newer frameworks.”

²⁹³ See Weinberg, *ibid.*

"Look at the fast-changing situation in your outlook on the cosmos. For example, Edward Kolb and Michael Turner published "The Early Universe"²⁹⁴ in 1994. It was their introductory (and mathematical) review of topics in cosmology, astrophysics, and particle physics. But since then, many changes in the field have made parts of the book obsolete. Publication of such works for readers outside the field generally seems to trigger their obsolescence. Some become obsolete even before they are published."

Will nods again. "No wonder that science is so very difficult to do."

Blown Away

The breeze has whipped up into a wind, and the skies over the boulevard frown with rolling clouds racing overhead. Will tosses back a swallow of coffee, the nearby tables and chairs scraping and rattling in the gusts of air.

"It's looking stormy," Katrina says, pulling back her hair to tie it. "Something is coming."

Will's feet tingle as if an electric charge is building in him. He looks up. Swifts rocket and ricochet overhead in clouds, feeding on insects fleeing in the turbulent air. "I can't let go just yet. The advance of understanding in physics seems unending. I want to embrace the infinite character of that process. No matter how far we can carry it, no matter how rich, elegant, and potent its results are, we will always be learning."

Katrina nods. "But it takes great effort to overcome human resistance to this idea of infinity. Modern string theories of physics face apparent 'infinities' appearing in many of the equations used. This forces physicists to 'renormalize' the equations to make the infinities vanish from the calculations. These renormalizations have produced significant advances in both the theories and their mathematics. Infinities must be accommodated. Hang on to your cup!" The wind builds in force – but a Warbler arrives, clinging to grillwork at the table edge, its feathers ruffling and smoothing, trilling.

*"Universal existences can be likened and compared to particular ones, for both are subject to one natural order, one universal law, and one divine arrangement. For instance, you will find the smallest atoms to be similar in their general structure to the greatest entities in the universe, and it is clear that they have proceeded from one laboratory of might according to one natural order and one universal law, and can therefore be compared to one another."*²⁹⁵

"The theme of fractals!" Will exclaims as the Warbler leaps up, tumbles in a gust, and blows away. Soaring overhead and past quickly, the Nightingale's song now cries out over the rising voice of the sky.

²⁹⁴ (Kolb 1994)

²⁹⁵ Abdu'l-Bahá, *Some Answered Questions*, newly revised edition 2014, 47: "The Origins of the Universe and the Evolution of Man".

"With inward and outward eyes he witnesseth the mysteries of resurrection in the realms of creation and the souls of men, and with a pure heart apprehendeth the divine wisdom in the endless Manifestations of God. In the ocean he findeth a drop, in a drop he beholdeth the secrets of the sea.

"Split the atom's heart, and lo! Within it thou wilt find a sun."²⁹⁶

"We're going to close the café! It's getting too wild out here!" And Katrina stands, leaning into the wind, clutching her menu sheets and papers. Will stands up and staggers for balance. They head for the café doors, about to be closed by two women, and a rumble from beneath their feet makes them both reach out to take hands.

"What was that?" she says. "I was about to talk about axiomatic inconsistency, and it's as if it's happening to us!"

They find a table inside as stabs of driven rain splash against the café windows. The place is dark. Will sits down, heavily, and she sits beside him. They look out at the boulevard. "Axioms arrange our pursuit of ideas, right? Like the planned arrangement of chairs and table out there?" Will's words are punctuated by slams and scrapes of metal as bits of furniture outside topple and blow toward the street surface. Their coffee cups, now on the pavement, rattle along, and the handle breaks off one of them.

"That storm's making rubbish as we talk," Katrina says. "Look at unresolved contradictions between quantum theory and relativity. Where are the symmetries of the realms where both theories operate? How can the axioms of both be reconciled? The contradictions don't invalidate the results of either of the two in its own realm of scale, do they? Quantum phenomena work to perfection at the smaller scales, where gravity has almost no importance. At the other extreme, relativity operates at the high-gravity scale. Only in the exotic places where the two scales meet, as in gravitational singularities – black holes – do you run into conflicts between the theories."

The floor shakes and seems to shift, but Will persists. "We try to stay out of those exotic places. We want an axiomatic system that works for the exotic scenarios; gravitational singularities where gravitation must work at the quantum scale."

She takes both of Will's hands, and in a moment this tired-seeming worker radiates pure and breathless beauty into him, bringing that adolescent kiss memory to erupt in him, stopping breath and heart and movement and even the storm building outside the café. Love, desire, fear, and wonder overflow him as she speaks softly, gently in his mind.

"Reality is far too rich for your axiomatic systems. Reality issues from one mighty axiom: the divine Utterance 'Be!' and all is called into existence. This one axiom gushes forth infinite theorems of existence itself, so rich, bewildering, and radiant that you juggle the

²⁹⁶ Bahá'u'lláh, *The Seven Valleys and the Four Valleys*, p. 12. The final couplet is quoted from an unattributed Persian mystic poem.

flaming torches of entire complex mathematical and scientific surmises, and one by one you toss aside your torches, spent, to seize new and brighter ones. Reality is no closed system. Reality is never wrong. Reality is the sole invariant. You wanderers, amazed and enchanted, sing whole systems and symphonies of praise and wonder for it all.”

Eleventh Fall

Katrina finishes this inner melody; her form shifts and veils itself; and as the ceiling of the café lifts and banks off into the storm, as the floor beneath them gives way, as the windows vanish in twinkling shards of ruin, as she spreads great wings and soars away reeling in the gusts above, Will begins yet another fall into piercing, smothering blackness.

Draft

V. DREAMING

*Summary, summary,
Sum up the mummery,
Characteristically
Terse and direct;*

*Summery, summery,
Lightly-dressed flummery:
Choreographically
What you'd expect?*

Will opens one eye to a blur. The other is stuck shut. His body complains, issuing reports from inflamed joints, bloated guts, parched throat, numbed feet, bruises everywhere. A thudding and beating of wings penetrates him. He raises his head from a hard floor.

I am old. But I was young, and flying, and falling, and walking, and...

Will slides into 1995. He reaches inside himself, open fully a little-used tap, and language flows, free and effortless, from his fingertips. He unreels a novel of a future world of humans and bioandroids, their bodies and brains derived from human DNA, the tale unexpectedly becoming one of race, subjugation, and conflict. Science and humanity meet in this story, foreshadowing a knot in time deep beneath his awareness, the knot of his world of the window and the sparrow piercing through it.

When his first successful andro arose from the vat with the novel connections intact and working, Hyonarsa noted in his journal: "He stood up dripping before me, and said in perfect Share-speech, 'Here in this place, you are awake! Why were you sleeping in my world?' 'Sleeping?' I asked. 'I wasn't sleeping. What world are you talking about?' He described his inner space to me, filled with the creations of his own imagination, and I was stunned. It was as if he had a world of his own making in his head, so real and vivid that it rivalled this everyday world of ours.

Research for the novel shows Will with great clarity that race is not scientific at all. Race is a social construction. DNA is unified, not defining a segregated set of races – and so are all humans, unified in all their diversity – but human treatment of one another divides them. Race, in America and everywhere, still devours human thinking.

The words of God teach him the truth, healing the metaphors of difference and strife. Science and faith together open the way forward. Now can everyone advance, and leave the nightmares of race behind? Really?

Will is suddenly old again, under the window. The floor is narrow hardwood strips, old-style, worn and even, nail heads not quite protruding. Dust. He lies for a moment while the wingbeats come and go, now loud, now fading away, as if the bird tests the glass again and again.

Desks, bookcases, piles of paper, chairs, lamps all dark. Cables. Dust. His usual prison. Once it was just his workplace, but now it is... what? *Why is it dark? Am I dead?*

The pandemic flood leaks into Will's mind, so many afflicted, so many dead, so many freely secreting its viral poison everywhere, so many imprisoned in home and office and hospital, and he is old, and why is it dark?

The bird – it was a sparrow - is gone.

There was a bridge. I was trying to cross it. I fell, and fell again. And again. And...

He lies on the floor, breathing slowly, to pull his scrambled experiences together.

I was a traveler, and there was Jeddin. We flew. I fell. He died and returned. Round and round we went, up and down, from one – wait. There was singing, magnificent music. And endless landfills, oh, yes, the smells of them! And an ant... no, many creatures...

A hand slides under his shoulder. "Here," says Jeddin. "Sit up. You have fallen out of time." He puts an arm around Will, and gradually they stand up. The window shows a dim gray sky and bare trees with many broken limbs.

Will rubs his temples. "Please tell me this was all some dream."

Jeddin laughs. The tones of his voice are so rich that Will starts to laugh with him. Jeddin says, "Which part? This part? Why try to make such differences important right now? Don't you want to see what you have discovered?"

"Should I fear the thought?"

"Here's the short-short version. Then you can decide."

"All right." Will sits in his usual shabby office chair, realizing too late that it's covered with thick dust.

Jeddin stands looking out the window. He says, "Desolation is here in this spot, emptiness. It is admonition. Here, now, is what you've seen. It will help for the next stage." He raises both hands, fingers splayed, and moving images bloom around them. He points with one finger as he traces through the images one after another, sometimes swerving so quickly that Will can't keep up.

As Will's gaze leaps and turns in pursuit from image to image, Jeddin says, "You've flitted and fallen through amplifications of the worlds you live in. You've tasted metaphor as a foundational food of human thought. You've wandered the family of infinities, the bewilderment of fractal geometries and scaling, and the paradoxes of inconsistency of systems. These all transcend the deeply-ingrained past, and now they transform every aspect of your world."

Will's mind seems to drift and spin, but Jeddin keeps going. "You've devoured human language, its richness, and its embrace of this universal inscription, your world. You now

see that those infinities, fractals, and inconsistencies infuse your thinking about human language itself in all its complexity. You've explored those three realms of ideas, changing the way you think about your everyday world, and discovering how that everyday world is cradled in a greater realm of existence."

Will stops massaging his head. "But what a confusing jumble it's been! I've been lost the whole way!"

Jeddin nods. "Of course! The sources you face are many. Associations emerge, and connections bridge, and they entangle all your disciplines of study! The old definitions and classifications of those seemingly-separated disciplines don't work any more."

"This journey lays bare the transformation of all human thought." Jeddin sketches with a finger in the air. "Would you like to retrace your travels so far?"

"So far?? You mean there's more? Why did this journey have to be so convoluted and tied in knots the way it was?"

"Because you actually think in convoluted, knotted ways, not in the way Aristotle and Plato organized things. Your brains and your attention move from association to association, paying no attention to categories. The classic ways fought against the power of your inner natures."

"But it worked so well!"

Jeddin frowned. "Yes it did, for those who used it to build knowledge and power for themselves, and exclude others. It was also easier for those others, because as adults they were not as well-developed as children are now. But now the boundaries of exclusion, the classes of distinction, the ruling shibboleths, blur and blend and interbreed and waken to life, because the whole world is new and always-advancing. Your brains adapt to fractal boundaries, to shifting sets of axioms, to infinite perspectives – and only in these 200 years have your brains and minds become fully capable of this transformation."

"But it's so confusing!"

"Really? A fractal trajectory turns back on itself many times, infinitely often, at all scales. It brings very-different things to your attention as you follow it. But your brain absorbs it perfectly. You only get in trouble when you try to jam the experience into little boxes of classification, little orderly lists. When you do that, you are dissecting living truth – and killing it in the process."

"Science does that! It's the only way we learn about our world!"

"No! Cutting things apart and analyzing them as inert objects is not all of science! It's only a first thin layer. In the past two centuries, your science gathered in new patterns, it watched things change, it traced connections, and just then the true complexity of your world opened itself to your minds and senses."

"But..."

Jeddin laughs. "Relax. Here we go." And he and Will are great birds once again.

Will glances around the dust-covered office. The discarded bits of plastic have disappeared. He looks out the window for the sparrow. It is gone.

Draft

VI. DREAMS OF FRAGMENTATION

The invisible hand that rocks the cradle rules the world.

The invisible hand rules the world.

The hand that rocks the cradle rules the world.

The hand that rocks rules the world.

The invisible hand that rocks rules the world.

The hand rules the world.

The rocks rules the world.

The hand. The rules. The rocks. The world.

All of the above. None of the above.

Watch the invisible hand. At no time does the hand leave the world.

"Come!" Jeddin cries. They rocket out of the grubby office, up, up, and on into the darkness of space, far beyond air, far beyond fear, their wings now folded sleek along their sides. "Look with me on it all!" They turn to see the earth.

The first time they took flight, Will saw things one by one, clearly. Now, his senses drown and choke in the flood. Not just some airy blue and white and brown marble, but all of the earth and its workings at every scale through every dance-step of time absorb him, devour him, digest him in the wonder of their complexity. Everything, everywhere, all of time... all of it fades from him.

"He is dying!" Miriam's warm voice, sharp with urgency. "He can't exist in all this at once!"

"Help him, then." Jeddin's voice. "My skills are not yours."

"Traveler, come to me," Miriam croons through the tangles and folds of awareness. "Come to me. This wretched trickster would easily kill you along with himself, except that he returns and you do not. Come to me, slowly, slowly now."

Will's eyes unstick themselves and open to a chambered garden floor. He lies in a cushion of sweet grasses, great floral gatherings twining and spreading above, and Miriam in many veils looks down and into his eyes, arresting the chaos of his overburdened thoughts.

"Where is the vardo, the wagon?" he blurts out.

She laughs, a soothing, musical sound. "Oh, that was for the travels you have already endured. This is all new, here. Who knows how things will be?"

"But how can I begin to make any sense of this overload?"

Her hand is cool on his temple. "A little at a time. Let's look at models. They're smaller and easier for you."

"One at a time, I hope!"

"Models are metaphors. They limit what you study – you can shut out all the surrounding noise and distraction. This always helps. Remembering their limits is important, just as it is with metaphors."

"Limits are good." The ache that filled Will's head is now weakening. "Aren't equations models in themselves?"

"They are. Many of them are simple. And they are components of more-complex models, even those models that constitute whole axiomatic systems. For example, the complex-number system is a model of mathematics that can be operated in many different contexts."

She has his attention focused now. He sits up on the grass as she steps back to gesture at some of the flowers and their plants. She plucks a plum from a branch overhanging them.

"Your models in physics and chemistry – in your so-called 'hard sciences' in general – are usually quantitative mathematical and statistical approximations. Mmm." Her teeth sink into the plum, juice dripping from her fingers. "They derive from specific, well-defined metrics and relations. They predict dynamic behavior of physical objects: planets, atoms, molecules, energies – all kinds of measurable phenomena."

Memory stirs Will. "Yes, like Einstein's cosmological equation." He holds out a hand to take the plum she offers him now.

"Yes. But models in the social sciences – in the so-called 'soft sciences' – are most often statistical approximations based on data derived from past events. These model approximations are arranged and interrelated to predict dynamic behavior of societies and cultures. Social-science models also apply non-statistical approximations where it makes sense, and these models are often coupled with qualitative features and structures."

"Hasn't it always been done this way?"

"Not until the past couple of hundred years. With all the new mathematical and scientific advances, you now find new ways of improving and integrating your models. At this threshold you see that your physical world of spacetime and human existence abides in a greater world, one of perhaps greater dimensionality, richness, extent, and qualities."

"But that gets out of our reach! We can't even imagine such things!"

"Really? Think of string theory²⁹⁷, where the number of dimensions needed to incorporate the broadest range of physics is at least ten! Modeling astrophysics this way has in turn led

²⁹⁷ Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory* (Norton 2010) – Greene writes, at the start of his chapter titled "More Dimensions Than Meet the Eye": "*String theory so thoroughly shakes the foundations of modern physics that even the generally accepted number of dimensions in our universe—something so basic that you might think it is beyond questioning—is dramatically and convincingly overthrown.*"

to an exceedingly-rich range of physical possibilities, some of which extend far beyond this universe of your past understandings.²⁹⁸

Will interrupts. "Yes, but I heard from the Nightingale that strange phrasing: '*a Firstness which cannot be regarded as firstness*'. Couldn't that be about possible proliferations of dimensions in the scientific sense? It seems self-contradictory. The term 'first' establishes an ordering, a sequencing, but the phrasing hints that there may be more than one such ordering. So the one identified as primary – 'Firstness' – is distinguished as 'preceding' an eternal creation, one in which ordinary 'firstness' is what we understand as time-dependent. What does this mean? Is Firstness an aspect of an ordering outside of time, in a realm in which the world **containing** time and ordinary firstness – our spacetime existence – is cradled?²⁹⁹ Or are there multiple time dimensions?"

Miriam smiles. "Models for this greater realm in which your world of sciences appears to exist lie beyond reach right now. You can't spend much scientific effort in contemplating such reaches of your existence."

"But we try hard to anticipate the consequences of our actions in less-scientific matters, such as politics, language, economics, and psychology. What can we do to justify this effort?"

"Why not consider these fields of study as starting points? Essential elements of the greater world of which your current sciences can model only a portion? Those models that work so well in the physical sciences might find extensions that help you. That's how science advances."

"Could our grasp of the greater world – religion in its true sense – energize and guide the advance of science into ever-greater realms of existence? That's a big claim. I like it, but it seems unscientific."

Miriam nods. "Religion historically offers guiding, anticipatory frameworks and dynamics that generate human advancement. Is there science you can glean from all that? You may not yet be equipped to judge. For example, the ability of religions to forecast future events is often termed 'prophetic' in your everyday usage. 'Prophetic' essentially means 'predictive' – anticipating future events."

Will says, "But these so-called prophecies are very often terribly vague, contradictory, incomplete, fragmented, or obscure! I saw that with these 'systems' of John Dee and Ramon Llull and others! Their predictive value was nothing. The same is true for the Revelation of

²⁹⁸ See Lisa Randall, *Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions*, p. 458.

²⁹⁹ See J. W. Dunne, *An Experiment with Time (Studies in Consciousness)* (Hampton Roads Publishing 2001) for an excursion into multidimensional time as experienced in carefully-documented dream experiences. This is not physics, nor is it falsifiable as physics, but its insights resonate with the idea that more than one timelike dimension may exist – an idea that has been examined by both physicists and philosophers.

St. John and Nostradamus and others. Their vagueness and ambiguity makes them irrelevant in the eyes of anyone trying to make practical use of them. That's not science."

Miriam draws herself up regally. "Some misperceptions and history may be obstructing your view."

How Much and How Many?

She begins. "First, you get caught up in your favorite details so much that you fail to see the important details of the larger picture. It's not just counting the trees and missing the forest – it's missing the fact that the forest is being torn down and you aren't counting the stumps, or the fact that the trees are infested with disease."

Will blinks. "Try to explain this to me."

"Look at the dynamics of chaotic processes, from evolving weather patterns to the oscillations of a compound pendulum. At a detailed level they defy modeled calculation of future states of their evolution. You can't predict specific outcomes."

"I know that."

"But researchers study them at many levels, and even when a specific future state of a chaotic dynamic system can't be precisely determined, the **class** of that future state can be predicted to a high degree of certainty. For example, you can't predict that it will rain in your neighborhood, but you can now predict a change in an overall series of weather patterns."

"How does that work?"

"Symmetries! Symmetries define the classes of states of dynamic systems. These don't relate specific states of the system, but they relate *collections* of states, where each collection is made up of closely-similar states. Once you look at the collections mathematically, you can simplify your studies of these evolving systems, and find patterns obscured by their (often-chaotic) details." ³⁰⁰

"So if I have a shipping container full of suitcases, I ignore the contents of the suitcases, and concentrate on where the container is going. But the suitcases may all have different sources and destinations!"

"During the time of the container's use, that doesn't matter. You simply follow the container – maybe on a ship or in an aircraft. By grouping the details of the suitcases, you can predict where they will and will not be made relevant. Thinking this way about chaotic dynamic systems, you use group-theoretical and topological tools to explore the arrangements."

³⁰⁰ The topic is deep and rich. See Robert Gilmore and Christophe Letellier, *The Symmetry of Chaos* (Oxford University Press 2007), from the book's overview (p. 13)

"With such tools, you can predict clearly whether or not a system will move into a new range of states, but you could not predict which state, out of that range of states, will be the exact one that emerges at the end."

"When the container moves from a ship to a truck, maybe? That seems limited."

"Yes, but such limited information can be of great value in, for example, the prediction of tornado weather in an area. It can also be of great value in predicting an economic bubble bursting, or a war starting, or an epidemic breaking out."

A shudder passes through Will, as his office room, its window, and the pandemic all bring shadows again to his mind.

Miriam touches his arm. "Are you all right?"

"I think so. But what does all this abstract information mean?"

"Why not consider a government as an example of a chaotic dynamic system?"

"That's easy." He laughs a little.

Miriam draws back to enumerate. "Each status, each possible state of being in this system can be defined with a set of measures and a set of states of being. The government makes transitions from one state to another over time. Tax rates, national debt, employment rate, market trends, productivity, and so on, all change through time. A one-party governmental system operates in a certain range of generally-predictable and closely-related states over long time periods, so that there is really just one class of principal states in such a setting. Civil unrest in such a system does not generally alter the system's collection of states very much at all; the government nearly always returns to the same range of states after efforts to create new symmetries involving dissenting points of view."

'Business as usual, we say.'

"Unfortunately, yes. Now compare the one-party system in this illustration with a two-party system which provides for two major collections of states, each collection associated with one of the two parties. Elections in such a system permit the movement from one collection of states to the other and back again, so that for one collection the measures take on identifiably-similar ranges of values differing substantially from the ranges of the other collection. One collection may have high employment and high tax rates in general, while the other may have the opposite. Change from one collection of states to the other is less-frequent and takes more effort."

Will nods. "The differences between the one-party and the two-party examples may not be significant sometimes. Why concern ourselves with these changes of party in authority when the problems we confront are sufficiently challenging to any and every political system, no matter what is its partisan structure?"

Miriam nods. "So if your choice of measures doesn't show any difference between a one-party and a two-party system you are modeling, maybe there is no meaningful difference."

"Give me an example."

She says, "How about using monetary measures that obscure the measures of incarceration rates in a society? By setting aside the monetary measures to examine the symmetries of systems with high versus low incarceration, you get a very-different perspective on the one-party versus the two-party government. In a society with a large gulag, the parties lose relevance. The gulag operates regardless of the number of parties."

"Wow. So it's about the things we choose to measure. Those choices are important."

"In large part, yes."

"There are other misperceptions?"

Which Ones and What's Together?

Miriam nods again. "Modelers using strictly-numerical mathematical models tend to dismiss the broader kinds of predictions as being useless due to their lack of specifics. A numerical model's worth depends completely on the specific values it produces, e.g., monetary value in dollars, production in tons, manufactured goods in numbers, masses of particles, watts of power. But not all outputs from models need be quantitative; some are mostly qualitative, e.g.: Is there some significant chance of tornadoes (or revolution) today?"

"You're just talking about vague sayings."

"True, but you use even those everyday adages as if they were models. And they are models, because they grant you qualitative predictive insight into processes for which scientific quantification and modeling is not yet practically possible. You can make useful forecasts with little more than some numbers and some basic patterns of thought. So, name me a few predictive sayings."

Sayings

"How about this one? *'Those who do not learn from history are condemned to repeat it.'*"

"A good one! You can't say exactly what the repetitions are or when and where and how they will occur, but you can see from the actions of a leader that he or she has overlooked or ignored conditions which will trigger such repetition. You can also infer with a high degree of certainty that, yes, the same thing will happen all over again, given the same actions prompting it. One can make useful forecasts and preparations in such situations. This is an application of anticipatory potential."

"How about this? *'What goes around, comes around.'*"

"That too. Every action has consequences that flow from it, and some of those consequences are invariably visited on the one(s) who committed the act. Sometimes the

chain of consequence is clear; in some case, it may be quite obscure. Although you can't always identify some specific blowback or consequence from an act returning to its perpetrator, you know to a near-certainty that some such consequence will return."

"Even better, this adage resonates well with the law of physics concerning the conservation of energy stating that energy itself is neither created nor destroyed, and merely takes different forms over time. In studying a closed physical system, this law means that energy emitted from one component of the system will in some form eventually return to that component in some degree."

"Yes, but how useful is knowing there will be consequences if we can't predict what they are?"

"That question fixates on specifics, but often you need to react instead to changes in the broader picture. The people who worried about permits and breadlines and sons being drafted into the armies fixated on the specifics, while the people who saw war and genocide coming to their country made their safe escapes. A good predictive model prepares one for big changes, even when the calculations seem incomplete."

"Good point. How about this one: '*Sacrifices must be made!*'"

"That's not one I know about."

Will says to her, "Those were the last words of German aviation pioneer and experimenter Otto Lilienthal in 1896, dying after breaking his neck in a glider mishap.³⁰¹ The Wright brothers and many aviation explorers honored him, crediting him with inspiring their efforts in powered flight."

Sacrifices

Miriam's eyes widen. "You live now with a vast sweep of the consequences, don't you? And consequences that flow from one's acts are not always adverse, are they? When one of you sacrifices time, effort, relationships, and even life itself, the powerful, beneficial effects that radiate from sacrifice may be felt across the whole human world over great stretches of time. Sacrifices are repaid – and often with great amplification."

Her eyes flash. "And here, here! is a great illustration of the triggering of a qualitative change that transcends the use of numbers, equations, and formulas in any traditional sense. For the effects of sacrifice to be modeled numerically will take you an order of mathematics you are only now beginning to explore.³⁰²

She holds up a finger, pausing. Then she speaks. "You grasp the truth of this potency of sacrifice in countless historical settings, and many works have traced in detail their radiating benevolent repercussions. Nikola Tesla set aside his rights for patent royalties

³⁰¹ Lilienthal's spoken words: "*Opfer müssen gebracht werden!*" ("Sacrifices must be made!") – from Ludwig, Charles, *The Wright Brothers: They Gave Us Wing*. (Mott Media), p. 183.

³⁰² The modern realms of functional analysis and tools such as the Dirac delta function come to mind.

due him from George Westinghouse when Westinghouse lacked money, so that Westinghouse might succeed in making their fruits beneficial to the public."³⁰³

She enumerates again, and this time I don't glance away for the vardo wagon and the singers. "A parent surrendering a child to rescuers during the Holocaust³⁰⁴, a martyr surrendering her life for her gender and her beliefs³⁰⁵, a Manifestation of God surrendering His life in agony on the cross, all of these exemplify the amplifying power of sacrifice."

At this moment Will and Marian both still themselves in surprise as the Nightingale's melody descends on them, the sweet rain of meaning music:

*"Know thou that when the Son of Man yielded up His breath to God, the whole creation wept with a great weeping. By sacrificing Himself, however, a fresh capacity was infused into all created things. Its evidences, as witnessed in all the peoples of the earth, are now manifest before thee. The deepest wisdom which the sages have uttered, the profoundest learning which any mind hath unfolded, the arts which the ablest hands have produced, the influence exerted by the most potent of rulers, are but manifestations of the quickening power released by His transcendent, His all-pervasive, and resplendent Spirit."*³⁰⁶

Miriam's face fills with joy. "How astonishing and uplifting! This amplifying power of sacrifice distinguishes its effects from those of its opposite: selfishness or greed-driven action. Greed invariably turns to ruin in the end, due exactly to the first two adages listed above. These can be modeled fairly easily. But sacrifice – the inverse of greed – has effects that, seemingly without sources of energy, amplify themselves! They unleash the energies of change from sources lacking any causative trace in your everyday world. 'What goes around, comes around' is utterly insufficient for gaining understanding of the miracle of sacrifice."

07734 Such pain I feel! You haven't told in full the story of the martyr woman of whom you speak! I will do it for you! She was executed by the Shi'ih clergy of Persia in 1852, and her martyrdom signaled the beginning of a sweeping change in the fates of women all over the world. Having removed her veil in a meeting of men – a breach of the cultural conventions of her time and place – she went on to call for the advancement of womens' rights. For this and for her religious beliefs, her life was taken from her. At least **I** can honor her beyond the depths of one of your footnotes!

Miriam holds Will's gaze. "Humanity's powers of anticipation deserve the utmost development. Modern science, integrated with the purest truths of human capacity such as

³⁰³ Quoted in Margaret Cheney, *Tesla: Man Out of Time* (Touchstone 2001).

³⁰⁴ The stories of Holocaust survivors, brimming with fortitude, familial sacrifice, and terrible trauma, are so numerous and well-documented that the interested reader can find them easily. One example: Stephanie Fitzgerald, *Children of the Holocaust*, (Compass Point Books 2011).

³⁰⁵ The sacrifice of Qurratu'l-'Ayn, a woman known as Tahirih. For a rich account of her dramatic life and death, see Nabil-i-Zarandi, *The Dawn-Breakers: Nabil's Narrative of the Early Days of the Bahá'í Revelation*, (Bahá'í Publishing Trust 1932), especially Chapter XV and Chapter XXVI pp. 615 ff.

³⁰⁶ Bahá'u'lláh, Gleanings from the Writings of Bahá'u'lláh, from XXXVI, on the effects of the sacrifice of Jesus Christ in His crucifixion:

the power of sacrifice, offers you paths of development toward an incomparably-beautiful human future.”

Seeing to the Heart

Charmed near her, Will says, “It seems the best of dreams.”

She looks down. “Realizing this dream demands human transformation. Your journey has shown you how hard it is. The tangible, tactile, visual things you use to help your understanding can't model the essential ideas you now use in your science, your engineering, and your everyday miracles of life. Recall the different illustrations you saw.” She splays the fingers of one hand, and one by one from each fingertip a gleaming wisp of meaning rises.

- “Topology forces you to ignore some of the ways you measure and shape the objects around you, in order to understand their properties that are hidden from everyday visualization and thinking.”
- “Chaos theory forces you to ignore the infinitely-detailed weaving of dynamic patterns so that you can see how they sort out into large classes that dance among themselves.”
- “Non-Euclidean geometry forces you to turn from the flat little world you navigate every day so that you can navigate worlds huge, convoluted, and tiny in ways you could not imagine.”
- “Complex numbers force you to ignore the restrictions of simple measurement to reveal the forces of nature at work in electricity, magnetism, and quantum mechanics.”
- “Statistics forces you to curtail the power of anecdotal ideas in the face of collected evidence that contradicts or alters those ideas.”

“They are still so new, so fresh! Given such complexities and their intangible character, it's not surprising that you still struggle with the implications of such explosive mathematical developments of the past two centuries.”

Poised at the Cusp

Miriam spreads her arms wide, veils rippling in a soft breeze, looking to the vast sky. Then she turns to Will. “The story of your advances of knowledge maps nicely onto the story of advances of the models you use to mirror aspects of physical reality. A better model improves on the predictive power of its predecessors or rivals. So! How do the three realms you have traversed –fractal geometries and scaling, infinities, and the inconsistency of systems – affect the ways you model your reality?”

Will holds up a hand, and she raises her brows. He says, “Each of them has historical traces that date to antiquity! Some of these traces are poetic, some are philosophical, a few are mathematical. It's just that they were treated without regard for their utility. They were playthings, ornaments. We knew all this before.”

She laughs. “But now they are useful and universally applied! That is what matters! Look at the way the works of Heron of Alexandria and his contemporaries were treated. Heron, also

known as Hero, was a Greek mathematician and engineer who lived just after the time of Jesus Christ. His best-known invention was an improvement on the steam engine developed over a century earlier by Vitruvius.”

“I remember! It seems you are making my point.”

“Not at all! Both of these versions of the steam engine prefigured the steam engines of two millennia later. Those engines bootstrapped the entire Industrial Revolution in your time. But 2000 years ago, they never found any significant, practical, widespread application.³⁰⁷ It has taken you all that time to get here.”

Now she glows with energy. “It’s not just this one piece of the theme, either. The world is completely transformed in the explosive changes of your time, so much so that you seem to be at a cusp, a singularity, where the way forward is unknown. The three mathematical examples you’ve seen – infinity, fractality, incompleteness – all synergize in an unpredictable process of advancement and unfolding, a process operating not in the limited realm of time at all.”

“What could that possibly mean?”

“You need other senses of what transformation can be, before you can explore it further. You think time is linear, step by step, tick by tick, with known stages of unfolding, but that is purely conditioning bestowed by your surroundings and teachings. Listen!”

Once more the Nightingale’s clarion voice descends to them.

“Although the divine worlds be never ending, yet some refer to them as four: The world of time (zamán), which is the one that hath both a beginning and an end; the world of duration (dahr), which hath a beginning, but whose end is not revealed; the world of perpetuity (sarmad), whose beginning is not to be seen but which is known to have an end; and the world of eternity (azal), neither a beginning nor an end of which is visible.”³⁰⁸

Will breathes softly, enchanted. “These are not physical ideas. They are mystical!”

“Yes, they are. But as with the lights casting shadows in the cave you witnessed, they cast their own lesser shadows into your thinking, and those particular shadows offer us ways forward. The notion of ‘realms’ here transcends your everyday sense of geography and place.”

“How does that work?”

“You usually start with some specific locus or spot and step from spot to spot in your thinking and awareness, not realizing that you inhabit multiple realms concurrently and simultaneously. Within your individual minds, the streams of awareness flow and join and

³⁰⁷ See https://en.wikipedia.org/wiki/Hero_of_Alexandria.

³⁰⁸ Bahá'u'lláh, *The Seven Valleys and the Four Valleys*, in the section of “The Seven Valleys” titled “The Valley of Unity”.

part all as elements of you, yet you assume their unity even as you arbitrate their many voicings of your complex selves.”³⁰⁹

“You live in beginning and end, aware of both, yet you also live and move at the same time in a life with beginning and *no* end, as in your contemplation of the infinite series of fractal elaborations that model some partial aspect of your vast reality.”

“Aha!”

“Among these fractal elaborations, blooming from repeated plunges deeper into smaller and smaller scales, lie hidden the minuscule openings of unsmooth possibility. Through such crevices gleam and sparkle beams of light you pass by in everyday life. The Black Swan³¹⁰ event, the butterfly wing waving the air into a hurricane, the snowflake triggering an avalanche, all show the utterly-unexpected choices and events that unleash great shifts in your whole world. Your grasp of this is new, even though you have old verses that express it.” She chants lightly.

*For want of a nail, the shoe was lost,
For want of a shoe, the horse was lost,
For want of a horse, the rider was lost,
For want of a rider, the message was lost,
For want of a message, the battle was lost,
For want of the battle, the kingdom was lost.*

She continues. “The tiniest of differences in a choice can have the most global of consequences, even if it’s only clear in hindsight. Bifurcation theory, a whole field of study of dynamical systems, is devoted to the disciplined exploration of this insight.”³¹¹

“And the results?”

“Powerful! The theory spells out the large qualitative changes in the behavior of a system when one makes a very small, very smooth change to one of its inputs. Not just a large change of value, but a change in character. Such a qualitative change represents a split, a branching or bifurcation of the system’s behavior. But until modern mathematics gave us the tools to study these transitions quantitatively, they were the stuff of epigrams and folklore. Now they can generate useful predictions, forecasts.”

Will recalls a story. “Even in fiction! A story³¹² has a hero searching through St. Pancras Station in London, trying to follow people who were disappearing mysteriously. He moves

³⁰⁹ Marvin Minsky, *The Society of Mind* (Simon & Schuster 1988) – This classic book brilliantly lays out the ways in which our minds employ many streams of thought, characterized as ‘agents’, that serve to moderate, damp, and essentially synthesize our very selves.

³¹⁰ Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (Random House 2007) – How ordinary everyday statistical methods fail to accommodate the great power and consequence of unexpected events.

³¹¹ Bifurcation theory originated in the work of Henri Poincaré.

³¹² Douglas Adams, *The Long Dark Tea-Time of the Soul* (Simon & Schuster 1990) p. 268.

very slowly, taking almost imperceptible steps, catches brief glimpses of a completely-different place, and then abruptly emerges in a different realm altogether.”

Miriam nods. “This mirrors the reality of today’s financial markets you live with, in which the iterated processes of eliminating risks yield vast ranges of investment choices with seemingly no risk at all in them. But these processes conceal minuscule slivers of possibility of the most terrifying failures.”

She shakes her head slowly. “You humans evaluate your risks poorly. You often discount or ignore statistical outliers: the rare and usually-inexplicable events that stand apart from all the rest of the data you collect. If the consequences of ignoring rare occurrences are minor, you can safely ignore these unexpected events. But if the consequences are disastrous, as when an Airbus cockpit design is subtly flawed and a plane full of passengers is killed, there is no recovery from the disaster. Examples even arise in climate studies.³¹³ Yet you dismiss possible disasters as if they were just small problems, solely because they are infrequent. Even though you can see the chance of disaster, you ignore its bitter truth.”

Her face is grim. “You have a great, continuing, looming disaster confronting you. It is your world’s failures to overcome your myths of race.”

Twelfth Fall

A flash of displacement jars Will momentarily out, back into the office with the sparrow at the window, the pandemic raging uncontrolled through his world’s fumbling denials. Resistant, he sags back into dream, wanting to continue the conversation with Miriam. But the dream is empty, dark air blowing past him in his fall.

Will is eighteen, in college, in 1961. He’s friends with a young couple – the man is White, and the woman is Black. They want to hear a jazz trio play, so the two of them and Will and his date set out from college town Ann Arbor to downtown Detroit, Michigan, to hear the Black trio, the Three Sounds.

The wife drives their little car. Will and his date sit in the back.

They pull up at a light beside a police cruiser in Detroit. Two officers in the car look over at the wife, and wave her to the curb. They examine her license, one says it had expired. For this they take her into custody.

The husband, Will, and his date get to the precinct and learn that she is in the lockup. When her husband goes to the rest room, a cop in the corridor roughs him up.

He finally finds bail money, and gets her released, five hours later. This was a part of Will’s country he’d never seen or understood before. He joins the civil rights movement.

³¹³ Nassim Nicholas Taleb, *Foiled by Randomness: The Hidden Role of Chance in Life and in the Markets* (Random House 2005), pp. 105-6, regarding the temptation to ignore statistical outliers – the exceptions ordinarily set aside as irrelevant.

And later, this sweet couple invites Will to find out about the Bahá'í Faith.

Are There Dimensions?

Abruptly, as if hitting a carpeted floor, Will regains himself. Miriam watches him patiently. He retreats from the recollection, and gropes for the conversation interrupted by memory. "Fractals are so new, and so pretty, but treating them mathematically must be very hard. Time-consuming, at the least."

Miriam pauses, stares at him for a moment. "Where did you go just then? Time-traveling some more?"

"You mentioned race. That dropped me out into the past of my life."

"It was time to show you more of where we are going. But we're still preparing that show, so please bear with me."

She says, "Some of the key ideas behind fractal mathematics have been studied since the 19th century, but the whole field did not truly erupt into life until Benoit Mandelbrot of IBM used computer-based, high-speed computation to illustrate for human eyes what the computations were laboriously unfolding: a rigorous generative system for mirroring innumerable patterns appearing in nature and in many human systems as well. Nothing of the sort had been possible until massive computer power enabled it. And get this – the whole field forced you to rethink dimensions completely."

"You mean, like one, two, or three dimensions? Or four?"

"Remember that snowflake, the Koch curve? Or the way a fractal pattern keeps repeating itself at more and more scales? One basic idea of fractal geometry requires you to abandon the notion of fixed, integral dimensions for familiar entities: the zero-dimensional point, one-dimensional line length, two-dimensional planar area, three-dimensional spatial volume. Fractal sets of points can be defined to build more or less continuously from one integral dimension to the next, letting you work with entities having 0.1, 1.5, or 2.3 dimensions – or even $\pi/3$ dimensions."

"This looks like nonsense."

"Truth often looks like nonsense! But you live intuitively with such ideas every day. Think of the atmosphere of the earth as a kind of 'shell' of air that covers the entire surface of your planet in two dimensions – latitude and longitude – with a little of a third dimension – altitude – built into it. The difference between the scales of the first two dimensions and the third is great – thousands of miles east and west, north and south, versus thousands of feet of altitude. If you combine all three, the combination reflects the character of a fractal dimension a little greater than 2 and considerably less than 3."

"Two big dimensions and one small one."

"That's right. This means that the small one doesn't increase the overall dimensionality very much. Its distances are much smaller. If you put two airplanes at randomly-selected locations in latitude, longitude, and altitude, tell me: Are they more probable to be at close altitudes irrespective of their places on a map, or at close latitudes and longitudes regardless of their altitudes? The answer reflects some of the character of fractal dimension."

"They'll more likely be at close altitudes, even if they're far apart across the globe."

"Exactly."

"You're treating dimension statistically, then."

"That's a whole discussion in set theory and more."

"I'll let it pass, thanks."

Calculus Can Be Broken

Miriam smiles. "Good, because there's another connection from the integral to the fractional. One of the mysteries of reality is that of flow, of currents, of continuous collective movement of some substance through a medium. You are now exploring this mystery in the new, complex patterns of mathematics that characterize flow and dynamics. Integration and differentiation in calculus have always been seen as stepwise processes that can be repeated: integrate one, two, three, or more times, or take first, second, or third derivatives, and so on."

"I understand that."

"Now you have the power to calculate integrals and derivatives that are not stepwise. They flow from step to step in a continuous way."

"What does that mean?"

"Instead of taking the first and then the second derivative of a function, for example, one can define a fractional derivative, one that falls between first derivative and second derivative. The 1.5 derivative. The $\pi/3$ derivative. Things like this seem useless and nonsensical until one delves deeper into the dynamics of complex systems."³¹⁴

"Whoa."

"And a whole spectrum, a continuum, of degrees of integration and differentiation, has been worked out to solve significant engineering problems. These novel fractal and fractional ideas draw you from your long past of enumeration – counting – and into continuity. You are now in the world of flows, of currents, of connections free of the simple

³¹⁴ Bruce West, Mauro Bologna, Paolo Grigolini, *Physics of Fractal Operators* (Springer 2003). The book demonstrates some striking and seemingly-paradoxical results, among them the fact that constants in a fractional derivative process do not necessarily behave as constants (pp. 81-82, 3.1.1 Constant Functions). Also see the Excursion titled **THE INCONSTANT CONSTANT**.

numerical signposts on which you have always depended. It is a challenging journey³¹⁵, even (and perhaps especially) for mathematicians and scientists who, having learned more-traditional methods of study, are now confronted with patterns that cannot be addressed or modeled with those methods alone.”

“Miriam, stop! I can't absorb any more of it right now.”

Are You Signal, or Are You Noise?

“I understand.” Her fingertips touch Will's shoulder, calming him. “There is no need to drown when you can dive and then surface again. It is time to redirect our travels to another theme we've already seen.” She looks past him at a puff of pale dust breezing by. “The idea of information seems obvious to you, but is the 'noise' you are hearing just noise alone?”

“I wish I knew.”

“People don't always agree – some dismiss a signal as noise and others elevate it as information. If you want to accept the idea of the unending flow of information into the human world from a non-human source, you must not dismiss such information on the basis of what you already believe. In this, you humans are your own worst adversary against accepting the new. So how do you discover new information? That is one of the foundational questions of science itself.”

Will recovers a little. “Information theory and its fruits have given us some of the filters we need.”

She nods, “But even now, with such accurate, conclusively-decisive means available to you, you still confabulate all kinds of mismatched and misconceived notions concerning your world and your affairs. You select some evidence and ignore or dismiss whatever invalidates your fondly-held ideas.”

“But now you can apply principles of information theory.³¹⁶ Those principles grant you some astonishing potential and power. Think of the flow of images and sound that make up a video stream³¹⁷ sent over a cable to your home, presenting some rich, detailed, dynamic view of events, dramas, ideas, games animations, and more, as if they are taking place in your own living space.”

³¹⁵ Denumerability advances out of its limitations to become flow; we are subsuming the old in the new. It has not been and still is not an easy emergence. The 19th-century mathematician, number theorist and algebraist Leopold Kronecker, was an inveterate opponent of the ideas of infinity set forth in the work of Georg Cantor. Kronecker is quoted as saying, “*God made the integers, all the rest is the work of man.*”

³¹⁶ The classic work on the foundations of information theory is Claude Shannon's “*The Mathematical Theory of Communication*”, which is available in a convenient edition containing an introductory piece by Warren Weaver.

³¹⁷ The technologies supporting such streaming processes over coaxial and fiberoptic cables currently use highly-sophisticated modulation and encoding methods to pack the maximum amount of video and audio information into the narrowest-possible bandwidth in the spectrum being used. By the stage when the signals bearing all the information have been compressed, transformed, and encrypted, these signals appear on inspection as nothing but digital noise.

"So far, so good."

"But if you examine closely the signals bearing all that information to the home or office or auditorium, it appears to be pure random noise. This appearance is due to the need to compress and encode the signals as much as possible. Compression and encoding render more-familiar forms of information unrecognizable. All of this is new."

"Oh! Maybe we should recast Arthur C. Clarke's observation³¹⁸ I passed earlier here:

"Any sufficiently-compressed signal is indistinguishable from noise."

Miriam nods. "You need the tools and disciplines of mathematics and science to discover how those signals you receive from outside your scope of knowledge carry meaning – information – and then you need to discover how to extract that information from them. Now your sciences are advancing to do much more of that."

Once again Will and Miriam stiffen to listen as the Nightingale glides past, unfolding pure music of meaning.

*"Praise be to the all-perceiving, the ever-abiding Lord Who, from a dewdrop out of the ocean of His grace, hath reared the firmament of existence, adorned it with the stars of knowledge, and admitted man into the lofty court of insight and understanding. This dewdrop, which is the Primal Word of God, is at times called the Water of Life, inasmuch as it quickeneth with the waters of knowledge them that have perished in the wilderness of ignorance. Again it is called the Primal Light, a light born of the Sun of divine knowledge, through whose effulgence the first stirrings of existence were made plain and manifest."*³¹⁹

Miriam is first to stir. "You awaken in the world without knowledge, insight, or understanding. The world confronts you with its contents, its processes, its evidences. In your explorations of all these things facing you, you gradually realize that you do not truly understand them. Understanding comes only slowly, incompletely, and with great effort. Then you hear the melodic utterance of the Nightingale. It baffles you. Can a 'dewdrop' be named the "Primal Word of God", the "Water of Life", and the "Primal Light" all in one single presentation? Is it merely poetic? Or is it pure meaning that you have never seen, words uttered in a language you do not know?"

Will is silent.

One college afternoon in 1961 Will has Sonny Rollins on his record player. He dozes off a little. Rollins is playing Limehouse Blues, with Percy Heath and Connie Kay of the MJQ backing him at a breakneck tempo. His playing weaves through Will's semi-awake state,

³¹⁸ In the section titled **Language, Magic, and Religion**, Clarke's words: "*Any sufficiently advanced technology is indistinguishable from magic.*"

³¹⁹ Bahá'u'lláh, *The Pen of Glory* (Bahá'í Publishing 2008), p. 93, from "Tablet to Manikchí Sáhib"

until suddenly Will hears words coming from the horn. The shock jolts him awake and he loses the connection.

What happened? How did it happen? Will has no cultural, linguistic, musical, or artistic background with which to make this connection with the playing of one musician.

How strange! Will hears Rollins telling him to get off his sorry butt and shoulder his life and live it to the fullest. It feels like a stern lecture from an older brother. He warns Will, and laughs at him, and sings for him, and waits for him, and celebrates him.

Many years pass. Will has a Rollins piece playing in his headset as he writes. He closes his eyes and soaks in the ever-shifting dance of melody. On a small stage in a dim, star-clouded hall, the musicians gather. Someone begins a beat with a Caribbean feel to it, staccato, layered, accented; one by one the instruments join in, at first quietly, then building, then softening, molding the world itself to intertwined melodies; one by one the players solo; they all jam and trade and return as the power of the music builds to thunder and wanes to peace.

Deep in the midst of it all, Sonny Rollins comes up and sings like the sun itself. As the music grows, fueled by the players, it becomes a living thing; the listening world itself comes into being. The universe expands from nothingness, and the Creator laughs, meaning itself ascends the stair of life, and we become His melodies.

What Is This, Anyway?

A veil drifts over Miriam's eye. With a finger, she moves it aside. "Do you remember the first time you saw some pattern? A pattern you've never seen before? How did it impress itself on you?"

Will recalls one. "I was standing in a swamp. I was a little kid. First I saw nothing but tall grass, but then some of the grass became something else that turned, twisted, raised up a sharp point and lowered it again – and then it looked at me. It was tall."

"Did it have a name?"

"No! It scared me! Then it turned again and big wings came out and it flew away. Its neck was all curled up. I told my mother, and she said it was a heron."

"How could she tell from your words what kind of bird it was?"

"The curled neck, she said. That's how herons fly. Other big birds extend their necks."

"So – a pattern. Isn't science the art of learning from your encounters with such patterns in the physical world? Imagine you are living in the 18th-century. Suppose the modern applications of quantum mechanics were 'leaked' to you as secrets. Would you understand any of what you are told? Even now, if most of you saw Maxwell's equations for

electromagnetism on a T-shirt, would you connect those symbols meaningfully with the words 'Let there be light'?"³²⁰

Miriam now comes to stand beside Will. They look out over a mist-adorned landscape of hilly greenery, gradually appearing from the uncertain dimness on very-early morning. "All of this weaves together. The birds of melody all gather here as you ask this one simple question: 'How does new information makes its way into the world?' New information revolutionizes all of humanity and the world you inhabit."

He asks, "The 'aha!' moments we see in the inspiration of insights? The ones suddenly emerging in our minds?"

She shakes her head. "No. I mean the mysterious and prolonged episodes during which individuals experience the bestowal of streams of knowledge never before in the human minds of the rest of you. These episodes, these passages of connection, are so intense and alien-seeming that the skeptical, the indifferent, and the dismissive ascribe them all to madness or illness. After all, when what is being presented contains no easily-comprehended or easily-accepted meaning, the incoming information seems to others nothing more than noise or babble."

Will laughs. "I understand a little about that. A friend of mine was a freshman student of English literature. He wandered mistakenly into a graduate physics lecture on quantum field theory, just as the professor was explaining the importance of the Wick rotation. He got out of there in a hurry. I've wondered what haunting melody of meaning there is in a Wick rotation. That was the only term my friend recalled from the experience. I wonder what it was all about."³²¹

Miriam laughs now as well. The beadings woven in her flash and glow. "A few, hearing in the strange language some haunting melody of meaning, might embark on a whole new voyage to seek out its greater music. If you start down that rabbit-hole you will have a long and tangled trip. But people dive down the rabbit-holes of religion the same way, and get lost just as easily." She points out over a tree-covered hillside. "See? The birds!"

Over the crest of the hill rises a flight of swallows through the mists, their voices rising to fill the air with meaning.

Fresh From the Burning Bush

"And the angel of the Lord appeared unto him in a flame of fire out of the midst of a bush: and he looked, and, behold, the bush burned with fire, and the bush was not consumed. And Moses said, I will now turn aside, and see this great sight, why the bush is not burnt.

³²⁰ See the Excursion titled **THE DANCE**.

³²¹ The Wick rotation, named after physicist Gian Carlo Wick, translates the spacetime metric between Minkowski space and Euclidean space. The inquisitive are invited to study special relativity to find out more. One finds a brief explanation in Roger Penrose's compendious book, *The Road to Reality*.

And when the Lord saw that he turned aside to see, God called unto him out of the midst of the bush, and said, Moses, Moses. And he said, Here am I.

“And he said, Draw not nigh hither: put off thy shoes from off thy feet, for the place whereon thou standest is holy ground.

“Moreover he said, I am the God of thy father, the God of Abraham, the God of Isaac, and the God of Jacob. And Moses hid his face; for he was afraid to look upon God.”³²²

Fresh From the Voice in the Cloud

And the swallows shift their music:

“And after six days Jesus taketh Peter, James, and John his brother, and bringeth them up into an high mountain apart,

“And was transfigured before them: and his face did shine as the sun, and his raiment was white as the light.

“And, behold, there appeared unto them Moses and Elias talking with him.

“Then answered Peter, and said unto Jesus, Lord, it is good for us to be here: if thou wilt, let us make here three tabernacles; one for thee, and one for Moses, and one for Elias.

“While he yet spake, behold, a bright cloud overshadowed them: and behold a voice out of the cloud, which said, This is my beloved Son, in whom I am well pleased; hear ye him.

“And when the disciples heard it, they fell on their face, and were sore afraid. And Jesus came and touched them, and said, Arise, and be not afraid. And when they had lifted up their eyes, they saw no man, save Jesus only.”³²³

Fresh From the Angel Gabriel

The swallows pass, but one circles back, its clear voice touching Will's heart.

“And here the words of the angel Gabriel appearing before Muhammad, Who had protested that He Himself was not literate.”

“Read: In the name of thy Lord Who createth...”³²⁴

The birds leave behind the enchantments of wonder. Miriam breathes, “Such onrushes of transformation for your whole human world!”

³²² Exodus 3:2-6, King James Bible.

³²³ Mathew 17:1-8, King James Bible.

³²⁴ Qur'án 96:1.

Will asks, "But weren't these mere pulses in humanity's growth? Weren't all of them looking toward some great emergence from our immaturity? And none of these powerful pulses of meaning was written down by the One receiving it! The story of Moses and the story of Jesus were oral accounts later set in writing by others. The story of Muhammad was transcribed by a secretary from Muhammad's own recitation of what was given him to recite. We could remember only the recitations, the spoken words."

Miriam nods. "And all that has now changed. The practice of oral recitation and eventual transcription, so error-prone and limited in its durability and reach, was superseded beginning with the Revelation of the Báb. He Himself wrote of His own experience.

Fresh From Truths Never Heard

Here the Nightingale trills, its tones piercing.

"The spirit of prayer which animates My soul is the direct consequence of a dream which I had in the year before the declaration of My Mission. In My vision I saw the head of the Imam Husayn, the Siyyidu'sh-Shuhadá, which was hanging upon a tree. Drops of blood dripped profusely from His lacerated throat."

Will's voice rises in shock. "What?" Miriam grips Will's arm to silence him as the song moves on.

*"With feelings of unsurpassed delight, I approached that tree and, stretching forth My hands, gathered a few drops of that sacred blood, and drank them devoutly. When I awoke, I felt that the Spirit of God had permeated and taken possession of My soul."*³²⁵

Into Will's stunned silence, Miriam speaks. "In His very first meeting with His first follower, Mulla Husayn, on the evening of May 22, 1844, the following took place. In Mulla Husayn's own words, after the Báb had looked over a treatise that the mulla had brought with him."

A skylark and the Nightingale fly to circle over them, singing. The skylark³²⁶ chants.

'Within a few minutes He had, with characteristic vigour and charm, unravelled all its mysteries and resolved all its problems. He further expounded to me certain truths which could be found neither in the reported sayings of the imams of the Faith nor in the writings of Shaykh Ahmad and Siyyid Kazim³²⁷. These truths, which I had never heard before, seemed to be endowed with refreshing vividness and power...'

Now the Nightingale returns.

³²⁵ Nabíl-i-'Azam, *The Dawn-Breakers*, p. 253

³²⁶ The voice of Mulla Husayn, describing his fateful meeting with the Báb.

³²⁷ In the years leading up to the Báb's meeting with Mulla Husayn, Shaykh Ahmad-i-Ahsa'i and Siyyid Kazim-i-Rashti actively sought out the fulfillment of the prophecies of Shi'ih Islam concerning the Promised One. See *Dawn-Breakers*, Chapters 1 and 2.

*"... Do not the peoples of the earth testify that the fundamental purpose of their creation is the knowledge and adoration of God? It behoves them to arise, as earnestly and spontaneously as you have arisen, and to seek with determination and constancy their promised Beloved."*³²⁸

And the skylark again, weaving with the sounds of the Nightingale.

*'He then proceeded to say: "Now is the time to reveal the commentary on the Surih of Joseph."'*³²⁹ *He took up His pen and with incredible rapidity revealed the entire Surih of Mulk, the first chapter of His commentary on the Surih of Joseph. The overpowering effect of the manner in which He wrote was heightened by the gentle intonation of His voice which accompanied His writing. Not for one moment did He interrupt the flow of the verses which streamed from His pen. Not once did He pause till the Surih of Mulk was finished.'*³³⁰

The Reluctant Student

The two birds wheel, lofted on a gust of wind, and are gone. Wondering, Will asks Miriam, "Maxwell's equations of electromagnetism suggest that such science could have been dictated to humanity from elsewhere just as these streams of spiritual knowledge were bestowed, yes?"

Miriam replies, "That is true, but it is not made easy. The teachings of both science and religion look easy and obvious, but that is because it takes a lot of study to see their inner beauty and complexity. She gestures, and a short scene plays itself before them.

[STUDENT (whining)]: "Why don't you just tell me the answer?"

[INSTRUCTOR]: "If I just tell you the answer, you will not understand it. You are not a parrot, set to repeat back some sounds. You are a person, expected to understand the meaning of those sounds, and to apply that meaning for benefit. You must make the journey to understanding."

[STUDENT (whining again)]: "But that's hard work!"³³¹

[INSTRUCTOR (laughing)]: "Yes, it is. And it is your work. Now get going."

The voices of the two birds reverberate in Will's mind. "What was all this about Surihs in the birdsongs? How are they related – is this all some mathematics, some pattern, some system? Like Maxwell's equations or...?"

³²⁸ *Dawn-Breakers*, pp. 59-61.

³²⁹ This prophecy, and the context of the Báb's words to Mulla Husayn, are discussed in an article by scholar Moojan Momen titled "The Impact of the Qayyúmu'l-Asma'", found at <http://wilmetteinstitute.org/the-impact-of-the-qayyumul-asma/> on January 6, 2020.

³³⁰ *Ibid.*, p. 61.

³³¹ Maxwell's equations are not just a single set of formulas on some T-shirt. They are formulated in many different ways depending on the context, application, and perspectives of their users. New formulations are derived as their mathematics and physics are continually enriched in human knowledge.

Miriam bows her head, and says, "Let these Maidens tell you." From around them, beings of light move gently closer, their smiles and faces glowing. Dazzled, Will looks down at their feet. Miriam says, "These Maidens are free of any names that you could know. They celebrate the wonder of the writing down of the Words of God by His Manifestation, an event unparalleled and unequalled in all of prior human history. Only by this sacred process of Inscription can the energies you see today be released and channeled to action."

Joseph, Muhammad, the Báb

A sweet soft voice behind Will. "The story of Joseph expresses the great theme of humans facing God. Joseph, the son of Jacob, betrayed by his half-brothers, enslaved, falsely accused, elevated to nobility, trustworthy, ever faithful, embodies in his rich and turbulent life the universal message of God to humanity."

Another gentle melodic voice. "The Surih of Joseph in the Qur'án tells the Biblical story of Joseph."

A third lovely voice rises. "The practice of commentary on aspects of the Qur'án originates with Muhammad Himself, as He recited the Qur'anic verses to those gathered with Him and explained their meanings. This practice, called tafsír (interpretation), was continued after His passing by Islamic scholars until the present time."

She pauses, and then says gently, "The Báb presented His commentary in the same framework as those who preceded Him, but its content was and is utterly revolutionary. The significance of the Báb's revelation of His commentary before Mulla Husayn may be seen first by its scope and evident implications – including both its size equivalent to that of the entire Qur'án, and its features that mirror unprecedented aspects of the Qur'án."³³²

"Briefly, the Báb has in this single work generated a revealed presentation of the importance of the entire Qur'án. While the Qur'án was revealed over a period of 23 years, the entire Commentary on the Qur'án's Surih of Joseph was reported to have been written down by the Báb Himself in several periods totaling roughly 48 hours."

A fourth voice, its tone varying and twining its music, comes in. "The Surih of Mulk, the opening chapter of the Báb's Commentary on the Surih of Joseph, spoken and written by the Báb as Mulla Husayn witnessed in one evening, contains countless meanings which defy mundane human comprehension. To one accustomed to framing ideas in mathematical terms, it is as if each word, each phrase, each sentence – even in the English of translation – serves as little more than a projection, a Plato's-Cave shadow, of layer upon layer of incomparably-rich meaning."

³³² See Todd Lawson, *Reading Reading Itself: The Bab's 'Sura of the Bees,' A Commentary on Qur'án 12:93 from the Sura of Joseph—Text, Translation and Commentary*, published online in *Occasional Papers in Shaykhi, Babi and Baha'i Studies*, at <https://www.h-net.org/~bahai/bhpapers/vol1/nahl2.htm> . "Claiming revelation" is a phrase used among Muslims to frame an accusation of apostasy and heresy.

So enchanting are the voices of these Maidens that Will stands transfixed, waves of feeling and thought moving through him. The equations of Maxwell and the layers of mystical detail fall together in patterns he can't assimilate; his mind drifts and turns.

Miriam speaks. "Let's play with it all, the way a child might play with a bag of pearls. Here is a mathematician acquainted with algebraic topology. She might see this kind of framing more specifically as a mapping from regions of a covering space (the originating Source of the Commentary) stacking up onto single points of a base space (your world). Here, an infinite number of deep ideas map into a single verbal expression. To your eyes, such overlaid and interwoven presentations challenge any distinction among them, and you find in the Surih's passages the apparent conflation of its referents, leaving you confused and in wonder."

As she says the last word, silence comes, and then the Nightingale, singing in tones so piercing, so plaintive, so potent, stabs Will's heart again.

*"O PEOPLE of the earth! By the righteousness of the One true God, I am the Maid of Heaven begotten by the Spirit of Bahá, abiding within the Mansion hewn out of a mass of ruby, tender and vibrant; and in this mighty Paradise naught have I ever witnessed save that which proclaimeth the Remembrance of God by extolling the virtues of this Arabian Youth. Verily there is none other God but your Lord, the All-Merciful. Magnify ye, then, His station, for behold, He is poised in the midmost heart of the All-Highest Paradise as the embodiment of the praise of God in the Tabernacle wherein His glorification is intoned."*³³³

When Will recovers, he mutters, "Who are all these people and entities being referred to, and how do they relate to one another, and how does all this relate to God? How can we ever grasp any of this?"

Miriam says, "The answers may take your species generations to begin to unravel. But listen!" And the Nightingale lavishes another theme on Will's ears.

*"I am the Flame of that supernal Light that glowed upon Sinai in the gladsome Spot, and lay concealed in the midst of the Burning Bush."*³³⁴

Startled, he turns to her. "When Moses faced the Burning Bush, far from us in the depths of time and removals of space, the Báb Himself was His illumination?"

She nods. "Indeed! And both of these melodies come to us from that Surih of Mulk that the Báb wrote and offered before the eyes and ears of Mulla Husayn in their holy moment of beginning. And this was the first time in human knowledge that the Word of God was written down directly by His Manifestation, to be read and gathered into the minds and hearts of all peoples."

³³³ *Selections from the Writings of the Báb, Excerpts from the Qayyúmu 'l-Asmá'*, from Chapter XXIX.

³³⁴ *Ibid.*, from Chapter XCIV.

Miriam reflects. "The sheer volume of this new age's divine information, poured out so prodigally, staggers all who contemplate it. The Báb's Commentary of the Surih of Joseph was only one of His many written works. His profusion, His teeming, electric efflorescence of laws, exhortations, prayers, and commentaries filled many volumes. And referring to the output of Bahá'u'lláh, the one named by the Báb as "He Whom God shall make manifest..." and here she gestures to a swallow soaring past, its notes falling into Will like springtime sun.

*"In this Dispensation, however, the outpouring of Divine Revelation has been vouchsafed to humanity in such profusion that, within the space of one hour, the equivalent of one thousand verses were revealed by Bahá'u'lláh. 'So great is the grace vouchsafed in this day that in a single day and night, were an amanuensis capable of accomplishing it to be found, the equivalent of the Persian Bayán would be sent down from the heaven of Divine holiness.'"*³³⁵

As the swallow flies away, the Nightingale dances an arc around Will and Miriam, singing again the eerily-mystical theme.

"I am the Maid of Heaven, the Offspring begotten by the Spirit of Bahá. My habitation is the Mansion of His Name, the All-Glorious. Before the Concourse on high I was adorned with the ornament of His names. I was wrapt within the veil of an inviolable security, and lay hidden from the eyes of men. Methinks that I heard a Voice of divine and incomparable sweetness, proceeding from the right hand of the God of Mercy, and lo, the whole Paradise stirred and trembled before Me, in its longing to hear its accents, and gaze on the beauty of Him that uttered them.

*"Thus have We revealed in this luminous Tablet, and in the sweetest of languages, the verses which the Tongue of Eternity was moved to utter in the Qayyúmu'l-Asmá'."*³³⁶

Will sinks to his knees, breathless, murmuring, "Any soul contemplating the illuminations from this, uh, this Library of All Things, knows only that he can't read even an iota of it, comprehend even an iota of what he reads, or fulfill even an iota of what he comprehends. How can we learn?"

Miriam puts a firm hand under Will's arm, urging him back to his feet. Her tone is stern. "You need tools and disciplines, fully consistent with and analogous to those of mathematics and science, to discern and comprehend the information granted to you for all kinds of knowledge. Most especially you need to comprehend the knowledge needed for advancing human civilization."

³³⁵ Adib Taherzadeh, *The Revelation of Bahá'u'lláh*, Volume I, p. 23, quoting from the Words of Bahá'u'lláh Himself. The Persian Bayán as revealed by the Báb contained nine 'unities', or sections, each comprised of multiple chapters each containing many verses.

³³⁶ Bahá'u'lláh, Gleanings from the Writings of Bahá'u'lláh, from CXXIX.

"But I can feel the truth of it! Why are the specifics so hard to hold in place in my mind? They feel like living lights that run away from my pursuing thoughts. Do the truths we usually understand matter to us at some deep level long before we sense them or understand them at a conscious level?"

She laughs. "The metaphor of the fish in the sea applies here. The fish navigates the water dexterously and with utter familiarity, but knows no entity called 'water'. A similar metaphor of your baseball player who unknowingly solves differential equations of pursuit in order to catch a fly ball, applies as well. Tell the fish about water, and it may forget how to swim. Tell the ballplayer about differential equations, and he or she may forget how to catch the ball."

"You live by models of reality that you derive at a deep level in your brains, but you rarely see those models clearly enough to extend them to greater ranges of potential. When you do extend them in detail, vast sweeps of possibility bloom before you. You derive consciously those differential equations of pursuit the ballplayer uses, and extend those derivations to physics, gravitation, orbital mechanics, and trajectory computation. Then you travel from the earth to Mars. You extend them even further with massive computational power, and visualize the multibillion-year evolution of entire galaxies of stars, or the development of the gravitational singularities that lie at the hearts of those galaxies."

"You see, you hear, you sense and grasp these truths deep in yourselves, but only now do you summon them up fully to conscious, disciplined practice. You are casting loose from the wharf of your long human past, setting out on a mysterious sea journey of possibilities."

"But how will we embrace the use of the powerful new ideas of our time? We desperately need to predict which choices in society will lead to benefit and which will lead to loss. We are in crisis all over the world at this moment."

"So," she says, "From a fish in the sea to a master of waters?" She smiles, and is gone.

In a sudden spasm of shift, Will is on the bridge once more. Ahead of him shines great light, in which three of the Maidens stand, and now he feels their connections with infinities, fractalities, incompletenesses – and much more. Summoning up his courage from inner, deeper levels of thought, he sees now that each of the three offers him a great and fragrant rose, one white, one red, one gold, the scents mingling in utter and intoxicating beauty.

He reaches out for the three sugar-scented roses, their thorned stems twining up from the thread of light ahead of him. He stretches fingers, slides one foot forward on this bridge now a hot wire burning his toes. A crimson petal grazes his fingertip with sudden shock.

Thirteenth Fall

Will falls once more from the bridge.

He's in his second year in college in 1961. His very-dear friend is trying to kill himself.

His friend's wife is out alone this evening meeting her friends. This would not be a problem except for the sufferings the two of them endure. He's White, she's Black, and they live every day through salt-spoiled restaurant food, police detentions, hate stares, vandalism, family rejection and disowning, constant insults, and minor violence. All in urban Michigan.

Will's friend is in a whirlwind of fear and worry. He is badly drunk. He has brought two Black friends and Will out with him looking for her.

They drive together on the Interstate leading into Detroit, and Will's drunken friend says he has to stop by the road. Will and the others think he wants to relieve himself.

He gets out of the car and runs, staggering along the roadside, traffic blasting by him a few feet away, his voice in the wind crying out with fear that he wants to die.

He isn't a big man. His other friends watch him go. Maybe they have no idea what to do. Will thinks, *I can't let him do this*. He runs after the man, catches up, and tackles him, falling with him to the asphalt and gravel shoulder.

His friend's breath stinks. He begs Will to let him up, that he is all right, that he'll get back in the car. Will releases him. A few wavering steps toward the car, and he abruptly swivels and races off again, stumbling, crying out, and Will chases him again and bring him down again. And again.

Finally his friends catch up with them, take the drunken man by both arms, and escort him back to the car. Will is on his knees, tears running down his face. A gentle brown hand comes onto his shoulder, one of his friends offering a few soothing words, helping Will back to his feet to dust off the grit and gravel as the tractor-trailers roar by in the night.

VII. DREAMS OF INFINITY

*Dive deep enough for pearls,
And you'll become a fish.*

The rushing air thickens, resists, slows Will little by little until he seems to glide in a sea not dark or blue, but roiled and scribbled in whorls coalescing and dissolving, writing in his vision in a language, a code, that whispers, mutters, croons, sings, cries, moans, offering no finger hold of meaning to him.

The Octopus

Fishes eye him, passing in silver and gray, striped and patterned. A small octopus comes sinuous onto his arm and says softly, "Here is a place familiar, yes?"

"No – I don't know what this is."

"Read the waters."

Will blinks and lifts a hand, letting a small eddy pass between two fingers, and words penetrate him. Then his own voice sings gently, in his ear but from a place far off in time.

*"My fingers touch her skin,
My voice sketches a tune
On her passion, the chords follow,
I strum. Fire kindles my song:
She is my guitar. I sing,
Perspiring, fingering her strings
Beneath your balcony, tasting
The salt running from my eyes."*

It is a lost poem of Will's own making, never given out. He looks down at the octopus.

"What is this place?"

The octopus raises an arm, coiling and then uncoiling it. "You are in the sea of abandonment, the realm of unfinished, discarded, rejected works forged and crafted by their makers traveling the great journey."

"They fell from the bridge?"

"Some fell and stayed. Some fell and found their ways again."

"I've been here before! The landfill!"

"No. That is the hell of permanence, of total desertion and despair."

"But I escaped it!"

"Yes – you held hope." The small creature drew a tip of its arm across Will's. "Your hope protects you. It summons imagination. It cries out light in your darkness. It shows you some small next step to take. It jolts you awake. And so here you have come."

"I'm still at sea here. What is this?" Will's fingers sift phrases, sentences, paragraphs, passages, all of them familiar in some way. Looking closer at a drifting passage, he reads.

A shock makes him start, and he clutches to keep the passage from drifting away. "I'm rewriting this right now!" A vision of a room, and a window, and a sparrow fluttering outside, then coming through the glass... Will shakes his head.

Does an octopus laugh? The sound Will hears from the creature on his arm is a suppressed gurgle. "Now you see the deeper convolutions of thought. Why don't you go ahead and rewrite the passage as part of our conversation?"

"Here? Now? Underwater?"

Another tiny gurgle. "Why not?"

"It's pretty clear, I think, but it's too much of a declamation. Let me re-say it this way."

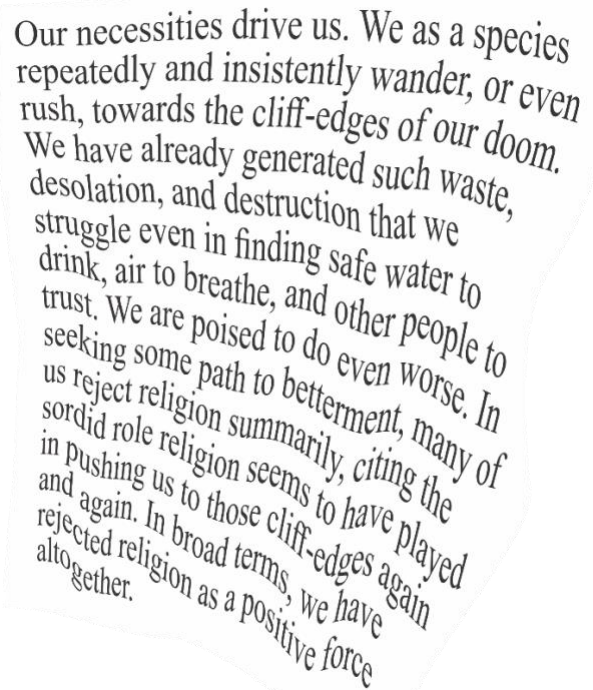
"We humans are racing towards the cliff-edge of doom. We've already generated so much waste, desolation, and destruction that we can't even find safe water to drink, air to breathe, or people to trust. Many of us reject religion, because it has played a sordid role in pushing us to the cliff-edge again and again. So we lack any essential, positive, unifying force. And we're set to do even worse."

"Hmm. Maybe that's better. I'm not as bored."

"Are you an octopus, or a critic?"

"Pray continue your efforts."

"Hmph. Well... even though peoples' perversions of religion have pushed us to the cliff's edge, again and again, we can't afford to throw away the good. The bad parts are our own fault. We receive teachings of infinite value to all of us, but we twist them into justifications for war, slavery, sexual domination, ignorance, prejudice, and worse. We seem blind to the possibility that the true, beautiful teachings of the religions give us clear and usefully-applicable insights and rules for our many systems of society. For our polities."



Our necessities drive us. We as a species repeatedly and insistently wander, or even rush, towards the cliff-edges of our doom. We have already generated such waste, desolation, and destruction that we struggle even in finding safe water to drink, air to breathe, and other people to trust. We are poised to do even worse. In seeking some path to betterment, many of us reject religion summarily, citing the sordid role religion seems to have played in pushing us to those cliff-edges again and again. In broad terms, we have rejected religion as a positive force altogether.

Figure 26 - Will's discard...

"All right," the little octopus says, "You seem to be improving things, so I'll be on my way. You'll be back here soon, I'm sure, trying to clean things up again." The creature drifts up on a swirl of current, blows Will a kiss with two suckered arms, and jets away.

The Sparrow

Will glances down at the brambles of language seething at his feet, and here and there are things he had written years before and forgotten altogether. A sadness comes up in him, a sense of loss, of erosion of that reserve of hope still warm in him. At that piercing moment a ripple in the surface sheets of text draws his eyes. He scoops up a quivering slip of notation, and it flutters weakly. Smoothing it, he finds a beak, a small head, and a wing emerging, wet and yet clean. The sparrow.

Will wipes away the entangling sheet and its texts, and the small bird looks up at him. "Thank you. What took you so long? Did you really want to give up hope with all these writings you made? Put them into the landfill forever?" It waves its stubby wings in the air, as if to dry them and clear them. "Come on! Keep going!"

Reabsorbed now once more in his flow of thoughts, Will returns to the theme, the small bird sitting at his left ear.

"Wait. You're still a bird. Aren't you going to turn into Jeddin or someone?"

"Never mind. Get back to work. Someone's here for you."

Miriam's voice whispers in Will's right ear. "You seem hesitant, maybe confused? Would you like me to help you?"

Tears come to Will, his head bowed. "This is so hard!"

"Look down." Miriam's voice has a sharper edge.

As Will looks down past his feet, the depths begin to recede, the texts fading into blue shadow, and they are rising, faster, faster, to a bright and glitter-drunken sea surface, bursting out of a vast onrunning swell of ocean into brilliance, wings spreading. The sparrow, clutching needle claws into Will's shoulder, trills and jitters song-patches that shine sunlight through him. Miriam and Will soar now, a long-winged pair, and her voice stitches melody and meaning.

"Witness the pouring-out of a pool of water over a field! See all of its branching streams flow into every recess and channel, around and under every growing thing! Feel its nurturance of every fiber of those lives! Trace exactly the unfolding and streaming of all the consequences! You now have the mathematics, the science to do all this."

"Your insights and rules for society must come to apply the same clear kinds of rules. They must trace the unfolding and streaming of consequences of social acts as plainly as tracing the irrigation of fields. So how do you engage these rules with the many, many meanings of the great truths of religion in the process?"

High in the sky among cirrus combs of cloud, chill in the sun, Will's memory drifts to his past. "Such integration – I've read works of fiction that use it. Isaac Asimov used it in his 'Foundation' trilogy, where he calls such discipline 'psychohistory'³³⁷. He gave some vivid illustrations of its future practitioners at work. But of course, it was sketchy."

07734 I will not let this blithe dismissal to the page-bottom pass! So, I have dragged it up here. Listen! Asimov presented his speculative ideas after "thrashing them out" with science fiction editor John Campbell, using the broadly-accepted mathematical ideas current in the 1940s. Given that the work is fiction, and the hand-waving oversimplifications are necessary in fiction, the ideas open the doors to further thinking along disciplined lines. Asimov's book "Foundation", in its reference to the fictional "Encyclopedia Galactica", defines 'psychohistory' as combining mathematics and other specialties to model statistically the behavior of large social ensembles – an approach which is now being applied in the study of speech recognition and other problems resistant to deterministic, deductive methods.

07734 There. I feel better now. I'll let the next few footnotes pass.

"Haven't you seen more-realistic material? Some of your contemporary writers of nonfiction history trace specific threads of actual consequence with considerable clarity. They single out certain elements as having primary importance."³³⁸

A Grain of Sand, a Tiny Spark: Seeds of Disaster

The little sparrow chitters happily away next to Will's left ear, loving their flight far beyond its usual low-altitude reach. Will asks Miriam, "What do we do, though? Some patterns we can't handle with the classic tools alone. Can we use the uncountable, the inconsistent, the fractal? These all refuse to treat numbers in any discrete, traditional sense."

Miriam nods. "Your accepted tools are still mostly quantitative. But mathematics itself has advanced in your time from its long-standing focus on the quantitative, the denumerable, toward a richer view of the qualitative. Does a pattern have a given property, or not; does it have some property only to a certain degree; or does it have some aspect of some property? This question seems deeply abstract, and many of its illustrative examples are also abstract³³⁹, but the concrete examples might help clarify the possibilities. Why not start with the qualitative?"

She continues. "Human behavior and thought are not easily categorized into fully-separated classes. Definitions of mental illnesses³⁴⁰, plant and animal species, and so-called

³³⁷ ...

³³⁸ Jared M. Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (W. W. Norton & Company 1st edition 1999) furnishes a systems-based, biological view of the successes and failures of contrasting human cultures. Diamond follows up this work with another, *Collapse: How Societies Choose to Fail or Succeed*, tracing the arcs of numerous societies that rose and fell, in ways that carry considerable contemporary relevance.

³³⁹ The notion of fractional dimension referred to earlier illustrates the abstract character of the qualitative distinction of dimensions. From the discrete difference between the line of one dimension and the plane of two, we find that we can navigate and measure in spaces between those two specific markers. Yet we can to some degree see these spaces in our everyday existence, from seashore contours to the barbs of a feather.

³⁴⁰ See Thomas Szasz, M. D., *The Myth of Mental Illness: Foundations of a Theory of Personal Conduct*

'races' of humans, all of these have proven themselves to be spectra – continuously-blending – and not categories. Your use of categorizations fails to address the variations that challenge the ways you categorize.”

“I know. We categorize to solve engineering tasks that address ‘real-world’ problems.”

“But maybe you can apply more-disciplined tools productively in all kinds of new places – even some you had never considered for detailed modeling. The study of chaos theory and fractal mathematics is so useful and productive that whole disciplines have sprung up. Now you model actual physical problems unsolvable before: turbulence, phase transitions, and other phenomena showing multiple scales of recurring behavior.³⁴¹ You find ways of relating large-scale processes to small-scale ones, and now you can see much more clearly how they affect each other.”

“Examples?”

“A grain of sand in a small gear can stop a machine that triggers the operation of a large engine. Or a tiny pulse of electrical energy can send a false signal to a circuit that monitors a human heart, and trigger a runaway condition in that circuit. These kinds of relationships are rarely considered in the design and creation of the systems in which the relationships are buried.”

“But those are really simple. What else?” At this great altitude they glide over endless sweeps and swells of spume-dotted sea shining with wind's tireless sculptings and urgings.

“Yes! Now you have modeling of dynamical systems having discontinuous (“sudden”) changes in natural phenomena, particularly in biology³⁴². That work exploded into a new field of study altogether, called ‘catastrophe theory’. It works on a wide range of natural dynamic processes, including the stability of ships, the scattering theory of optics, the collapse of elastic structures, the growth of bee colonies, and the cell differentiation processes of embryology³⁴³.”

“You're saying that modern mathematics has quietly entered into contemporary human thought, transforming our views of our world with little everyday notice.”

“I am. But this is all still embryonic, not that far from Isaac Asimov's vision of predictive mathematical psychohistory. Too many subtleties and unknowns, still – and when you plunge into genomics, the complexities are boundless.³⁴⁴ Worse yet, the bad habits of your social human past continue to disrupt the science you seek, ideology and bias corrupting

³⁴¹ Bruce J. West, Mauro Bologna, Paolo Grigolini, *Physics of Fractal Operators*, p. 310. To get some feeling for where mathematics is taking us in contemporary science, explore the Excursion called **The Inconstant Constant**.

³⁴² See René Thom, *Stabilité Structurelle et Morphogénèse* (Benjamin 1972).

³⁴³ Tim Poston and Ian Stewart, *Catastrophe Theory and Its Applications* (Dover republication 1996) – All of the processes listed in this sentence are described in detail here, along with many others. The authors of the book provide a rich bibliography of specific, technical, contemporary research that exploits these new disciplines fruitfully.

³⁴⁴ See Nessa Carey, *Junk DNA: A Journey Through the Dark Matter of the Genome*.

the process and its results.”³⁴⁵ Miriam looks a bit grim. “Even when you operate even the most-scientific of processes, your lesser natures limit you.”

The sparrow erupts in a burst of chattering song-syllables, excited, and a familiar Nightingale melody wings to them from far off.

*“... they object to that which they comprehend, not to the expositions given by the Expounder ... Their objections, one and all, turn upon themselves...”*³⁴⁶

Miriam pauses, then says, “In 1981 a physicist examined one modeling application of mounting contemporary concern: climate change. He traced its consequences in the possible social and cultural upheavals in global human life. He concluded that getting advance knowledge was most urgent even then.”³⁴⁷

“His work explored six different hypotheses for climate change as seen historically, but none of these addresses humanity’s emerging impacts over the past two centuries. The details he unravels only hint at the urgency of the climate-modeling task as it drives forecasting and modeling of human change at all scales.”

Will frowns. “And look where we are now.”

She nods. “Where environmental change meets human society, natural law and science interact with human law and religion.”

“That hasn’t helped us much, I’m afraid.”

Her eyes flash. “But think of religion in the sense of ‘the energizing catalyst of science’! Think of religion as purified by being taken only from the sources, the fountainheads, the revealers of the great faiths and their pure teachings. If you frame religion as mere human authority, dogma, doctrine, and hierarchy, it can have no positive role in this interweave with science. You have the same problem with science in any of its entanglements with bureaucratic, philosophic, and monetary issues. Ridding yourselves of the great heap of useless and misleading obstructions in both realms is your hardest challenge.”

Jane Plays Games

The winds over the great ocean and sky tweak the air now and then, in little whorls telling Will that a flier has passed by not long before they moved through its wake. “In all this sky, this huge space, we seem to have had company pass near us.”

Miriam seems now a great sea bird with long, narrow tapered wings. They have become a pair here. “There are others traveling, yes,” she says. “Come. I see a pattern off there below, an archipelago’s convolutions. Let’s go see.” She dives.

³⁴⁵ (Poston and Stewart 1996), p. 409 and p. 410.

³⁴⁶ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat).

³⁴⁷ See the thorough text by Robert Gilmore, *Catastrophe Theory for Scientists and Engineers* (Dover reprint 1993), Chapter 16, pp. 428-429.

They spiral in descending helices to islands of sand and growth, skimming coves, bays, inlets, and lagoons, coming to morph to winged human form, standing at the edge of a ring of others like themselves. Their ring defines a flat sandy space in which movement subtly shifts and shadows the sand. Will starts to speak. "What - "

All faces turn to Will and wings rise in warning. A woman next to Miriam whispers, "It has taken days, but the change is about to begin." She adds, "You haven't seen this, have you? We are modeling your world here, gaming it, and the moment is coming when your world's great shift is entering its most-chaotic stage."

Will leans towards this woman and whispers back. "How are you connected with... wait. Is this the world of the bridge? The landfills? The vardo? The sea? Or the... Who are you?"

She smiles. "Call me Jane. This is the world of your window and your little bird. You are there." She points a wingtip at an infinitesimal mote of light in the sand. "See it?" Will's sparrow companion chitters, and the speaker laughs softly. The sand continues to move, ever so slightly, gathering here, dispersing there, tracing filmy tantalizing lines that link and break like language. All the others watch it raptly.

"But I am here, not there."

Jane shrugs. "As you believe." She turns to the expanse of sand again, concentrating her stare on its movements. Miriam and Will stand transfixed as the slow changes of the sand draw apart, interconnect, mount and sag, in movements broader and deeper, until a whorl appears climbing and gathering into a dust devil that obliterates the entire center of the space at the center of the gathering.

Groans and cries from the watchers. Tears flow from Jane's face to the robe she wears, streaks staining the cloth with their own iridescence. "This is the thousandth trial," she says now, her voice breaking but no longer a whisper. "The way forward for your world is narrowing so much that we can't play it."

"Our world is in danger?" Will's neck prickles. "But this is a game, isn't it? It's not the world."

Jane turns to him wiping her eyes. "Through most of your human history you have played games of many kinds. Games let you compete for supremacy, wager on outcomes, entertain players and spectators, teach behavior. Games illuminate action and its consequence. A game is a kind of model. It takes its properties from the world and reduces them to a framework for their disciplined manipulation. Modeling with games offers potent fruit for human advancement. But our gaming here tells us that human advancement can fail. In fact, we can't find a way for humanity to advance. It reaches this critical moment, and then it falls back, collapses."³⁴⁸

³⁴⁸ See Charles R. Hadlock, *Six Sources of Collapse: A Mathematician's Perspective on How Things Can Fall Apart in the Blink of an Eye*, Mathematics Association of America, 2012.

"How are you so sure your game reflects our world that well? Aren't there many things missing from the game that might affect its outcome?"

"We build our games around your patterns, your metaphors, your action. Many of your games model competition and conflict. Such games help develop sound military thinking, strategy, and tactics, help build businesses, help work out political campaigns, and help find effective practices in martial arts. Chess, aikido, backgammon, Go, Monopoly, Dungeons and Dragons, football, dance contests, Grand Theft Auto, World of Warcraft – all competition-based games. They mirror your cultures and feelings. They dominate human attention and interest. They produce effective results and advantages for those who master them."

"But there is always a loss, a defeat, right? A losing side?"

Jane nods. "We are trying to see how we can dispense with complete loss. That requires fundamental change in human thinking. You are not changing enough to escape from the doom we keep finding in what we play here in our sand world."

Will flashes to 1958. He is in prep school, learning oil painting from his late father's best friend and companion. Near the end of summer, before he returns to school in New England, he unrolls a long canvas paper and sketches an oil mural, in umber and burnt sienna tones: the skeletal remains of a ruined city. He pins the mural along one wall of his bedroom, and when fall comes he returns to school.

His mother, who no longer sleeps in the master bedroom, sometimes takes Will's bed. Will talks with her every so often by phone from school that fall, and one time she tells him, "I was sleeping in your room, underneath that picture you painted, and I had a waking nightmare that the picture was bleeding and there were people crying out."

Will doesn't know what to say.

Jolting him back to their conversation with Jane, Miriam asks, "You've seen other possibilities in your journey, haven't you?"

"Yes, but they are not in the game here."

Miriam nudges him. "Well?"

He turns to Jane. "What if you could find other ways to use games, models?"

She nods. "We've learned a lot, but it doesn't reflect your world's movements. Your science, for example. Think of your science explorations as modeling processes. You advance a hypothesis, test it, evaluate the results, and repeat until you have formed conclusions that derive correctly from your evaluation. That can be seen as a game."

Will recalls traces of his journey. "Then why do you not build it all into your game here? Our newer games give us anticipatory potential, not just in competition and war but in society at large. We ask: 'If I do this thing, what will happen?' We ask this question knowing that actually doing the thing may have unforeseen and catastrophic consequences."

Jane laughs, a bitter edge to her voice. "You already know that even in a game such as chess, making a seemingly-innocent move can result in an overwhelming defeat. In your rich world, the mere push of a button can do the same thing, whether you are in a competitive framework or a cooperative one. You seek and you need greater anticipatory power. But nearly all the time you ask the question 'What will happen?' and then you ignore the answer."

She continues. "Your flight simulators enable novice pilots to learn how to fly an aircraft without the dangers of actual flight. Medical simulators let student physicians learn how to react to different ensembles of symptoms in a heart patient. These simulators are in effect games, with the payoffs being the competencies in their respective specialties. They teach you to anticipate the results of your actions in ways that serve advanced human need."

"Your sciences in general use simulations all the time: wind tunnels for aerodynamics; computer models for epidemiology, traffic and highway engineering, and astrophysics; even emulation software for computer designs themselves. Simulations give you great anticipatory potential. From watching the simulated spread of a disease in a model, you can predict outbreaks and critical features of the spread that you need to understand in combatting epidemics."

The bitterness rises as her voice sharpens. "And what do you do with all this wonderful 'anticipatory potential'? You use your beautiful flight simulators for murderous drone strikes and terrorist attacks! You butcher others half a world away, from an armchair! You throw your potential away, deny it, reject it, and hurl yourselves into the abyss, time and again. See?" She gestures at the sand floor, which is now an empty pit of flat bare stone. The other watchers have drifted off, whispering in pairs and threes.

"But then you watch the flow of simulated traffic in a highway setup, you find bottlenecks in a highway design and improve the design. You pinpoint and pinch off the early budding of pandemics. So many examples! The payoff for your society is the improvement of human well-being and dynamics. What could be wrong with that?"

"And look at the sheer magnificence of your accomplishments! Interplanetary spaceflight seems to be no game, but it is an amplified form of a differential game of pursuit, in which one player tries to catch up to another under various rules of movement³⁴⁹. In spaceflight, the craft accelerates out of the gravitational well of one planet, sets its course to coast to the gravitational well of another planet, and then decelerates to orbit around or land on the second planet, all the while finding trajectories that best preserve its fuel. Now you get a spacecraft to make a 'tour' past a whole series of planets. A computational tour de force."

³⁴⁹ For deeper exploration, see Rufus Isaacs, *Differential Games: A Mathematical Theory with Applications to Warfare and Pursuit, Control, and Organization*, a classic in game theory. Differential games, using powerful computational resources, exemplify one of the great advances from move-based, step-based interactions into the dance of continuous flow, recalling that baseball player catching the fly ball without awareness of the processes making the catch possible.

"All this while you let entire multitudes of your own precious human life languish, sicken, and die, even though you could prevent that just as easily as – no, far more easily than – you send a space probe to sample the methane seas of a distant moon. No. Our game is as accurate as it can be, mirroring your grand and tragic folly quite faithfully." The force of her words counterpoints the shining rivulets descending her face from her eyes.

I will die soon. Will's own words keep returning to him, and as he looks into Jane's deep green eyes a shock hits him, and he is stricken to stillness. He stammers, "What do you see?"

The island breeze is soft, and they all stand silent.

"Tell me," Jane at last says to him, "Why have you come on this journey?"

"I feel as if I will die soon. I want to offer everything I have to make the world a little better. But I don't know enough to do that. Here, I've learned from the birds, some of them so far beyond me that I can only catch a little of their music of truth. But we all seem to have some flight in us."

Jane nods, turning to Miriam. "You travel with him?"

"Yes, and I try to offer him what I have. He doesn't really understand that he understands more than he says he knows."

"What?" Will turns to Miriam.

She laughs. "Think of a different kind of game."

"Oh, well... there's the computer game called Civilization. It challenges its players to juggle its economic, religious, political, military, social, and scientific features and dynamics to produce a desirable outcome."

Jane asks, "And there's always a winner and losers?"

"Well... yes. But it could be played either competitively or cooperatively. It depends on the players, not on the game. It's almost a detailed simulation of interacting human civilizations, and other newer games of this kind are coming all the time."

Recollections return to Will. "And – oh, yes! In schools, innovators are transforming the learning process by using concepts and tools derived directly from gameplay.³⁵⁰ On Day One of a course, a teacher can walk in and wake up the students with the words, "Today you all have an 'F'." All they can do after that is raise their grades. Level up!"

As Will speaks, he senses the almost-whisper of song from the sparrow nestling near his ear. It is as if the song is reaching into him, gathering words to his ideas, and speaking them

³⁵⁰ See Lee Sheldon, *The Multiplayer Classroom: Designing Coursework as a Game* (Course Technology 2012), p. 13. Sheldon describes the ways teachers have incorporated computer and other gameplay into the learning process with considerable success, including his own classroom work with students.

out through his own mouth. An otherworldly feeling rises in him, but he lets the words flow.

“Researchers extend the use of games much further. Games can be developed and played for the direct benefit of the players and those in their world – and indeed for the benefit of the world itself.³⁵¹ Others focus intensely on what games offer us for social transformation, whether it is harmonious or disruptive: the game, mirroring human interplay in its complexities and emergent outcomes, pushes our material boundaries outward into greater realms.”³⁵²

He adds, “Our familiar game of Monopoly, first known under the name “The Landlord’s Game”, began as a promotion of the Single Tax Movement by Elizabeth Magie, a Quaker woman, in 1904.”³⁵³

Jane says, “See how gameplay is a form of modeling in deeply-complex and widely-varying frameworks? It fits well into your scientific processes of exploration. Games become catalysts for insight and potential advancement in the boundaries interlacing science and religion. With games, as with modeling in general, you realize more of your anticipatory potential. You extend your reality.”

But she still looks grim. “Never mind. Your society fails at the end despite all this. That is where you still have a long journey ahead of you.”

Will lowers his head. But Miriam whispers to him, “You are forgetting something, aren’t you? Are these games really as potent as you and Jane seem to think they are?”

Will closes his eyes. An image comes, no, it is voices, soft, melodic, harmonized, feminine, coming from the sparrow? *No. The Maidens. Infinities, fractals, incompleteness... games.* They do not fit together, but then a moment fuses them in a shower of sparks.

He looks up. “Games end! Games are finite! Games have limited shape and they have fixed, closed rule sets! Does this mean we might make games and models that ignore these limitations?”

Jane stares at him, and Miriam smiles. Jane asks, “How?”

“Jane, you mentioned the differential game of pursuit. It uses the infinities of calculus in forming its approximations, doesn’t it?”

³⁵¹ See Jane McGonigal, *Reality is Broken: Why Games Make Us Better and How They Can Change the World* (Penguin 2011), pp. 12-13.

³⁵² See Mary Flanagan, *Critical Play: Radical Game Design* (MIT Press 2013), p. 1. In 1932 Charles Darrow acquired a copy of Magie’s rules, and began distributing the game under his own identity, selling the game to Parker Brothers. That firm eventually discovered that Magie held the rights, and compensated her, although their profits from the subsequent rousing and continuing success of the game remained largely in their hands.

³⁵³ *ibid.*, pp. 85-88. In 1924 it became Monopoly, and fifty years later it spawned Anti-Monopoly, the brainchild of a professor seeking to challenge the idea of monopolies altogether.

"Yes, that's true."

"And if we find flaws, contradictions, or nonsense in a set of game rules, do we change the rules of the game? Games evolve to clarify their rules, don't they? So by their nature of change, they are incomplete."

"No! They are fine as long as you stay away from the flaws."

Will pounces on that. "There! When you stay away from the flaws, the game does not evolve as its makers evolve. It loses meaning. But human makers of games move on, and the game dies. We need the flaws!"

Now Jane's green eyes widen. "So we have this game of sand, this model of human existence, but it is not properly reflecting the change in that existence. Do you mean that we need to evolve our game, our model?"

"Maybe! And not just occasionally, but continuously. That's what life does."

Jane throws her arms around Will, confusing him and making the sparrow leap and hover for a moment. Over Jane's shoulder, Miriam's grin shines at him.

He disentangles himself. "Uh, Jane, I need to go. As you said, I have a long journey ahead. But it's been a good visit." Jane looks down, then around, beckoning to some others nearby. Will turns with Miriam, they spread their long wings, take a run and a leap, and they are airborne again in the unending ocean sky.

Miriam sweeps the horizon with her look. The high air is smooth and cold – no ripples or bumps, just an occasional undulation as a thin cirrus mist caresses them. "More and more, you see clearly the world of infinite potential in your existence. Now you can explore fearlessly the possibilities your world offers you. You're learning."

"Because your world holds infinite potential, all process is unending. Some, like Jane, don't engage this thought of 'infinite potential'. They assert that a 'Theory of Everything' can bring a finite end to your searches and elevate you to some final pinnacle of achievement. But the evidence tells you insistently that the searches must continue. In cosmology, theories founder in a sea of infinite cosmic variations, but not so much in biology, cognition, and consciousness. There, you still argue on whether or not reductive ideas can explain all these sciences in physical, even mechanistic, terms."

She frowns. "Is mathematic completely mechanistic, reductive? How can mathematics advance possibilities that lie beyond straightforward reductive explanation? You've already reviewed some hints of such pursuits in chaos-theory work³⁵⁴. There, clear, useful qualitative modeling results emerge from the quantitative basics."

She enumerates. "Think of our three Maidens – here we can name them Infinity, Fractality, and Inconsistency. Qualitative aspects of the infinite provide a framework of limits for your

³⁵⁴ Robert Gilmore and Christophe Letellier, *The Symmetry of Chaos*, op. cit.

calculations. Fractal patterning of your world, so difficult to model computationally, transcends computation to connect different realms of study conceptually. And inconsistent systems of modeling often coexist productively and usefully.”³⁵⁵

Cradled in the Brane

A recent memory surfaces in Will. “I watched this science fiction film, ‘Interstellar’, where the characters venture through a ‘wormhole’ to a distant galaxy of stars. Does this fit in with the themes?”

Miriam’s eyes widen. “Yes! No one has ever found one of these things, but its speculative existence is supported by calculations of theoretical physics. A wormhole is a connective distortion of spacetime that allows one to “jump” great distances between points in the universe, just by traversing it. Calculations have shown the possibility of it.”

Will recalls a bit more. “Later in the story, the characters drop within the event horizon of a gravitational singularity known as a black hole. Instead of being annihilated by the tidal gravitational forces there, one of them finds himself in a different kind of space. It’s called the ‘*bulk*.’”

Miriam says, “What else do you remember of it?”

He goes on, “As I recall, in the bulk he is able to view and even communicate with our familiar world at different moments in time, as if time were simply another dimension one could travel freely either way. The film is deeply rooted in contemporary science, some at the validated level, and some only speculative. Astrophysicist Kip Thorne served as the science advisor for the film. He wrote a whole book in which he spells out the science itself for the general reader.³⁵⁶ In the book, he discusses the bulk as a higher-dimensional aspect of the universe, with the even-more-speculative idea that the bulk is inhabited by intelligent beings. He also offers ‘*brane*’ – a term for a more-general kind of membrane – to refer to universes like our own that are cradled or embedded in the bulk.”

He laughs. “Like a brain embedded in a fat body?”

Miriam ignores the joke. “For you, everything beyond this boundary of your known reality is pure speculation. Could there be life-forms outside that boundary? Intelligent life-forms? How could you even begin to visualize or explore a world that has its dimensions arranged differently from yours? You can imagine its mathematics with some hard work, but its physics, its chemistry, its biology? No.”³⁵⁷

Will backs away from the thought of such exploration. “It sounds like nothing but science fiction to me. I’ve read a lot of that. Hyperspace, subspace, warp drives, ansibles, all kinds of

³⁵⁵ For more on the bridging of our mathematical and human realms in the past two centuries, see the Excursions essay **Error! Reference source not found.**

³⁵⁶ Kip S. Thorne, *The Science of Interstellar* (W. W. Norton 2014).

³⁵⁷ See Kip S. Thorne, *ibid.*, quoted at <https://medium.com/@wwnorton/an-interstellar-explainer-what-are-bulk-beings-1f0d0d99f847#.asfr192df>.

ways to get from one place to another faster than the speed of light. We've got good imaginations working on that all the time. But nothing real. No science and engineering to show for it."

Miriam shrugs. "You're right, but not long ago you would have been right to say the same thing about a lot of newer science and engineering that's working in your world right now. Branes and the bulk are active topics of scientific theory. Among the brilliant physicists studying them is Lisa Randall, who explores the concepts in some detail. She characterizes the term 'brane' as the set of dimensions serving as boundaries to the higher-dimensional space termed the 'bulk'."³⁵⁸

"Do you mean that the way a balloon is a two-dimensional boundary for the volume of air inside it?"

"That's a good analogy. And Randall gives you a novel perspective on gravity. Compared to the other fundamental forces, gravitation is exceedingly weak. She suggests that gravitation may be strong in a brane in which your universe is embedded, with its appearance here simply a kind of 'leakage'."³⁵⁹

"That's a wild idea."

"Maybe, but see how far you have come in harnessing your speculations in science to your experiences in the human world! From the 19th century on, you have transformed crazy speculations into realities. From a few electrical pulses sent along a telegraph wire you built a globe-girdling, throbbing, vital society of all humanity, blazing with information-rich light. The fact that you are now discussing in scientific terms the possible existence of a greater realm cradling your everyday world is astonishing in itself. You are still only at the beginning."³⁶⁰

She laughs. "It's a great story! The filmmakers of 'Interstellar', aided by Thorne's guidance, treated your familiar dimension of time as an element of your own brane. In the story, your brane is cradled in the bulk in such a way that a human consciousness could travel in the bulk, and traverse your brane's time freely. In effect you can get off your "railroad-train" of time and walk or ride back to an earlier station. Using gravitational waves, the film's protagonist sent detailed scientific data back in time to Earth and his child daughter, who perceived it as Morse code."

"But that violates causality – it's a time travel paradox. It's only fiction."

³⁵⁸ Lisa Randall, *Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions*, p. 53 – the brane is necessarily of lower dimension than the bulk it inhabits, existing as a boundary of the bulk, just as a membrane (see the name relationship?) exists as an enclosing boundary for a biological cell.

³⁵⁹ *ibid.*, p. 59.

³⁶⁰ The reader interested in exploring these ideas of space and dimension further will find more information and connections in the Excursions essay *Space and Spaces*.

Miriam laughs. "So was the idea of teleportation. Now you are researching actual teleportation of electrons. You've already done it with photons.³⁶¹ You've also experimented with quantum time reversal."³⁶²

The Bulk of Reality

High over the ocean expanse, again the song of the Nightingale winds its insistent theme to them.

*"Every thing must needs have an origin and every building a builder. Verily, the Word of God is the Cause which hath preceded the contingent world—a world which is adorned with the splendors of the Ancient of Days, yet is being renewed and regenerated at all times."*³⁶³

The now-familiar song fades again, and Will says to Miriam. "What an astonishing idea! That there is a creator of everything – that is a familiar concept. But to have the process of creation be pervasive, continuous, unending throughout time and space, renewing and regenerating our world on a continuing and uninterrupted basis? And that there is a Cause outside of time itself, beyond time's chain of causation?"

She nods. "In Thorne's and Randall's terms, it seems as if your braneworld is always receiving creative energies conveyed into it from the bulk in which your world is a mere boundary. Viewed this way, some added meanings of these words of Bahá'u'lláh may become clearer."

They hover, silent, still far above the blue and misty ocean world, some far-off nacreous tendrils of cloud whispering pale shimmers of color. Miriam says slowly, dreamily, "Bahá'u'lláh wrote those words of the Nightingale in 1873 or 1874, long before cosmologists had conceived the unbelievable scope of your universe. At that time, no one was aware that the faint swashes of light visible in telescopes as 'nebulae' were anything but gas clouds among your stars of the Milky Way."

Will gazes upward to veils of aurora, far above them, raining solar protons in their dancing magnetic mystery. "How immense it all is."

Miriam nods. "And these lights over us are barely the beginning of your vision now. Over time, Henrietta Leavitt worked out ways of determining stellar distances, and then the great telescopes of the 20th century were built. Astronomers, Edwin Hubble among them, analyzed the implications of what they saw, and so you learned that the nearest of these swashes of light were objects similar to the Milky Way itself, each one containing billions of stars, all many times farther from you than anything in the Milky Way."

Unexpectedly, a long-hidden thought emerges for Will. "Miriam, you and your companions keep referring to my world as if you are not in it. You call it 'your world'. Let me ask you

³⁶¹ See <https://phys.org/news/2020-06-teleportation-quantum-world.html> .

³⁶² See <https://www.nature.com/articles/s41598-019-40765-6> .

³⁶³ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, "The Tablet of Wisdom" (Lawh-i-Hikmat).

this: What is your world if it is not the same as mine? Are you elsewhere – a dream place, an imagination realm, some mystical or ethereal span? Where are we now, that we can have this conversation?”

“Hush,” she says.

Their wings carry them through the limitless sky, its clouds and illuminations now far off below them streaking and dotting the space as calligraphic mysteries, vaporous shikastih and nastaliq³⁶⁴ carrying meanings unknown to Will. These atmospheric inscriptions, slowly shifting in crosswinds and undulations, form notes of song now returning again from the Nightingale.

“Thou hast, moreover, asked Me concerning the nature of the celestial spheres. ... The learned men, that have fixed at several thousand years the life of this earth, have failed, throughout the long period of their observation, to consider either the number or the age of the other planets. Consider, moreover, the manifold divergencies that have resulted from the theories propounded by these men. Know thou that every fixed star hath its own planets, and every planet its own creatures, whose number no man can compute.”³⁶⁵

The song, plaintive, remote yet intimate, moves them both near to tears as they glide in the chill heights, and then Miriam speaks. “Bahá'u'lláh firmly set aside the older interpretations of traditional scriptures. He asserted precisely what the astronomers of the 20th century later demonstrated with scientific clarity. He has firmly affirmed the intimate connection between science and religion.”

Again the Nightingale sings.

“O PEOPLE! I swear by the one true God! This is the Ocean out of which all seas have proceeded, and with which every one of them will ultimately be united. From Him all the Suns have been generated, and unto Him they will all return. Through His potency the Trees of Divine Revelation have yielded their fruits, every one of which hath been sent down in the form of a Prophet, bearing a Message to God's creatures in each of the worlds whose number God, alone, in His all-encompassing Knowledge, can reckon.”³⁶⁶

Miriam and Will look around and up for the source of the birdsong, but as they raise their heads to the thinning sky above, they find themselves rising on a sudden updraft so potent that they cannot turn or dive away to escape it. The sky darkens around them, thinning to evanescence, and they are in the vacuum of space, the earth dwindling at the speed of thought.

³⁶⁴ Forms of pen script used in Arabic, renowned for their flowing beauty, speed of use, and great clarity. The novelist Doris Lessing, in her series of novels collectively called Canopus in Argos, titled one of the novels Shikasta, and explored in it the idea of different ranges, layers, or realms of space.

³⁶⁵ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LXXXII.

³⁶⁶ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LI.

Will tries to gasp for breath. Nothing happens. They hurtle in emptiness until it seems to envelop them in stillness. Miriam cries, "Look!"

The song of the Nightingale has turned to visible language all around them, at first barely distinct from the darkness everywhere, then forming into lines and strokes and webs of meaning coalescing, then animating into scenes all unfolding music and beauty at all scales from stellar to planetary to geographic to personal. Time seems only a flavor, a thread in the weave of glory enwrapping them in a delight so potent that, swept up in it, they fold their wings and wrap arms tight about each other to witness it all.

All this wonder of song sprouts, spawns, interlaces, separating, harmonizing, celebrating, chanting and cheering and dancing, and everywhere in the universe the fruits of divine bounty come to ripeness, bear forth their seeds, and gift world after world, age after age, in all the nesting-places of the stars of all the galaxies.

"Look!" Miriam gasps, and one spark of scene from the profusion draws them into its embrace as they cling. They stand now on sand under hot sun. The Nightingale hovers, singing, above a desert promontory.

"I am the Flame of that supernal Light that glowed upon Sinai in the gladsome Spot, and lay concealed in the midst of the Burning Bush."³⁶⁷

Miriam pulls away, staring, as a trembling figure on the promontory faces a great light. She says in a soft voice of wonder, "This song is of the Báb, the forerunner of Bahá'u'lláh. It celebrates the otherworldly event that took place when Moses received His revelation on Mount Sinai³⁶⁸. How far removed from the astrophysics of your time this is! Yet it traces out a trajectory backward through time that evokes the traversal of the protagonist of 'Interstellar' in the bulk, as he searches out a way to send information back in time to Earth."

Will is exhilarated. "So the Báb might have thought about wormholes in spacetime? But could His connection to Moses have some time-travel paradox effect?"

Miriam stand close beside him, and her warmth excites him still more. "Who knows how He might have put it? His realms are far beyond anything you can know. I don't understand all this either. The Báb was born in 1819 in Shiraz. He first revealed His Teachings in 1844, and He was executed by a firing squad in 1850. The Nightingale just sang us the Báb's extraordinary claim that He Himself spoke to Moses, who perceived him as light. That seems to lie outside time completely."

Will's head hurts. "Metaphor and physical reality meet? Confusing! But this idea that our world is a limited part of a greater world - it's always been a part of human tradition and literature, at all levels. The words of the Venerable Bede, his banquet-hall image. The quote

³⁶⁷ The Báb, *Selections from the Writings of the Báb*, (Bahá'í World Centre 1982), "The Commentary on the Surih of Joseph (Qayyúmu'l-Asmá)..

³⁶⁸ The Bible, Exodus 3.

from the Báb here. The works of Kip Thorne and Lisa Randall. Paradises and hells. How can we know what is built for us, and what we build in our imaginations?"

At that moment, Miriam's hand is in his. A Warbler swoops near, circling them, singing.

"From this narrow slip of land he hastened upward to the Well-Beloved, soared out of this dust heap to pitch his tent in a fair and shining place."³⁶⁹

Will shudders, recalling the Maiden and the same words sung earlier by the Warbler. The song continues, varying.

"He escaped from the prison of this world, and pitched his tent in a wide and spacious land."³⁷⁰

Miriam says softly, "Calling your world 'narrow' or a 'prison' stands in stark contrast to the image from the Venerable Bede. The wintry exterior of the Bede's portrayal contrasts so sharply with the uplifting beauty offered by 'Abdu'l-Bahá as the Warbler just sang. Neither is based on any rational or material evidence, but increasingly you find evidence hinting at your world's existence within a greater reality."

"You mean a reality that isn't a dark winter storm outside this world? Space looks a lot like a dark and wintry place right now!"

"A reality beyond space, beyond spacetime and its dimensions! You seem to be drawing back the curtain of your past limitations, but they've always taken you away from the idea that religion in its true sense could be energizing and guiding the advance of science into ever-greater realms of existence."

Will mutters, "Yeah. Religion has gotten in the way all along."

"That's true! Weigh carefully the information you take from religious sources! Consider only the recorded utterances and writings, translated as authoritatively as possible, of those who claim to have received them directly from a source beyond your world. Check those claims by evaluating the abundant, evident fruits of what they have bestowed. That should eliminate much of the contaminating effects of human intervention and alteration."

Miriam's eyes sparkle. "All the specific, sacred sources sung here by the glorious birds have clear, immediate, and documented connections to their divine origin. These sources are Muhammad the Messenger of God, the Báb the promised Qa'im, and Bahá'u'lláh the twelfth Ímám and the Glory of God. Some quotations are taken from the writings of 'Abdu'l-Bahá, the son of Bahá'u'lláh, who spoke and wrote by his Father's conferred authority. There is no break, no gap, no corruption or stain on these revelatory floods of meaning."

³⁶⁹ 'Abdu'l-Bahá, *Memorials of the Faithful* (Bahá'í Publishing Trust), No. 31 Áqá Muḥammad-Ibráhím.

³⁷⁰ *ibid.*, No. 11, Darvísh Šidq-'Alí.

"Miriam, how can we understand? We know that our understanding is deficient, and we are always trying to improve it. Don't our misunderstandings corrupt and mar our grasp of the meanings given us?"

She smiles, and speaks slowly. "Everything in the universe, issuing from and sustained by the Creator, follows undeviatingly its path and adheres to its properties as the Creator has mandated. Every law of science you can derive from your experience of the universe attests this essential truth. Each electron abides over time, unless it is converted to energy, but the energy can again become an electron, preserving its mass-energy perfectly. The same is true for each proton. They obey the principle of the conservation of mass-energy."

"Similarly, no matter where in space and time you go, the momentum and angular momentum of things will not change due simply to change of location. The conservation laws of physics grant these certainties. To all of this certainty there is one exception: the choices made by you humans."

Will asks, "But are human choices an exception to the physical certainties of our world? We can't make choices that violate the laws of physics, even when desperation or extremity drives us to try."

Miriam turns and takes a step back, her eyes flashing. "Your real choices relate principally to your relationship to the greater world. That relationship is exclusively human, possessed by no other lesser entity in your world of physical existence. One may choose to do one thing or another in this world, but the flow of consequences of the choice can either degrade one's being or elevate it. The degradation or elevation is not physical, but spiritual."

Now from not far off the Warbler returns to circle them, its voice enchanting.

"Man is in the ultimate degree of materiality and the beginning of spirituality; that is, he is at the end of imperfection and the beginning of perfection. He is at the furthestmost degree of darkness and the beginning of the light. That is why the station of man is said to be the end of night and the beginning of day, meaning that he encompasses all the degrees of imperfection and that he potentially possesses all the degrees of perfection.

"He has both an animal side and an angelic side, and the role of the educator is to so train human souls that the angelic side may overcome the animal. Thus, should the divine powers, which are identical with perfection, overcome in man the satanic powers, which are absolute imperfection, he becomes the noblest of all creatures, but should the converse take place, he becomes the vilest of all beings. That is why he is the end of imperfection and the beginning of perfection.

"In no other species in the world of existence can such difference, distinction, contrast, and contradiction be seen as in man. For instance, it is upon man that the effulgent light of the

Divinity has been shed, as it was with Christ—see how glorious and noble man is! At the same time, he worships stones, trees, and lumps of clay—see how wretched he is, that the object of his worship should be the basest degrees of existence, that is, lifeless stones and clods of earth, mountains, woods, and trees! What greater wretchedness can there be for man than to worship the lowliest of all things?”³⁷¹

Will feels the music. “So each of us has what no other living creature has: the choice between pursuit of the material existence and pursuit of the spiritual existence.”

“Yes! The Creator grants you the choice toward the greater world in return for obedience to the Creator’s laws for humanity. Each of you may enter onto a path toward the Creator, beyond your temporary physical existence. This relationship, this agreement, is called the Covenant of God. This supreme Covenant constitutes the heart of the energizing catalyst for your science.”

“How so?”

“When you choose to move on the path of search toward the Creator in obedience, you elevate and ennoble your beings, your societies, and your science itself. Science and religion together serve your advancement. To ignore science is to be consumed by superstition, and to ignore religion is to be blinded to one’s true nature.”

Again the Warbler trills.

“Religion and science are the two wings upon which man’s intelligence can soar into the heights, with which the human soul can progress. It is not possible to fly with one wing alone! Should a man try to fly with the wing of religion alone he would quickly fall into the quagmire of superstition, whilst on the other hand, with the wing of science alone he would also make no progress, but fall into the despairing slough of materialism.”³⁷²

Miriam says with force, “The willful rejection and disobedience of both spiritual principles and physical laws have eroded and destroyed all too much of your humanity and your world. To accept the Covenant with one’s Creator is to embrace recognition and obedience to both, to open the way to continuing advancement of knowledge.”

“How can we keep this... Covenant?”

“Dance beside me.” Miriam extends her arms to Will and performs a pirouette, then another. Birdsong rises around them in this desert, the sun now moving toward the horizon, the sands cooling at last.

³⁷¹ ‘Abdu’l-Bahá, *Some Answered Questions*, No. 64.

³⁷² ‘Abdu’l-Bahá, *Paris Talks*, No. 44.

Will begins to turn, and turn, mirroring her movements, and suddenly dizziness rises, making him stagger aside to regain his balance. Miriam laughs, still turning and turning like a dervish. "Try again!"

Again he nearly falls. "How are you able to stay in your turns without getting disoriented?"

"Watch my eyes!" she says, still turning. He follows her gaze, seeing her head whip around so that her flashing eyes remain fixed on some distant point near the setting sun, never sweeping around with her turn. "This is how one can turn and keep balance. It is the same with the Covenant. Life is filled with turnings, but when you keep the Covenant foremost in your attention, you will not lose your balance or your way. This is part of keeping to the Covenant."

"But how does this work, without the dance steps? Where is the true power of the dance metaphor here?"

Stabbing through the star-marked evening with a shock come the Nightingale's notes, responding acciacatura, appoggiatura, flashing musical illumination.

*"Peruse this chapter of the Bayán every month! Its title is 'On this, that he who adduceth any proof other than the Book of God and the verses of the Bayán, other than the powerlessness of all to produce their like, is veiled from any proof. He who recounteth any miracle, other than the verses, is veiled from any truth. He who claimeth to reveal divine verses should not be opposed by anyone. All must recite this gate once in every nineteen days, and ponder day and night upon that which is revealed therein.'"*³⁷³

All of that is the title? Breathless, Will waits. The stars seem to dance in their places, and the Nightingale sings out clear again as light.

"Notwithstanding the impossibility that none besides Him Whom God shall make manifest will be able to claim such a mighty Cause, it is enjoined in the Bayán that should anyone make a claim and verses be manifested from Him, no one should oppose Him, that haply no grief should assail that Sun of Truth.... His verses are, by themselves, sufficient proof of the radiant lights of the Sun of His Being, just as the powerlessness of all is the mighty evidence of the utter need and dependence of all upon Him.

*"The reason for this command is that haply, in the Day of the Revelation of that supreme Truth, the feet of the people shall not falter upon the bridge, and that they shall not pronounce judgment against the Fashioner of their existence, adducing against Him the very shadow of His verse in their heart, and rendering naught, and at once, all their inmost realities and deeds, without even perceiving it."*³⁷⁴

"The bridge!" Will gasps out. "The bridge!"

³⁷³ See Nader Saiedi, *The Gate of the Heart*, p. 370.

³⁷⁴ *Ibid.*, p. 371

"Do you see more of it now?" Miriam faces him, a step away. He fixes his eyes on hers, and executes a quick spin to face her again, his head snapping to catch her gaze quickly. He doesn't reel or fall.

"Eyes stay on the revealed truth, yes?" Will grins.

Miriam lowers her gaze to the darkened sand. "You are beginning to understand."

Stars, Signals, Light

She mesmerizes me. The starlight in Miriam's glistening eyes floods Will with meanings. So much more than comparisons, models, likenesses, with poetic and mystical meanings unconnected to the homely roots they use to express elevated ideas, the images, movements, and forms of the dance and its music radiate meaning and its comprehension into him.

New thoughts utter themselves from him. "Astronomers can't travel to the Sun, or to Alpha Centauri, or to the Andromeda Galaxy (M31), or even to our local asteroid belt or our Oort Cloud of frozen planetoids. They can only use the light that arrives in their eyes. But with nothing except that light, they spell out with great certainty the character, composition, and dynamics of objects in our Universe at the extreme limits of all vision of all kinds."

Miriam bursts out, "Oh, the profusion of different sizes and types of stars! How they evolve! You learn using only their emission and absorption spectra, their apparent luminosity and mass, their apparent movement over time, and their relationships with other stars and objects near them. You do all this using only the light that registers in human eyes, aided by nothing more than optical telescopes and prisms, composing your models of cosmic reality using the powerful tools of mathematics and physics."

Over them in the evening shading of sky, stars emerge in gleaming wealth. She continues, "You opened your eyes wider to extended forms of light: radio waves, ultraviolet and infrared, gamma rays, X-rays. You drew back your curtains on a Universe of vastly-greater wealth and complexity. Hidden stars, newborn galaxies, gravitational singularities and lenses, exoplanets, all emerged to your wondering eyes. All from light. Until the construction of the gravitational-wave detectors such as LIGO³⁷⁵, light is all you have had."

She twists sinuously through the grace of a slow turn, continuing, "Light has bestowed on you a view of a Universe of appalling scale and mystery – a great beginning. But given the evidence you now find for dark matter and dark energy, you still have no idea what most of your physical Universe is made of. Light has even told you what you are made of – 'star stuff': the elements created in the monstrous explosions of giant stars gone supernova,

³⁷⁵ Janna Levin, *Black Hole Blues and Other Songs from Outer Space* (Knopf 2016) – the story of how and when we opened our ears to the cosmos, told by one of the great physicists (and fine writers) intimately involved with the search and the work to detect these waves and ripples and pulses of spacetime itself.

scattered throughout the galaxies, and captured gravitationally by smaller stars like your sun to generate the life you know."³⁷⁶

Will laughs. "What more is light telling us?"

And Miriam laughs too, taking his hand again. "You venture even more audaciously with your speculations than you do with your beliefs^{377, 378}. You circle the traps of attractive patterns and models as relentlessly as you strain to catch SETI signals from some remote, non-human intelligence in the Universe. Reading what you can of reality, you seem overwhelmed with the potentialities."

From a high and rocky spot in the darkening desert, an ethereal figure, a maiden, steps softly and smoothly down toward them. A gesture from her, Miriam draws away from Will, and they stand side by side, transfixed in wonder. The maiden speaks. "You are near the exciting confluence of science and religion. Light as creation, as illumination, as sustenance, as nurture of your essential beings – the metaphor reflects and elaborates in your inner mirrors of thought. It resonates with the scientific uses of the same metaphor as nurture of your physical beings, cradled as you are in this minuscule nursery solar system, drifting in a quiet bayou of a gigantic ultra-galactic storm of light."

The maiden raises her arms high, and her robe shimmers with living language. "And the holy light of the bestowal of creation blazes through both sacred scriptures and cosmological models, informing both. Few things are as exhilarating, as vitalizing, as uplifting, as exalting, as such a metaphor made real."

Will's eyelids sag, heavier and heavier, and he goes down to his knees, curls on the sands, and falls into timeshifted dream.

Fourteenth Fall

It is 1967. Today Will is driving the 45-minute commute from his blue-collar town to the prosperous suburb where he works. Only his Black commuter friend is with him, and they banter back and forth as Will drives down the expressway in the morning.

The friend is teasing Will about his beard. It's a rather van Dyke-ish sort of thing, unruly and dark, and he make a naughty remark about its appearance. Will starts laughing, and

³⁷⁶ Donald Clayton, *Principles of Stellar Evolution and Nucleosynthesis* (University Of Chicago Press, reprint edition 1984) – Clayton's book presents for us the mathematics and physics by which our world's astrophysicists were able to derive this amazing story.

³⁷⁷ Charles Seife, *Decoding the Universe: How the New Science of Information Is Explaining Everything in the Cosmos, from Our Brains to Black Holes* (Penguin Books reprint edition 2007) – one must embark on reading a well-written book with such a title with considerable suspicion and skepticism. Theories of Everything abound. Still, this is one of the basic paths to worthwhile ideas and the models that can be derived from them with stricter and richer toolsets.

³⁷⁸ Michael Talbot, *The Holographic Universe: The Revolutionary Theory of Reality* (Harper Perennial reprint 2011) – here as with Seife's book just cited, skepticism is warranted at yet another Theory of Everything dressed up with very good writing. And again, the ideas reach across disciplines and patterns of thought in potentially-useful ways.

flings his right hand up off the steering wheel in a gesture of amused dismissal. Instantly his friend flinches away from him in a reflex.

He's anticipating a blow to his face.

Will's hand has come nowhere near him, nor was it aimed toward him. An uneasy silence. Finally they start talking again as if nothing had happened.

A lurch in Will's dream, and it is 1968, and they are driving to work again, on the same highway. The Democratic Convention has brought a wave of police vigilance. A cop stops them.

Before he reaches the car, Will starts muttering angrily about it. His Black friend puts his hand on Will's arm. "Be cool," he says, "and let me do the talking."

And so he does, and the cop lets them go.

Draft

VIII. DREAMS AT THE EDGE

The voice of the Nightingale weaves a familiar strain of song through Will's tangled drifts of sleep.

"...if the Sun of Truth were suddenly to reveal, at the earliest stages of its manifestation, the full measure of the potencies which the providence of the Almighty hath bestowed upon it, the earth of human understanding would waste away and be consumed; for men's hearts would neither sustain the intensity of its revelation, nor be able to mirror forth the radiance of its light. Dismayed and overpowered, they would cease to exist."³⁷⁹

Into this inner pavane of dream comes a trio of figures, men it seems, their features and garments shifting and shading as they come nearer and stand before Will.

"You!" He recognizes two of the Cielito Lindo singers.

[INESPERADO]: "I am Inesperado, their brother. No one expects me."

"Oh, wonderful. Another joker. One who sings, too? And now you're all stuck in my head."

[EMBROLLO]: "We are here to inform you as you dream. It saves time."

"You're not going to sing again, are you?"

[ESTRUENDO]: "Not this time."

[INESPERADO]: "Unless you want us to..."

"No, please!"

[EMBROLLO]: "We'll tell you of three men of your new and amazing time. The lighting is good here in your head. Not as dim as in some heads."

[INESPERADO]: "The harmony gets clearer between the emergent ideas entering your world and the ideas you grasp progressively in your efforts to understand those ideas. You don't get things 'right', but you do get them better. And you don't need to abandon mathematics or its applications to accomplish betterment of understanding of the emergent ideas."

"Emergent?"

[INESPERADO]: "It means unexpected, suddenly appearing unanticipated, like discoveries and flashes of insight, the Aha! moments too."

[EMBROLLO]: "First comes Robert Rosen.³⁸⁰ He was a theoretical biologist who applied systems thinking to biology. He focused on the relations among the organized elements of a complex biological entity, developing relational models. He found that the incorporation

³⁷⁹ Bahá'u'lláh, from Gleanings XXXVIII.

³⁸⁰ (1934-1998)

and study of relations among elements generates understanding of what life is itself, in the broadest sense. This flies in the face of conventional thought concerning structure and function of organisms and organs."

[ESTRUENDO]: "Next is Nassim Nicholas Taleb, a statistician, risk analyst, and scholar who studies what is termed 'randomness' in its roles in financial markets, politics, and other settings in human affairs. His approach to randomness is iconoclastic and penetrating, showing the paradoxical successes that can emerge when one takes into proper account the disproportionate impact of unusual events in contexts that are not fitted for such events."

[INESPERADO]: "The third is Laurent Nottale, an astrophysicist. He advances a form of relativity based on the application of fractal scaling and trajectories in the underlying structure and workings of spacetime and the quantum fields of physics. His approach is a significant attempt to reconcile the long-standing incompatibilities of relativity and quantum theory."

[EMBROLLO]: "These are just examples. There are many others carrying on related explorations. They seem fearless. All three of these people have chosen pathways of study away from the mainstreams of thought in their respective areas. All three use powerful mathematical tools with the greatest discipline. Yet their work, as examples of the works of many others advancing in similar ways, takes us toward both richness and simplification of your understanding."

Emergence from the Machine

[INESPERADO]: "Rosen demonstrates clearly and mathematically that reductionist, mechanistic analyses and models of complex systems are completely incapable of deriving results that are usefully predictive of the behavior of such systems. He shows that such analyses and models reflect only the functioning of the ensembles of their parts and not the emergent capabilities that arise from the system operating as a whole."

"That word 'emergent' again."

[INESPERADO]: "Yes. Rosen uses the idea of life as his prime example. When all you can do is to tear life down organ by organ, molecule by molecule, reaction by reaction, you still do not understand what life itself is."

"So what?"

[INESPERADO]: "Rosen's main idea is 'entailment': the way in which one event, assertion, or process leads to others, especially in complex systems where the relations among components of a system generate unpredictable consequences. Conventional models of such systems, constructed to mirror aspects of their behavior, are blind to such unpredictability."

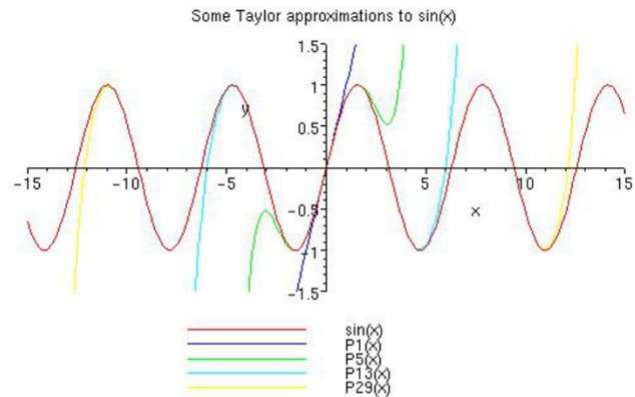
[INESPERADO]: "He said that the division, or duality, characterizing science and other human undertakings also happens between the hard and soft sciences themselves. The

hard sciences such as physics and chemistry produce results with metric accuracy, potency, and assurance, but the soft sciences such as sociology and psychology produce results that often lack rigor and repeatability."³⁸¹

In Will's dream, Miriam's question surfaces from far off. "How can mathematics advance possibilities that lie beyond straightforward reductive explanation?"

The three maidens she summoned drift into his dream-slackened mind again. Qualitative limits for calculations.

Fractal patterning of the world, connecting different realms conceptually. Coexistence of inconsistent systems of modeling. These thoughts flow into the words Will is now hearing.



found at <http://www.math.utah.edu/~kitchen/1220F06/sine.html> on 1/9/2020

Figure 27 - Polynomial Blowup

[INESPERADO]: "The conventional methods of science amount to the use of the "machine metaphor", limiting the science of biology (for example) to the mechanistic, with unfortunate consequences. This treatment of biology does violence to your grasp of reality."³⁸²

[INESPERADO]: "Rosen developed and applied the mathematics needed to establish firm, disciplined foundations for his work³⁸³. One can extend Rosen's basic study from biology – life itself – to cosmology – the universe itself – and toward the very limits of your human capacity to comprehend. Rosen sees complex adaptive systems as essential elements of any science. This allows you to transcend the limited framework of most contemporary scientific thinking. From these adaptive systems, no matter how well-understood their details and structures may appear, utterly-unexpected outcomes emerge. Every society, every biome, every organism can and does surprise you."³⁸⁴

Will asks, "Why do we always have unexpected results arising when we make good models?"

[ESTRUENDO]: "What you make are only models, and they have limits. Think of infinity! Your journey has taken you there already. The relationships of numbers to infinities defy intuition, but they are both demonstrable and useful. Here – look at the relationship between a polynomial approximation of a transcendental function and the infinite-series

³⁸¹ See Robert Rosen, *Life Itself* (Columbia University Press 1991), Praeludium, pp. 1-2.

³⁸² Robert Rosen, *Life Itself*, Prolegomena, p. 23.

³⁸³ Robert Rosen, *Anticipatory Systems: Philosophical, Mathematical, and Methodological Foundations* (Springer 2012).

³⁸⁴ (G. West, Scale 2017). Also see Nessa Carey's *Junk DNA* for many examples of emergent phenomena.

exact expression of that function. The sine function, for example. Its value is expressed as the sum of an infinite number of terms. You can't compute an infinite sum in a finite period of time, but you can compute the sine value to a desired degree of accuracy by truncating the sum at some point. This works quite well as long as you don't try to use the truncated function to compute values outside its useful range. It blows up!"

[EMBROLLO]: Your sciences progress in an infinite number of steps along many paths, toward limits you believe exist. You don't have a "final step" in the process, but you do envision a limiting boundary of some kind. Why consider that boundary as finite? It might be a final boundary at infinity itself."

"But he just said we have to limit our computation and stay inside its useful range."

[EMBROLLO]: "Your progress in science continually extends that useful range. This extension process need have no limit to it. Look at what your physicists have done with calculating the fine-structure constant of quantum electrodynamics! It has been tested to within ten parts in one billion. Now, stretch the idea."

Will waits, his dream in a moment of stillness.

[EMBROLLO]: "Think of how you transit from natural numbers to real numbers. From the former you can generate many more of the latter.³⁸⁵ You build from the elements of a smaller world a whole realm of elements and their relationships in a larger realm. This is Rosen's observation!"

"I don't understand that."

[ESTRUENDO]: "Rosen discusses limiting processes in his work, using as an illustration the way the definitions of continuous mathematical functions constitute only a specialized subset of a much-larger family of functions that can only be defined as limiting cases of sequences of such continuous functions. This much-larger family is the focus of the field of functional analysis, which supports the rigorous use of discontinuous functions in engineering and physics. A case in point: the Dirac functions used in quantum theory."³⁸⁶

"I'll take your word for that, just because it's opening a rabbit-hole at my feet," They laugh.

[EMBROLLO]: "It applies not just to the example of infinity, but also to the realm of fractal geometry and the realm of inconsistency within a system. It applies as well in the evolution of many branches of mathematics and science, as you continue in your expansions of

³⁸⁵ In mathematical terms, given a set with a certain number of elements, one can generate a larger set, called the power set, consisting of all possible combinations of the elements of the given set. So given the three element set {1, 2, 3}, the generated power set is { \emptyset , 1, 2, 3, {1, 2}, {1, 3}, {2, 3}, {1, 2, 3}} – a set with six elements (\emptyset stands for the empty set). In general, if a set has N elements, its power set has 2-to-the-Nth elements. The size of the power set gets bigger very fast – a 20-element set has over a million elements in its power set.

³⁸⁶ Robert Rosen, *Life Itself* (Columbia University Press 1991), Chapter 2, pp. 31-32 –

understanding of what seems an infinite world, or more richly-stated, a world within worlds.”

Unlimited Future

A glimmer comes to Will. “So we hope to advance the boundaries of our limitations *toward* the limitless, even if we can't expect to arrive at some end that has no end? Is it possible that we can reframe ‘religion’ here somehow?”

The three men look at him without speaking. He goes on. “What about that range beyond our scientific boundaries? Doesn't it offer us navigation, guidance, for our advancement of those scientific boundaries onward? There's always more science, right?”

And in the moment of his last word's expression, the three dissolve in light, and Will's eyes open to the nighttime desert chill of myriad stars, vibrant now again with the Nightingale's familiar melody.

*“Look at the world and ponder a while upon it. It unveileth the book of its own self before thine eyes and revealeth that which the Pen of thy Lord, the Fashioner, the All-Informed, hath inscribed therein. It will acquaint thee with that which is within it and upon it and will give thee such clear explanations as to make thee independent of every eloquent expounder.”*³⁸⁷

*“...man can never hope to attain unto the knowledge of the All-Glorious, can never quaff from the stream of divine knowledge and wisdom, can never enter the abode of immortality, nor partake of the cup of divine nearness and favor, unless and until he ceases to regard the words and deeds of mortal men as a standard for the true understanding and recognition of God and His Prophets.”*³⁸⁸

Will rises to stand in the starlight-whispered darkness. Grains of sand fall away from his cheek. Everything feels sharp, pure, clear as crystal, under no shadow, caught in no veil, without blockage or distraction. It seems unbounded freedom. His heart skips, then slows to an easy rhythm. Rapt and alive with wonder, he gazes up at spark-splendors of light.

A soft touch on his shoulder, and Miriam is next to him again, sharing the moment. She says slowly, “Your range of understanding always advances into what is always for you a larger world, unfolding brand-new properties and behaviors. From antiquity, you rise to Copernicus, and to Newton, and then to Einstein, your new comprehensions reaching to extend your grasp of the universe's meaning. Now you stare into the images of singularities in spacetime, those ‘black holes’. Your voyage defies any final arrival. Isn't this the greatest of all ways to frame your application of religion at its best: the unending tracing, mapping, and application of your human course of advancement?”

³⁸⁷ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat) – this passage was quoted earlier in the section **A First Trial: Language And Universality**.

³⁸⁸ Bahá'u'lláh, *The Book of Certitude* (Kitáb-i-Íqán), p. 71 – quoted in the same section as the previous passage.

She grips his arm. "If you truly understand religion itself, you'll see that it doesn't obstruct the paths of science. Religion must open wide all the true ways forward in science. And so religion invites you to develop anticipatory potential at the very edges of the sciences you advance."

The idea moves Will. "So can we extend such anticipatory potential beyond those edges into realms not within the ranges of the sciences current at the time? Is that what you are saying?"

She relaxes her grip – her arm is warm by his. "For one thing, the Revealers of religious knowledge provide you with anticipatory information from outside your familiar reality, as in prophecies and religious laws, isn't that true?"

"Yes."

"And for another thing, you extend science, continually, to provide anticipatory information as in modeling forecasts and natural laws. All from scientific processes within your familiar reality."

Even in the darkness of desert night, the Warbler returns to them.

"... How can a man believe to be a fact that which science has proved to be impossible? If he believes in spite of his reason, it is rather ignorant superstition than faith. The true principles of all religions are in conformity with the teachings of science."³⁸⁹

Miriam's arm presses a little more against Will's, side by side. "Science works on an advancing boundary of knowledge, with spirituality (religion) offering a "road map" for the scientific advancement of that boundary. The boundary is always advancing, so there is no end stage. Information from outside your everyday reality informs the advancement of that boundary, so you can sustain a fully-consistent, fully-dynamic relationship between science and religion."

Miriam and Will are leaning a little toward each other. Will says, "But there always seems to be some accretion of useless and misleading ideas that obstruct the advancement of our grasp of truth."

Miriam nods. "This is not a scientific problem. It is a problem of human advancement. There are many examples of resistance and denial even on the part of the very scientists who are charged with advancing knowledge³⁹⁰. You are creatures with limits, and when your limits are challenged, you often react defensively. One of the principal tasks of religion is to grant you courage and trust sufficient to develop beyond your self-imposed limits."

"It is long past time that you connected the power of inner truth to the engines of your outer development. When you do this, you can shrug off the inferior concepts and models

³⁸⁹ 'Abdu'l-Bahá, *Paris Talks*, 44.

³⁹⁰ Thomas Kuhn, *The Structure of Scientific Revolutions*.

of your past. Then you can read more clearly the map of what the universe is telling you now, and you can advance toward better understanding.”

Will turns toward her. The stars seem to dance in her eyes. He takes her hand. A shock, delight and horror all in a split second, seizes him, and Miriam, the desert, the stars, and the night are gone.

Now he teeters, terrified, on the hot wire of light over a dark blood abyss. The bridge again. Feral noises gather like storms around him from behind and below, as from the far end of the bridge, beyond this thin thread of a tightrope, a fitful gleam beckons in the great distance. Will is alone.

He tries to fix his gaze on that faroff spark of light ahead, recalling the spins, fighting for balance, but his eyes reel. Clutching at empty air, through and into thrashing noise and chaos, he falls and falls.

Fifteenth Fall
Harrowing Hell

Now the fall drags on, into darkness burning deeper, into chaos blizzards and junk tornadoes that hurl Will back and forth, twisting and racking him, missiles of chrome and steel rubbish stabbing him, jets of industrial poison clawing and eating at his skin, as he descends faster and faster into jungle blooms of advertising, animations, jabbering heads bursting threats at him from screens without frames, pornographies of insect parasites luring his fascination towards doom, stupefactions of explosions of blood and rape and murder, and he lands at long last in pieces strewn across a tree-covered mountainous hillside of rotting debris, his left arm in a tree, his left leg torn away and broken across a distant stone outcrop, the rest of him just colorful litter in a heap of plastic, metal, fabric, and the fluids of his no-longer-tidy everyday being.

Will's head, neck, and shoulders lie flat, a stride away from his torso, his insensate eyes staring up into a sky so far beyond black that it consumes the eye itself. Yet he stares, dazed, as if he is whole and alive and able but thinking *this will clear, and I'll check my body and get up and find Jeddin and...*

“Look who dropped in again!” Matt's voice. “And you thought you were done with me! Welcome back!”

“You!” Will gasps, slowly gaining awareness.

“Yes, me! Me and all my friends! And look at you!”

Will tries to move, but immense pain floods his awareness. “I can't feel my body.”

“Of course not! You're here! You're there! You're everywhere!” Matt laughs loud and long. “Turn your head – over there is some rock where your leg landed.”

Will sees it. He closes his eyes. “Miriam, Miriam! Where are you? Miriam!”

Matt laughs again. "She's not coming down here. You've been jabbering all along about hells, and now you've found them for yourself. Welcome home."

Matt's grin comes down at him, and Will says, "This is not my home."

"You think not? Isn't this how your father ended up, in pieces in the trees and the rocks? You wanted to find him. Here you are!" Matt gestures around at the hillside, as a small gust of air grows into a fitful dawn wind, waving the trees and leaves in gloomy shadows. "Here – a little light against the blackness ought to show you the scene."

"This is not my home. This is my dream, and you are in it. My own nightmare."

"Nonsense!" Matt sneers. "It's all dream. Your precious Miriam is a dream inside a dream inside a dream. You don't even know who or what she is." He sweeps his arm around at the trees. "This is as close to any reality as you'll get. Do you think the unicorns and the wagon are coming to save you? Again? Ha! Here!" Matt turns and beckons.

Around Will, bending close over him, faces and dancers, images and streams of drama come hungry, promising and luring and seducing and dragging him into lurid color and sound and lies of being, tearing his consciousness into shreds of attention and fascination. He gathers in the last fragments of his self and hope, and looks steadily into the eyes of an older woman crooning the virtues of a soothing pain-relief drug.

The scene stops and stills. Her eyes, wide with the smile of an advertising appeal, ring pain at Will. Clearly now he hears a soft whisper from her image.

"How could he die and leave me with nothing? I hope this gig will pay enough so I can cover my rent and the food for the next two weeks. And the bill for the casket hasn't come yet. Maybe if I do this ad well they'll let me do another one and pay me again."

The image fades to a little boy playing on a beach. A young man comes up and gathers the boy in his arms, both of them Black, both smiling, as a brand name for a realtor appears in the scene. Again, the image freezes, and Will hears two whispers now.

"I wish my dad was holding me instead. This man is nice, but my dad's in prison and I wish he could hold me."

"This kid is all right! If I could only get Geena to hang onto her job a little longer, maybe we could find a better place together. This outfit sure isn't going to do it."

The image fades into a sweeping vista of seascape rolling through Will's vision, as a voice states in portentous tones the virtues of the environmental cleanup initiatives of a huge energy company. The camera turns to show the face of the speaker, a pilot narrating the scene. Again the scene freezes, and the man's hoarse whisper comes to Will.

"I can't believe they're making me do this. Fifteen years over war zones taking fire, and these liars will only pay me to lie for them while they dump oil and gas and plastic everywhere."

Scene after scene pours over Will, but each time he brings the scene to a halt to hear the voice of its truth speak to him. As he lies still, listening, Matt bends close.

"Enjoying the show?"

Will holds Matt's gaze, and then, in a great effort, he freezes the scene between them. Now a very-faint sound, beneath a whisper but speech as if from a distance, comes to him. He listens intently, and words begin to form. They are in Matt's voice, barely audible.

"Hope. This broken man still has hope. How can he still have hope? Here he is, fallen to pieces, lying here while I mock him, and he still hopes enough to listen to their hearts. It's too hard for me to work on him, to get him to settle in and stay. I like him. I want him to stay."

Will says, "You like me? Is that why you want me to stay?"

Matt stiffens, stands up, says, "What? Like you? No! Yes! I..." His voice trails off.

"I'm listening to your heart. I may be broken in pieces, but I hear your heart."

"I'm a demon! I haven't got a human heart!"

"You're not a demon." An idea blooms in Will. "You made your home in despair. You can always move and make another home. You're like me, but you've stopped looking."

Now Matt is running his hands over his own body, rumpling his shirt, fingering his hair. He looks down at Will. "Here you are, busted in pieces, and you're telling me I can go find a better place to be. Is this some kind of irony? It's all dreaming, right? No waking up."

Will thinks, reaching back over the stretch of his long journey, and says, "It's all dreams, but we're always waking up. That's inner progress."

Matt looks saddened. "But you're right where your father was at the end. In pieces. Is that progress?"

For a brief heartbeat, Will sees Matt's face shift toward a long-gone, deeply-familiar form, its expression still downcast, and just for that one heartbeat, Will is young. "Yes! This is a gift to me! A terrible gift, but it teaches me hope." As Will speaks the word 'hope', a surge of emotion and movement rolls through him, and his body is whole once more, its wounds vanishing, his clothing intact.

It is 1951 and 2021 all at once. The seventy-year span slams down into a single moment. Will's voice, child and man in one, fills his own ears. Matt's eyes widen, blazing with surprise.

*Wake up and die right
My dad said to me
Each boyhood morning
As if he knew from
Trying it once and
Coming back again
To rouse me from bed.*

*When the plane he rode
Broke up in a storm
Smashed him into bits
Wide awake to die
Right and then come back
Each morning after
To whisper to me*

*Wake up and die right
My dad said to me
I was nine or ten
He died right then but
Since then and always
Rouses me from bed.*

Matt staggers back a step. "How can this be? Is it because you're – we're – dreaming?"

"I don't know!" Will struggles to his feet, sweeps his arm across the wide range of mountainous streams of light and sound, and all goes quiet and muted. "I know that I can keep going, and I choose to keep going. Maybe when you see all that I see, you will come out to the journey again too."

"I need to see better." Matt looks around, shakes his head as if to wake himself from sleep. He faces Will. "Do you know what you've been doing, in this journey of yours? You fall from the office, you fall from the bridge, you land here, in hell – but then you get pulled back out again."

Will says, "That's been the pattern, hasn't it?"

Matt's eyes widen. "Your rescuers, and now you! You are harrowing hell! It's for the people trapped here. You want them to come up out of these empty dreams into better and better ones. Isn't that the way you see it?" His demeanor has settled from scorn into wonder.

"Explain it more to me. 'Harrowing of hell'? It sounds like a farmer turning soil."

Matt nods. "It's like that – a farmer turns and breaks the earth with a plow or a harrow to make ways for seeds to grow."

"What does that have to do with hell?"

"It means that... hell isn't forever, at least not for..." Matt stumbles, thinking. "Hell, hells are states of being and seeing and feeling – that's what your pattern seems to say."

Will picks up the thread of Matt's words. "So if we choose to change our states of behavior, or vision, or inner thinking, we can be like seeds. We can thrive, or we can wither. We can come and go, move in and out of hell. But that's not the way people have always thought about hell, is it?"

"No! The harrowing of hell theme is ancient. Orpheus and Eurydice. Odysseus and Teiresias. Jesus rescuing those before His time. Muhammad visiting hell with the angel Malik. Sometimes a deity descends into hell to rescue or converse with one there, and sometimes a human being descends to find and rescue a loved one." Matt pauses. "But this, now, you and me! Did you come down, fall down in here to bring me out?"

Will is silent. Matt goes on. "Dante told how Jesus Christ was supposed to have entered hell to rescue and bring forth the 'virtuous pagans' – the people who lived before Him such as Adam, Noah, and so on." Matt takes Will by both arms, earnestly asking, "In this new time of yours, do you, others like you, harrow hell from time to time? To find and rescue out the ones you love? The ones trapped in the hells of their despair and inner failure?"

Now Will lets the words and the ideas sink in. "I don't know. Others have come for me. What I do know is that you and I are human. When you are ready, I'll come back, or I'll find you."

Matt holds up a hand, shushing, and they listen. Far off above them in the impenetrable murk, the voice of the Warbler weaves its melody.

"Existential rewards consist in the virtues and perfections that adorn the human reality. ... man was immersed in darkness and becomes luminous; he was ignorant and becomes informed; he was heedless and becomes aware; he was asleep and is awakened; he was dead and is quickened to life; he was blind and begins to see; he was deaf and begins to hear; he was earthly and becomes heavenly; he was material and becomes spiritual.

"Through these rewards he is reborn in spirit, is created anew, and becomes the manifestation of the verse in the Gospel that says that the Apostles 'were born, not of blood, nor of the flesh, nor of the will of man, but of God'³⁹¹ —that is, they were delivered from the animal characteristics and qualities that are inherent to human nature, and acquired divine attributes, which are the outpouring grace of God.

As the song dances onward, Matt's face, upturned, softens into a look of wonder.

"This is the true meaning of being born again. For such souls, there is no greater torment than to be veiled from God, and no worse punishment than selfish qualities, evil attributes,

³⁹¹ Cf. John 1:13.

baseness of character, and engrossment in carnal desires. When these souls are delivered from the darkness of these vices through the light of faith, when they are illumined by the rays of the Sun of Truth and endowed with every human virtue, they reckon this as the greatest reward and regard it as the true paradise.

"In like manner, they consider spiritual punishment—that is, existential torment and chastisement—to consist in subjection to the world of nature; in being veiled from God; in ignorance and unawareness; in engrossment with covetous desires; in absorption in animal vices; in being marked by evil attributes, such as falsehood, tyranny, and iniquity; in attachment to worldly things; and in immersion in satanic fancies—all of which they reckon to be the greatest of torments and punishments."³⁹²

Matt turns to Will, looks down with what seems shyness, and asks quietly, "Will you come for me?"

"Yes. Yes, I will. When you are ready, and you call out. I will come and find you."

"You know where to find me." They both laugh now. The dismal, dancing dump of video and sound fades just a little. Will's eyes blink shut, open, shut, and as he turns, he slides into another stratum of dream.

A 1968 payday. Will stands in the bank, in line at a teller's station. His Black friend sees him and comes over. He and another friend are Will's passengers on the daily commute to and from work, a 45-minute ride from Waukegan's working-class homes to the sleek executive offices of United Air Lines in Elk Grove Village, where they all work. Will is the only one with a car to use for commuting.

His friend says to Will, "They're putting pressure on me at work to show up earlier. We're not getting there on time for my boss. I'm afraid I'll lose my job."

"I'll try to do better," Will says, feeling uncomfortable. Between heavy traffic and an unreliable car, the long drive's duration is sometimes hard to predict, especially in the Chicago-area winters.

"I need to ask you a favor," his friend says, his face pinched with stress. "I want to get a bank loan to get my own car, but the bank won't lend me the money. Could you co-sign with me for the loan? They'll probably okay it if you're on the application."

Will stiffens. To do what is asked makes Will responsible for the repayment of his friend's loan, and Will was already barely able to pay the bills for his own family. He looks down. "I wish I could," he says, ashamed. *He needs my help, and I don't have what he needs.* His friend turns away.

³⁹² From 'Abdu'l-Bahá, *Some Answered Questions*, pp. 233-234, and at www.bahai.org/r/356035276 .

I will die soon. The insistent thought wakes Will in his sprawled body on the floor of his office room. The sparrow flits back and forth outside the window, now and then beating its wings against the glass in frustration.

His feet refuse to come under him. Weakness fills him and he sinks back down, his head on one arm, the arm that felt Miriam's touch... Sparrow wings against glass, whup, whup, swish.

I know this room-world. This world will kill me soon. Awareness creeps in Will: the world is killing many, many people as he lies on the floor in his room hiding from the world's threats, its chances, its malign transformations. Here in this room he signals out to others, his words streaming like electric rain falling deep into the landfills and sludges of abandoned meaning and purpose, into realms of Matt Daemon and octopus, into oblivion.

My world is dying. Dying is my world. Will tries to breathe, truths advancing on him. Disease fastens its teeth in all of humanity as humanity stokes the fires to advance its fevers. Yet science and religion together, their purposes in pure harmony, show him that distant light at the far end of the bridge. If only he could take a deeper breath... the air itself seems syrup-thick, resistant, unwilling. He can't breathe. His eyes close into darkness.

"My friend. My friend. Can you hear me?" The soft male voice sounds urgent.

"Come, wake up!" A familiar voice, maybe Jeddin? Will is still trying to draw a breath, but a peculiar sensation in his throat releases him from the urgency, as if fresh air were flooding him inside without effort on his part. *Where could it be coming from?*

"Jeddin?" Will's query is an exhalation of this sweet air from nowhere. His eyes open. Sky, clouds, grass, garden. Fragrances painting themselves in his nostrils. "Is Miriam here?"

Jeddin, of bird-form in dappled feathers, is bending over Will. "No. You reached too far to her."

"Too far? But she was so close, so close to me."

"Exactly. Too close. When you come too close, you lose what you seek."

"How am I breathing when I can't breathe? I'm choking, but the air fills me."

Jeddin nods. "The air filling you now is of a higher order, coming from a greater reality. It is the air of spirit."

"Am I dead?"

A bright laugh. "Not yet! But what would that mean – death – when you can breathe and speak without ordinary air?" Jeddin's voice seems surprisingly familiar.

Will gathers himself to sit up in these aromas and their breezes of beauty. "It's as if life comes into me from outside, and I don't have to do anything to breathe or drink or eat. I

just... am." As he rises to his feet, a peculiar sensation fills him, as if he is part of the garden and it is part of him, and he and Jeddin seem to be two plucked strings in an orchestra of being.

Jeddin smiles at Will's stunned expression. "You are sensing the Source, the origin of what forms and sustains all things. You have a brief span here."

"And then?"

"Then you return to consciousness as you know it. But you don't really know it, do you?"

"I live it every day!"

"Yes, but the human mind is necessarily limited. You can count the number of neurons and synapses in the human brain, but you can't trace the deeper meanings of consciousness itself.³⁹³ You rise to awareness in this world, and you fade from awareness of it, in every morning and evening, and in the morning and evening of life."

He raises an index finger. "But... when you open the portals of possibility to a source of information outside your capacities, the light of knowledge shines on you, infusing and informing your perceptions and your sciences with meaning."

Will stiffens as the Nightingale's music arrives once again, rose-scented, gorgeous.

'... whatever is in the heavens and whatever is on the earth is a direct evidence of the revelation within it of the attributes and names of God, inasmuch as within every atom are enshrined the signs that bear eloquent testimony to the revelation of that most great Light. Methinks, but for the potency of that revelation, no being could ever exist. How resplendent the luminaries of knowledge that shine in an atom, and how vast the oceans of wisdom that surge within a drop! To a supreme degree is this true of man, who, among all created things, hath been invested with the robe of such gifts, and hath been singled out for the glory of such distinction. For in him are potentially revealed all the attributes and names of God to a degree that no other created being hath excelled or surpassed. All these names and attributes are applicable to him. Even as He hath said: "Man is My mystery, and I am his mystery."³⁹⁴

"Manifold are the verses that have been repeatedly revealed in all the heavenly Books and the holy Scriptures, expressive of this most subtle and lofty theme. Even as He hath revealed: "We will surely show them Our signs in the world and within themselves."³⁹⁵ Again He saith: "And also in your own selves: will ye not then behold the signs of God?"³⁹⁶ And yet again He revealeth: "And be ye not like those who forget God, and whom He hath

³⁹³ Here is where the use of the mathematics of complexity in biology, as Robert Rosen has done, urges the likelihood of consciousness as an emergent phenomenon facilitated by the sheer volume and richness of the human 'neurome': our brain and all its interconnections in the full blaze of its operation.

³⁹⁴ *Hadith-i-Qudsi* from traditions of Islam.

³⁹⁵ *Qur'an* 41:53.

³⁹⁶ *Qur'an* 51:21.

therefore caused to forget their own selves.”³⁹⁷ In this connection, He Who is the eternal King—may the souls of all that dwell within the mystic Tabernacle be a sacrifice unto Him—hath spoken: “He hath known God who hath known himself.”^{398 399}

“My world seems to be dying,” Will says to Jeddin as the Nightingale soars away. “That’s too hard to ignore.”

Jeddin replies, “This song expresses the profound connection of everything in your world to its single source of meaning and being. It raises the distinction of human beings, so that you can see in yourselves the signs of the sole source and origin of who and what you are. Then you have hope.”

“Not many of us seem to hope.”

“Everyone makes a choice, to hope or not. But hope obliges you to pursue it. And in pursuing it, you discover and prepare the road maps for your sciences to follow.”

“First, you follow your maps to navigate your universe’s terrain and advance your scientific understanding. Second, you discern the source of meaning and being, and apply its guidance and inspiration, for those maps you develop and use in greater realms. Given that you can embrace the source itself, this second process becomes much easier.”

The Nightingale returns, this time dancing in the air above them, singing with power and beauty.

“Every word that proceedeth out of the mouth of God is endowed with such potency as can instill new life into every human frame, if ye be of them that comprehend this truth. All the wondrous works ye behold in this world have been manifested through the operation of His supreme and most exalted Will, His wondrous and inflexible Purpose. Through the mere revelation of the word “Fashioner,” issuing forth from His lips and proclaiming His attribute to mankind, such power is released as can generate, through successive ages, all the manifold arts which the hands of man can produce. This, verily, is a certain truth.

“No sooner is this resplendent word uttered, than its animating energies, stirring within all created things, give birth to the means and instruments whereby such arts can be produced and perfected. All the wondrous achievements ye now witness are the direct consequences of the Revelation of this Name. In the days to come, ye will, verily, behold things of which ye have never heard before. Thus hath it been decreed in the Tablets of God, and none can comprehend it except them whose sight is sharp.

“In like manner, the moment the word expressing My attribute “The Omniscient” issueth forth from My mouth, every created thing will, according to its capacity and limitations, be

³⁹⁷ *Qur’án* 59:19.

³⁹⁸ *Hadith* narrated from ‘Alí the son of Muhammad.

³⁹⁹ Bahá'u'lláh, *The Book of Certitude* (Kitáb-i-Íqán), paragraph 107.

invested with the power to unfold the knowledge of the most marvelous sciences, and will be empowered to manifest them in the course of time at the bidding of Him Who is the Almighty, the All-Knowing."⁴⁰⁰

To Embrace True Freedom

The song ends, the Nightingale vanishes away, and in Will the mysterious supply of air now quenches thirst, fills appetite, perfuses all senses, meaning itself generating reality. The sensation intoxicates him beyond rapture.

"My friend. My friend!" Jeddin's voice penetrates, and Will again sees the grasses and the flowers now fading to the wooden boards of his room, his head bruised against a chair leg. He gulps air.

"Uh. Back to reality, I guess." Will rubs his temple as he tries to sit up, glad to be breathing in the usual way again.

"Reality? Why do you call this reality?" Jeddin is now sitting in the comfy little chair in the office's corner. "Didn't you like the reality you lived just before you returned here?"

"That was just a vision, or a dream, maybe? A hallucination?"

Jeddin shakes his head. "You may not like the idea that your existence is derivative, not essential, but there it is. The Nightingale made clear that existence is granted and sustained and energized from far beyond your own capacities and selves."

"Where no one can pull the plug and shut it down."

"Exactly. Much of your ancient heritage of philosophy and thought looked outward from yourselves into a world on which you impose your own meanings. When you encounter aspects of the world which resist such imposition, you cling at great length and with great tenacity to your own imposed meanings. Those meanings seem part of your selfhood. But your selfhood is not your individual property - it is instead a conferred gift. It seems to you at odds with your evident need for self-possession."

"But what else is there? I'm traveling this adventure alone!"

"Are you really? Then who are all these beings you encounter? I'm just one, Miriam is another, Matt is another, and all the singers and the rest. Are we just words to you, names you hammer onto pages here like pitons for scaling some steep mountain scarp?"

"Ah, that's not fair."

Jeddin ignores him. "You worship personal freedom of choice, personal sovereignty, and liberty far above relationship, mutuality, and interdependence. Such ingrained perspectives undercut your willingness to learn from others, to accept a place in society equal with

⁴⁰⁰ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LXXIV.

others, and to acknowledge sources of wisdom, guidance, and law that are greater than yourselves.”

Jeddin's hands are uplifted, palms up, open. “So you hobble and blind yourselves to possibilities that grant you greater freedom and power than you have ever hoped for. A paradox! You underestimate the creative, sustaining power of your inner awareness. So when you are told that religion grants you access to such power, freeing you from the confines of your own denials and dismissals, you resist. Your all-too-human tendency is to see religion as a confining influence, not a freeing one.”

Will says, “But science is a freeing influence, not a confining one! Its successes prove it! We fly high, dive deep, plunge into space, tame the world's energies, and much more, all through our discovery of, and adherence to, natural laws of science.”

Jeddin nods. “That is not enough. Look around. Your world is dying. Now you must transform your human perspectives to match those of science – but the work ahead of you is staggering. You can't do it all alone.”

Will shrugs and mutters, “Trust in others is in short supply.”

“Exactly. And trust, in God and in others, is the one thing you need most.”

Once more the Nightingale circles them, enchantingly.

“Consider the pettiness of men's minds. They ask for that which injureth them, and cast away the thing that profiteth them. They are, indeed, of those that are far astray. We find some men desiring liberty, and priding themselves therein. Such men are in the depths of ignorance.

“Liberty must, in the end, lead to sedition, whose flames none can quench. Thus warneth you He Who is the Reckoner, the All-Knowing. Know ye that the embodiment of liberty and its symbol is the animal. That which beseemeth man is submission unto such restraints as will protect him from his own ignorance, and guard him against the harm of the mischief-maker. Liberty causeth man to overstep the bounds of propriety, and to infringe on the dignity of his station. It debaseth him to the level of extreme depravity and wickedness...

“Say: True liberty consisteth in man's submission unto My commandments, little as ye know it. Were men to observe that which We have sent down unto them from the Heaven of Revelation, they would, of a certainty, attain unto perfect liberty. Happy is the man that hath apprehended the Purpose of God in whatever He hath revealed from the Heaven of His Will that pervadeth all created things. Say: The liberty that profiteth you is to be found nowhere except in complete servitude unto God, the Eternal Truth. Whoso hath tasted of its sweetness will refuse to barter it for all the dominion of earth and heaven.”⁴⁰¹

⁴⁰¹ Bahá'u'lláh, *The Most Holy Book* (Kitáb-i-Aqdas), paragraphs 122-125; also quoted in *Gleanings from the Writings of Bahá'u'lláh*, CLIX.

One single line reverberates in Will after the song fades, and he speaks it. *“That which beseemeth man is submission unto such restraints as will protect him from his own ignorance”.*

Jeddin nods. “The laws of science perform exactly this function in your physical world. But now this observation extends to the social and spiritual worlds. It is no less potent in the greater world than it is in the physical world.”

Now the song's conclusion emerges more clearly, and Will repeats it as well. *“True liberty consisteth in man's submission unto My commandments, little as ye know it. Were men to observe that which We have sent down unto them from the Heaven of Revelation, they would, of a certainty, attain unto perfect liberty.”* A warmth fills him. “It's a paradox: Submit, and be free.”

As Will looks around the confines of his little room, Jeddin reflects. “Every great dispensation of religion, in the radiant arc of its appearance among you, has proved the truth of this seeming paradox. Embrace its laws and teachings, and people prosper, prevail, elevate human existence for many generations. Refuse, and you fall away. At the outset of each age, powerful opposition seemed overwhelming, but the transformative processes and energies unleashed from the greater world turned every setback into an illuminating victory, every sacrifice into an abundant harvest of human benefit, and every misstep into a road map for the advancement of human civilization.”

“Look to the melodies of the Nightingale⁴⁰², the songs of the Warbler⁴⁰³! Look at the great historical records! They all affirm this universal pattern, worldwide, all through human history.”

Will says, “But so many resist any suggestion that we should restrain or channel our scientific efforts according to limitations imposed by society as a whole. Restricting our scientific investigations in any way seems to them oppressive and tyrannical. They say that if we can do something with science, we should feel no restraint in doing it.”

Jeddin frowns. “Indeed. And as you can plainly see, taking this position has led you already to the brink of planetary disaster.”

The Nightingale's notes shower down again upon them, secret rain of meanings.

“Strange and astonishing things exist in the earth but they are hidden from the minds and the understanding of men. These things are capable of changing the whole atmosphere of the earth and their contamination would prove lethal.”⁴⁰⁴

⁴⁰² Bahá'u'lláh, *The Book of Certitude* (Kitáb-i-Íqán) – this work sets forth in its opening sections the patterns of human response to the appearance of the revelations of God, and the results.

⁴⁰³ ‘Abdu’l-Bahá, from *Star of the West*, Book II, Vol. III, No. 6, p. 6; June 24, 1912, “Interview between a Prominent Rabbi and ‘Abdu’l-Bahá” – a key excerpt from this interview is offered in the Excursions essay [Butterfly Effect Illustrations](#).

⁴⁰⁴ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “Words of Paradise” (Kalimát-i-Firdawsíyyih) – from the Ninth Leaf of the Tablet.

Jeddin remarks, "Ah! Think of the discovery and application of atomic power, beginning with Albert Einstein's insight into the equivalence of mass and energy. And the Nightingale's meanings here can extend to consider almost any of the heavier chemical elements such as uranium, thorium, radium, polonium, lead, or mercury. Most of these have severely-toxic properties, whether atmospheric or otherwise. Radioactivity, with the creation and use of nuclear and thermonuclear weapons, is the worst."

"The Nightingale sang in the late 19th century when little or nothing was known in the human world of any of these elements or their properties, with the exceptions of lead and mercury, and even with these two elements the full toxic impact of their presence among us was poorly understood."

Now the Warbler's tones trickle through Will.

*"Scientific discoveries have increased material civilization. There is in existence a stupendous force, as yet, happily, undiscovered by man. Let us supplicate God, the Beloved, that this force be not discovered by science until spiritual civilization shall dominate the human mind. In the hands of men of lower material nature, this power would be able to destroy the whole earth."*⁴⁰⁵

He asks, "When did the Warbler sing this?"

"In 1911. At that time, Einstein's Theory of Special Relativity and the equivalence of mass and energy were known and understood in the world of physics, although their deeper consequences were yet to be discovered and put to use."

"At that same time," Will says, "our world was in global turmoil, and the first of two hideous world wars began three years later."

Jeddin shakes his head sadly. "Yes. And by the start of your Second World War, scientists had learned the secrets of atomic fission and chain reactions, leading to the detonation of two terrible nuclear bombs over Hiroshima and Nagasaki in Japan at the end of the war."⁴⁰⁶

Again the birdsong reawakens in Will and he recites it again: "that this force be not discovered by science until spiritual civilization shall dominate the human mind."

Jeddin smiles. "The song teaches the balance of science with religion. Without the moderating, civilizing effects of spiritual advancement, the effects of scientific advancement on humanity can be and have been nightmarish in the extreme. In other words, the rampant advance of science without spiritual direction confront you with the threats of

⁴⁰⁵ 'Abdu'l-Bahá, from an interview quoted in numerous sources but originating in the book by Lady Sara Blomfield, *The Chosen Highway*, Chapter III, "'Abdu'l-Bahá in Paris", in which He visited with the Japanese ambassador to Spain at the Hotel d'Jena.

⁴⁰⁶ Ironically, 'Abdu'l-Bahá's statement was made to the Japanese ambassador to Spain, at a time when the Japanese were planning domination of the Far East – leading in the end to the Sino-Japanese War starting in 1937 and the horrors of the Second World War, ending in atomic disaster.

total destruction, even as it tantalizes you with the promises of wonder and elevation. In effect, utter liberty leads to devastation.”

Again the Nightingale circles near, chanting irresistibly its rhapsody.

“Above all else, the greatest gift and the most wondrous blessing hath ever been and will continue to be Wisdom. It is man’s unfailing Protector. It aideth him and strengtheneth him. Wisdom is God’s Emissary and the Revealer of His Name the Omniscient. Through it the loftiness of man’s station is made manifest and evident. It is all-knowing and the foremost Teacher in the school of existence. It is the Guide and is invested with high distinction. Thanks to its educating influence earthly beings have become imbued with a gem-like spirit which outshineth the heavens. In the city of justice it is the unrivalled Speaker Who, in the year nine⁴⁰⁷, illumined the world with the joyful tidings of this Revelation.”⁴⁰⁸

“And it was this peerless Source of wisdom that at the beginning of the foundation of the world ascended the stair of inner meaning and when enthroned upon the pulpit of utterance, through the operation of the divine Will, proclaimed two words. The first heralded the promise of reward, while the second voiced the ominous warning of punishment. The promise gave rise to hope and the warning begat fear. Thus the basis of world order hath been firmly established upon these twin principles. Exalted is the Lord of Wisdom, the Possessor of Great Bounty.”⁴⁰⁹

Jeddin reflects. “Wisdom teaches you that both reward and punishment are essential for your human world for its lasting, advancing order and harmony. Science and religion depend fully on each other for human advancement. You still struggle to embrace this truth. Look at genetic engineering. Look at artificial intelligence. Each new scientific discovery seems to unfold innumerable moral questions about your actions and their possible consequences.”

He’s right. Will says, “But a lot of public reaction rejects science itself, wholesale. People trade away knowledge and understanding for blind faith and cultivated ignorance. We’ve seen this with the anti-vaccination movement.”

⁴⁰⁷ the reference to “the year nine” is to 1853 CE, nine years after the Declaration of the Báb in 1844 CE. The reference to “the unrivalled Speaker” can be taken to refer to Bahá’u’lláh Himself. The occasion can be considered to be the initial outpouring of the Revelation of Bahá’u’lláh in the dungeon prison of the Siyáh-Chál:

“During the days I lay in the prison of Tíhrán, though the galling weight of the chains and the stench-filled air allowed Me but little sleep, still in those infrequent moments of slumber I felt as if something flowed from the crown of My head over My breast, even as a mighty torrent that precipitateth itself upon the earth from the summit of a lofty mountain. Every limb of My body would, as a result, be set afire. At such moments My tongue recited what no man could bear to hear.” Bahá’u’lláh, *Epistle to the Son of the Wolf*, p.22.

⁴⁰⁸ Bahá’u’lláh, *Tablets of Bahá’u’lláh*, “Words of Paradise” (Kalimát-i-Firdawsíyyih) – from the Fifth Leaf of the Tablet.

⁴⁰⁹ *ibid.*

Jeddin: "Both religion and science are necessary. Neither science nor religion is sufficient alone. Together, both are sufficient."

The Black Swan

A great black bird shadows the window of the room with huge wings, then seems to drift through the glass, alighting on one of the low file cabinets and carefully folding itself to compactness, to stare from Will to Jeddin expectantly. It is a swan.

In a low, rattling tone it says, "Are you surprised to see me here?"

"Yes!" they both respond.

"Good! That was the idea! I am here to change your thinking, to tell you of Nassim Nicholas Taleb, the mathematician, statistician, and iconoclast. In two of his books⁴¹⁰, he dismantles much of the long-accepted 'wisdom' of the field of forecasting. He uses the idea of me: the "black swan", meaning the disruptive occurrence and effects of an event of extremely-low probability and high risk – to show how traditional statistical methods and forecasting systems fail catastrophically in complex, real-world settings."

Will asks, "Why is this important to us right now?"

"Your forecasters use the so-called 'normal', or Gaussian statistical distribution all the time, in everything from the hard sciences such as physics and chemistry to the very-mushy forecasting processes of financial markets. With it, you apply straightforward patterns to data in order to derive useful, predictive rules (and models) in the field in question. But Taleb demonstrates, mathematically, that such applications all too often miss their mark, and do so with wildly-inaccurate results." The swan arches its neck to preen a few black feathers.

Jeddin now leans back against a bookcase, relaxed, and after a brief pause, Will says, "Well?"

The big bird looks at him with one bright eye, its neck now extending a bit. "The normal distribution works well when you are predicting the likelihood of finding a person of a given height. But that fails when you are required to scale your forecasts up or down."

"What does that mean? Is scaling something special?"

"Yes it is. If you look at a scalable statistical distribution with a magnifying glass, the magnified segment of it looks much the same as the original distribution. If the original distribution has bumps or sharp changes here and there, so do its magnified segments – like the fractals. But this is not true of the well-known Gaussian distribution. The closer you look at it, the smoother it gets. It is not scalable – one cannot change the scale of its use and

⁴¹⁰ Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* and *Foiled by Randomness: The Hidden Role of Chance in Life and in the Markets*.

get useful results. This property makes the Gaussian distribution 'well-behaved'. Hah!" This last exclamation comes out as a honk. "The world is NOT well-behaved!"

"Do you have an example?"

The swan undulates its graceful neck. "The prediction of the value of the German reichsmark of the 1920s was an utterly-catastrophic failure. Ordinarily one would expect smooth rises or declines in the value of a currency, consistent with Gaussian thinking, but this one dropped in value by a factor of a trillion within just a few years."⁴¹¹

Now the swan opens its long wings a bit as it sits, and Will sidles warily back a little. The room is not big enough – these wings would span more than the room's whole length. The bird speaks again in its low rasp and rattle. "Life in your world, unfortunately, is not usually well-behaved. Your scales of study and endeavor are no longer limited to some physically-bounded range of magnitudes. Long ago, weight, size, speed, vision, and available information all fell within human, manual control – if you couldn't lift it, carry it, see it, count it, or remember it, or find an animal or make a simple machine to help you do these things, you didn't concern yourself with it. The Gaussian rules worked well for most things."

"Why not now?"

"Your eyes are so wide open now! You can image atoms at a trillionth of a meter, and galaxies a billion trillion meters away, You can try to count the billions of stars in nearby galaxies. You can penetrate the human brain and enumerate its trillions of synapses on its billions of neurons. You store and retrieve scraps of information from many million trillions of terabytes of data storage. You compute models of a universe evolving at thousands of trillions of calculations per second. You amass wealth in the trillions of monetary units in seconds, and disperse it with equal speed. You have broken the chains of your past limitations, and now you fly!"

The swan's excitement seizes it, and its wings wave wildly, scattering papers, books, waste, and desk articles everywhere. "The number and kind of black swan events and effects proliferates madly! You are forcing your boundaries of science onward into these new, poorly-charted realms of the fractal. But your species has seen all this before."

"We have?"

⁴¹¹ Taleb, *The Black Swan*, Chapter 15, "The Bell Curve, That Great Intellectual Fraud" – the author invokes the scalability property of fractal phenomena, meaning that no matter what scale of measure one is using, the phenomena at that scale behave as do the phenomena at other scales. On p. 233, Taleb compares the distribution of wealth predicted by the Gaussian and the fractal laws, and on p. 234 concludes: "*Let us look more closely at the nature of (wealth) inequality. In the Gaussian framework, inequality decreases as the deviations get larger—caused by the increase in the rate of decrease. Not so with the scalable: inequality stays the same throughout. The inequality among the superrich is the same as the inequality among the simply rich—it does not slow down.*"

"Oh, yes! From the littlest things, great things emerge! Here, now I see that little bird coming."

The Warbler is in the room, circling the ceiling, singing.

*"When He was living upon the earth He was alone, ridiculed and rejected by His own people. Almost everybody cursed and ridiculed Him. His own relatives left Him; even His disciples almost abandoned Him; they placed upon His head a crown of thorns and paraded Him over the streets, and finally they crucified Him. He was alone! alone! but the traces of His work and the signs of His message have filled the world."*⁴¹²

Jeddin stirs. "The Warbler sings of Jesus Christ."

The song continues, as the swan, its wings again folded, sits quietly.

"During the lifetime of Jesus Christ the believing, firm souls were few and numbered, but the heavenly blessings descended so plentifully that in a number of years countless souls entered beneath the shadow of the Gospel. God has said in the Qur'án: "One grain will bring forth seven sheaves, and every sheaf shall contain one hundred grains."⁴¹³ In other words, one grain will become seven hundred; and if God so wills He will double these also. It has often happened that one blessed soul has become the cause of the guidance of a nation."⁴¹⁴

The Warbler departs, evaporating through the window. The swan says, "In general, the movement of information or effect throughout a population is in general terms scalable, fractal in its behavior. And when the information carries the power to amplify its own spread, the effects accelerate. A forest fire, a piece of longed-for or feared news, an epidemic, a financial collapse – these take you well beyond human communication. You can't model them usefully with classical statistical tools. But use the insights, methods, and models now unfolding as you explore the world of virtually-infinite scaling of your awarenesses. You are pushing back the boundaries of your complex world – and the insights of both religion and science are offering you maps to study and use."

"But be careful. Not only do your old models of reality fail, they fail catastrophically. You start out making models to predict what will happen to you, and you end up facing the truth: you cannot know *from your models alone* what will happen. Models are incomplete."

The black swan rises, stretches its neck upward, and with the thunder of wings roars potent through the window and disappears, leaving behind a pile of droppings on the file cabinet. Will cleans things up, regretting the lost sheets of notes under the bird's roosting place.

⁴¹² 'Abdu'l-Bahá, from *Star of the West*, Book II, Vol. III, No. 6, p. 6; June 24, 1912, "Interview between a Prominent Rabbi and 'Abdu'l-Bahá".

⁴¹³ from *Qur'án* 2:261.

⁴¹⁴ 'Abdu'l-Bahá, from *Tablets of the Divine Plan*, "Tablet to the Bahá'ís of the Northeastern States", second paragraph.

Will wonders as he cleans up how these changes in scale generate so much mystery. Jeddin is watching the cleanup process, and he stirs.

"How about a little help, here?" Will asks him. Now they seem to drift a little, weightless, and the room expands abruptly, leaving them floating like dust particles in sunlight, the expansion increasing, the walls and ceiling and floor receding into great darkness until the pinpoint magics of stars gleam and flicker, impossibly beyond reach, all of this happening in pure silent calm.

"No need," Jeddin says.

"What size are we now?" Will mumbles, looking down at his hands now empty of wads of paper full of bird droppings. He and Jeddin are fledged again, and they are themselves now two luminous birds, feathers inscribed in all colors woven of elusive meaning, and space embracing them in peace.

"Wait!" Jeddin says, "Wait!" Now human forms coalesce out of darkness, plentiful, fecund, morphing and writhing and connecting in webs, tearing apart and rejoining, unhealing and healing, still in shadow but more and more like singing scriptures and poems and musical scores. Will and Jeddin float entranced by the spectacle surrounding them, mesmerized.

One of these forms emerges toward them, its alto melody reminding Will of the scaling of fractals, repeating itself in patterns short and long, high and low, all perfectly and sweetly interlaced.

Its alluring voice comes. "Here, here is just one of your many wonders, in the speculative work of astrophysicist Laurent Nottale in relativity and quantum theory, a plunge to trace the possible relationships of fractal scaling with your many universal models. Here you find a striving to reconcile the familiar model of general relativity with the also-familiar model of quantum theory. Nottale's approach uses a specific reliance on fractal geometry and its treatment of different scales of measure. He sees spacetime itself as comprised of fractal elements."

"That's a strange idea." Will.

"One implication of this assumption is that scaling up from such elements can be shown to yield the familiar laws set forth in both quantum physics and relativity. Nottale explores these theoretical results in his works, generalizing the principle of relativity in an effort to embrace both large-scale and small-scale theories and models.⁴¹⁵"

"His work reaches across many disciplines and applications, from the cosmic scale to the sub-particle scale, and even into the intermediate scales of biology and the life sciences, informing their patterns with new insight and richness. Whether one grasps and agrees

⁴¹⁵ Laurent Nottale, *Scale Relativity and Fractal Spacetime* (Imperial College Press 2011), Part I "General Introduction", pp. 7-8.

with his approaches or not, his work gives a deeper appreciation of the human mind pushing the very fringes of understanding onward into fecund and bewildering terrain: the essence of the scientific process."

Will looks from this presence outward to the many others in their surroundings. "So many of these! It's not a landfill! It's a spacefill!"

Jeddin is laughing. "Here," he says. "Let's hear all these grand unified theories at once!" He throws his arms wide, and his great wings, and, caught up in the spirit Will joins him as they float back to back in this unempty emptiness. Shouting begins.

"6D (2,0) superconformal field theory! Black hole thermodynamics! Brane cosmology! Canonical quantum gravity! Causal dynamical triangulation! Causal fermion systems! Causal sets! Conformal field theory! CPT symmetry! Dark fluid! de Broglie-Bohm theory! de Sitter invariant special relativity! Digital physics! Doubly special relativity! Eigenstate thermalization hypothesis! Event symmetry! Fractal spacetime! Gauge gravitation theory! Gauge theory! Gauge theory gravity! Hidden-variable theory! Kaluza-Klein theory! Liouville field theory! Loop quantum cosmology! Loop quantum gravity! Mathematical universe hypothesis! Minimal Supersymmetric Standard Model! M-theory! N = 4 supersymmetric Yang-Mills theory! Next-to-Minimal Supersymmetric Standard Model! Pilot wave theory! Quantum cosmology! Quantum field theory! Quantum field theory in curved spacetime! Quantum mechanics! Quantum thermodynamics! Randall-Sundrum model! Scale relativity! Stochastic electrodynamics! String theory! Superfluid vacuum theory! Supergravity! Superstring theory! Supersymmetry breaking! Technicolor! Theory of everything! Thermal quantum field theory! Topological quantum field theory! Twistor string theory! Two-dimensional conformal field theory! Unparticle physics! Yang-Mills theory!..."

"STOP! STOP!" The words come from Will in pain, as if mathematical nails are being driven through his skull. "This is like Matt's list of demons!" Jeddin is laughing out loud now. The noise subsides, and the little mosquito voice drills in Will's ear.

07734 You were thinking about footnoting all of these, weren't you? Reference them all to death and let your readers just gloss over them and ignore the real things behind them, the great labor, the mad intelligence, the vast mathematical skills? That would be just like you, yes it would. But you'd get the consequences, because every one of them is changing all the time, and none of them will be here in a little while. New ones will be. It's the nature of the electric spacefill of ideas. They come and go like mayflies. And so will you.

Jeddin smirks. "These are just some of the disciplined speculations. Would you like to hear all the fringy ones? That's a much-bigger space."

"Please, no. Spare me." Will massages his temples as the singing, chanting, shifting forms and patterns recede into dimness all around them. "At least this spacefill isn't full of goo and slime the way the landfills are."

“True, and that’s because each of these interrelated proposals follows scientific discipline and yields to sound challenge. They come, they are tested, and they fail or evolve or combine to engender new ones. And once in a while, one of them breaks through to new truths about your universe. There are black swans in this endless sky!”

Small Events and Global Consequences

“Jeddin, is there a pattern here? Our societies are transformed by local, simple events that amplify or explode into global change. I’m thinking of those words from the Warbler’s song we just heard, about Jesus Christ.” And the Warbler’s notes fall on them insistently once more.

“When He was living upon the earth He was alone, ridiculed and rejected by His own people. Almost everybody cursed and ridiculed Him. His own relatives left Him; even His disciples almost abandoned Him; they placed upon His head a crown of thorns and paraded Him over the streets, and finally they crucified Him. He was alone! alone! but the traces of His work and the signs of His message have filled the world. Man must be just. After these statements no one can deny the greatness of Christ.”

Jeddin remarks, “Christianity spread so fast in its first few centuries!⁴¹⁶ For Islam, it was the same.⁴¹⁷ These seemingly-insignificant beginnings changed the entire human world. Both were unexpected, especially because the favored expectations were so wrong. Black swans.”

The Warbler’s song repeats its theme.

“... I scatter the seeds today, six months hence they may become apparent. In the meantime, can anyone deny the germination of these seeds, and when they are grown, repudiate the fact that these plants owe the origin to the seed?”

Jeddin and Will spread wings and bank in a circle in the dim reach of emptiness around them. Slowly they descend, a world coming to living, expansive form beneath their feet. As they glide closer to a wildflower field below, a shadow passes over them, and the black swan cranes its neck to peer briefly back at them.

The three of them stay in the air together – a breeze seems to buoy them – and the black swan speaks. “Move from minuscule scale to global scale, and suddenly everything changes. Supercool a lake of water below its freezing-point, and it remains liquid. But then drop a chip of ice in the supercooled water, and instantly ice spreads all through the lake. This is called a ‘phase transition’. At one point in time, everything is in one state, and in a brief interval, it all shifts to a sharply-distinct state.”

⁴¹⁶ John Julius Norwich, *Byzantium: The Early Centuries* (Knopf 1989) – the beginnings of the great Christian Empire of the East, starting with the birth of Constantine around 294 CE, shows how quick was the spread of Christ’s religion.

⁴¹⁷ Balyuzi, H. M., op. cit.

The great swan wheels to lead them around into an updraft, its voice grating. "When you view the human world with historical vision, a year is a blink of an eye, and in that perspective you can then see how quickly change sweeps over you. You know this intuitively, but you do not treat it formally. Human society undergoes phase transitions all the time, yet the science involved has not been sufficiently advanced to formalize and predict them well. Yet you already have the necessary mathematics for characterizing the thermodynamic phase transitions of fluids⁴¹⁸. And there is a vast range of work still ahead of you."⁴¹⁹

"You are at the barest beginning of understanding this new world, a world in which the embrace of science and religion is intimate, all-encompassing, and utterly harmonious. The mathematics you generate today, as potent and advanced as it may be over its historical sources and past evolutionary stages, is just a toe in the waters lapping the shore of some vast ocean of your incomprehensible future." And as these words trail off, the three soar over a rise to see the great sweep of wave-rhythmed waters below – they fly onward into the unknowns of some infinite greater world, freed from the weight of what lies behind them and those who cling to it.

The swan's low voice continues. "Humanity astonishes me. In your fertile speculations in the scientific fields, growing from speculation into research, testing, consultation, and insight, you see the embodiments of the consistency of religion and science. Those who pursue the practices and principles of both have all accepted the hardest and loneliest paths forward."

"The frontier of your science is a boundary moving outward, the leading edge of a wave of advancing human awareness moving into the unknown. But with your fresh eyes of new mathematics, science, and human possibility, you can see this wave in much greater detail as a fractal edge no matter where you look! Its convolutions and extensions reveal to you the universe's unending span, from its most infinitesimal particle to its utmost infinite grandeur. Drawing you onward is true faith, and the record of your journey is true science."

Ahead of them the sky is radiant with sunlit white streaks of cirrus, almost aglow in the high air.

Alongside them glides a frigatebird, in echelon off the swan's great wing, opposite Will and Jeddin. It calls out.

"Limiting processes are a gateway that can take us from a given world to a generally much larger world (since there are more sequences than elements)... The elements of this larger

⁴¹⁸ See Robert Gilmore, *Catastrophe Theory for Scientists and Engineers*, Chapter 10, "Thermodynamics" – this gets into the mathematical details of phase transitions.

⁴¹⁹ See Tim Poston and Ian Stewart, *Catastrophe Theory and Its Applications*, Chapter 14, "Thermodynamics and Phase Transitions" – despite their qualifiers, the authors show us that a great deal of sound work has been done in this area, and offer some tantalizing hints for leads in its broader application.

world may have new and different properties from those with which we started; properties generic in the large world but vacuous in the small one that gave rise to them."⁴²⁰

"This from Robert Rosen's work, on the ways biology transcends your "machine metaphor". Biology generates emergent anticipatory behavior from assemblages of components not capable of such behavior. Speculations have led you to consider the possibilities for some kind of extraterrestrial life, but few of your ideas on these possibilities offer much beyond a mirror of what you already know."

Genes and Metaphors Entwine

The frigatebird dodges as the Warbler, flying impossibly high and fast for such a small bird, joins in with its melodious notes.

"The earth has its inhabitants, the water and the air contain many living beings and all the elements have their natural spirits, then how is it possible to conceive that these stupendous stellar bodies are not inhabited? Verily they are peopled, but let it be known that the dwellers accord with the elements of their respective spheres. These living beings do not have states of consciousness like unto those who live on the surface of this globe: the power of adaptation and environment moulds their bodies and states of consciousness, just as our bodies and minds are suited to our planet.

"For example, we have birds that live in the air, those that live on the earth and those that live on the sea. The sea birds are adapted to their elements, likewise the birds which soar in the air, and those which hover about the earth's surface. Many animals living on the land have their counterparts in the sea. The domestic horse has his counterpart in the sea-horse which is half horse and half fish.

*"The components of the sun differ from those of this earth, for there are certain light and life-giving elements radiating from the sun. Exactly the same elements may exist in two bodies, but in varying quantities. For instance, there is fire and air in water, but the allotted measure is small in proportion."*⁴²¹

Incredulous, Will objects. "A sea-horse, half horse and half fish? That makes no sense!" The Warbler dives away.

Jeddin laughs. "All this journey through language and metaphor, and you still get hung up and confused about them! Start with the first part of the Warbler's song. It shows you the possibility – the pathway toward understanding – that admits of states of existence and consciousness unlike your own, formed by the conditions of their settings and the adaptive

⁴²⁰ (Rosen, Life Itself 1991)

⁴²¹ 'Abdu'l-Bahá, from a translation compiled by Elizabeth Fraser Chamberlain titled 'Abdu'l-Bahá on Divine Philosophy – it must be noted that this translation has not been fully and authoritatively authenticated, and is only presented here illustratively.

processes operating in those settings. You should view this no more speculatively than you would the projections of astrophysicist Kip Thorne regarding spacetime wormholes."

"Yes, but then..."

He waves Will off. "The horse metaphor elaborates on the idea of adaptive correspondences. You instantly objected to *'the sea-horse which is half horse and half fish'*, claiming that the statement is meant literally. From a scientific perspective, this is clearly not the case. So, consistent with our assumptions regarding the correctness of science, the idea is given here in an ontological sense, metaphorically speaking⁴²². Two aspects of the half-horse-half-fish observation present themselves, one genetic, and the other morphological."

"This is looking complicated. The statement just doesn't make sense."

Jeddin responds quickly and impatiently. "First, as the study of the biological genome continues, you are discovering that your human genetic codes are over 95% similar to those of chimpanzees, and the similarities decline as the species being compared are more unlike each other. Think metaphorically. The metaphorical mixing of different types of creatures evokes the order of life's actual chemistry and codes. Don't treat it too literally."

"Second, before modern molecular biology, the human scientific process of taxonomy (classification of species) relied heavily on appearances and apparent forms (morphology) to attempt to relate different creatures in hierarchies of species. To describe a creature as half-horse and half-fish in such a process is to capture its apparent elements of likeness and distinction for purposes here of illustrating human classification and association: the ways you think about likeness and its derivations."

"But - "

"Oh, and along that line, you know that some humans show vestigial gills when born? Your relationships to other biological creatures are not always so neatly defined."

"All right, I'll let it go for now."

*Words come up from memory. "The universe is not only queerer than we suppose, but queerer than we **can** suppose."*⁴²³

⁴²² As is so often the case with the Writings of 'Abdu'l-Bahá, one must often make effort to penetrate the subtleties and unravel the resonances even in just a brief passage. For the above metaphorical usage, we can find some clarifying exploration: "*Within metaphor, a distinction can be drawn between mere and ontological metaphor; whereas the former simply associates a physical concept with a metaphysical one, the latter recognizes that all concepts resonate with possible transpositions and, as such, brings to the fore the world-making power of speaking. Furthermore, ontological metaphor structures experience as an openness to . . . movement between concepts.*"

(from Clive Cazeaux, *Kant, Cognitive Metaphor and Continental Philosophy*, Routledge 2007, cited at <http://grammar.about.com/od/mo/g/ontologicalmetaphorterm.htm> .) From 'Abdu'l-Bahá's assertion we see this open "movement between concepts" at work. More on ontological metaphor, including numerous examples, can be found in Lakoff and Johnson (Lakoff and Johnson, *Metaphors We Live By* 2008).

⁴²³ Attributed to J. B. S. Haldane.

In full flight, Will closes his eyes, the wind smoothing his patterned plumage. It seems to him a dream of light now, and he follows Jeddin and the black swan through nothing more than the tickles and touches of their shifting wakes of air. As Will relaxes into peace, Miriam's croon rises in him.

"If you contemplate the woven light of the living human mind, you see that it transcends the brain and its material neurons and glia altogether, evidencing its origins and connections in the greater world in which your familiar existence is cradled. Such transcendence implies that this woven light, this radiant patterning of true sentience, cannot be restricted in its appearances and testimonies no matter where in the entire creation you live. Its possibilities reach even to the most remote and inaccessible worlds, even to the most-divergent forms and processes of sufficient complexity."⁴²⁴

"Think of the vast and infinitely-varied realm of chaotic order that operates at every scale of subtlety and size in the heart of a mighty star. Might such a complex order embrace patterns of sentience informed by the Creator? Might it not then radiate forth not only the light of its enduring combustion but also the infinite Light of the knowledge of its Maker?"

The Nightingale's glorious song emerges in Will again.

*"My eternity is My creation, I have created it for thee. Make it the garment of thy temple. My unity is My handiwork; I have wrought it for thee; clothe thyself therewith, that thou mayest be to all eternity the revelation of My everlasting being."*⁴²⁵

And Miriam's voice fades in Will's flying dream with these words. "And so from such radiance from but one informing Word, on the greatest of cosmic scales, the Creator calls into being a universe to love Him."

Elements and Metaphors in Alloy

Will's eyes open again. The black swan rolls slightly left, then slightly right, its course unwavering, leading Will and Jeddin into a brilliant, swirling cloud of living light, blinding Will. The big swan says, "Ah, little Nightingale! Do you have new song for us again? Can you sing to these guests of mine of human beings transmuted, turning to God?" And then the Nightingale's notes fill Will's heart.

⁴²⁴ When one recalls our exploration of the richness of a higher-dimensional realm in which our own is cradled, it is striking to consider that perhaps our sensory and bodily limitations serve as our 'sandbox' reality, giving our nascent existence a supportive, sheltered 'nursery' to prepare us for life in the greater world that cradles it. This theme has been taken up by many others in many different ways. The idea offers some intriguing perspectives of what we consider non-phenomenal: hallucinations, visions, personal manifestations that seem to grant different people some fleeting glimpse of the greater world's beings and properties. A scientist accepting the idea of this cradling of existence might view such occurrences as a kind of thinning of some membrane separating our sandbox world from its surroundings, as it might be, a breakdown of 'insulation' leading to a brief "short circuit" of information moving into our own space and time. The implications of such a view for acceptance of the great diversity of human experience might bring about better treatment of those for whom such "short circuits" seem a more-common aspect of daily life.

⁴²⁵ Bahá'u'lláh, *Hidden Words*, Arabic no. 64.

"It is evident that nothing short of this mystic transformation could cause such spirit and behavior, so utterly unlike their previous habits and manners, to be made manifest in the world of being. For their agitation was turned into peace, their doubt into certitude, their timidity into courage. Such is the potency of the Divine Elixir, which, swift as the twinkling of an eye, transmutes the souls of men!"⁴²⁶

"For instance, consider the substance of copper. Were it to be protected in its own mine from becoming solidified, it would, within the space of seventy years, attain to the state of gold. There are some, however, who maintain that copper itself is gold, which by becoming solidified is in a diseased condition, and hath not therefore reached its own state.

"Be that as it may, the real elixir will, in one instant, cause the substance of copper to attain the state of gold, and will traverse the seventy-year stages in a single moment. Could this gold be called copper? Could it be claimed that it hath not attained the state of gold, whilst the touchstone is at hand to assay it and distinguish it from copper?"⁴²⁷

Again Will resists the ideas. "This sounds like alchemy, in nothing but our own medieval sense of the term! What are the scientific meanings here of terms such as 'elixir', "diseased condition", 'touchstone', and 'seventy years'?"⁴²⁸

Jeddin snorts. "Will! Again, this is your usual human engagement with such metaphorical and extended use of language⁴²⁹. Take a deeper look."

"We will go deeper now," the black swan booms, and caught in his wake they plunge into light so seething that it stabs through Will's eyelids. A cry of pain escapes him, but the swan continues. "Well after these words were first sung, you yourselves have come to understand in considerable detail how the natural elements such as copper and gold were created, and what comprises them. Briefly, none of the elements heavier than iron existed in the early universe. Over aeons, the stars coalesced gravitationally out of nothing but hydrogen."

"We are entering the heart of a star now. I shield you." The light and heat ebb away enough that Will can sense the roil and wrack of wellings of fusion in the interior of this vast forbidding place.

The swan's voice deepens to a contrabass. "The mighty gravitational force accumulating the elements in a star compress everything together – the cause of the thermonuclear reaction of the star's burning. Against the gravitational force, the energy generated from the burning

⁴²⁶ Bahá'u'lláh, *Kitáb-i-Íqán*, para. 164

⁴²⁷ *ibid.*, para. 165

⁴²⁸ Many may find more comfortable the idea that seventy years, as the "threescore years and ten" mentioned in the Bible as the expected human lifespan, signifies the development of human worth from a lesser state ("copper") to its best state ("gold") in the natural course of life. As with any metaphorical usage, the meanings proliferate.

⁴²⁹ There is a certain irony in objections to the use of metaphorical and poetic language when describing scientific phenomena: the same professed incomprehension on which the objection is based can often be found in that same person's inability to comprehend the rigorous, profuse, and disciplined mathematics of the science itself.

process pushes everything outward. The two forces achieve stability when the star reaches a size where the two forces, inward and outward, are equal.”

“When the compression of a star reaches a sufficient pressure, the star’s hydrogen kindles and begins to burn in the thermonuclear sense, which means fusing into heavier elements. The hydrogen fuses into helium, the helium into carbon and oxygen, and those elements in succession onward up to iron.”

Will vibrates with this gigantic voice, now roaring above some mighty din of change, and the swan now carries him and Jeddin inward, still speaking. “But iron does not burn in the thermonuclear sense, and it is very heavy when bound into a great star, say, one weighing between 10 and 50 times the weight of our Sun. Such a star, its fuel spent, can no longer use the energy of its burning to support the iron.”

Now they arrive at some poised center, in a fire-frozen moment in time, a hard core of inert metal rising beneath them. Will is grateful for the black swan’s shield, seeming to make him, and Jeddin beside him, nothing of material substance at all.

The swan seems not to notice. A moment passes in the roar, and then everything above them in the star collapses inward upon them, through them, its gravitational attraction overcoming the radiation of energy. An instant later, everything blows up and past them outward, rebounding in a staggering explosion called a supernova.⁴³⁰

Now they are all flying outward with the debris of the stellar explosion, and the swan speaks again in a more-ordinary register. “In that moment of collapse, the atomic nuclei of atoms were slammed together. They fused into the nuclei of even-heavier elements all the way up to uranium and beyond.”⁴³¹

Will asks, “And the copper and gold?”

“Both copper and gold are formed, built up from smaller atoms in this catastrophic process. Gold is much heavier than copper⁴³². There are many paths to the formation of the gold, but many of them lie through the stage during which copper is formed. It all happens in what we would call in astrophysical terms a single moment. Once gravitation overcomes the failing outward pressure of fusion at the stellar core, the surface of the star collapses inward at about a quarter of the speed of light. The momentum of the collapsing material, consisting of atoms of lighter weight than iron, is so great that the electron shells of the atoms are themselves jammed onto the nuclei they surround, and adjoining nuclei then fuse in collision to form all the elements of greater atomic weight than iron.”

“The energy that forced the collapse of the atoms themselves, stored in the nuclear fusion process, releases as the supernova explosion, hurling most or all of the newly-created

⁴³⁰ See https://en.wikipedia.org/wiki/Type_II_supernova for an excellent narrative and a useful list of references.

⁴³¹ Donald Clayton, op. cit.

⁴³² Gold has atomic number 79, copper has atomic number 29.

elements into interstellar space at great speeds. And we are now traveling with it, lumps of stellar debris all around us."

Will's curiosity surfaces. "But what does this mean? I heard in the song the statement that *'Were it [copper] to be protected in its own mine from becoming solidified, it would, within the space of seventy years, attain to the state of gold.'* How can such a statement find meaning within what we already understand of science? It cannot."

Jeddin comes in. "Here again you are compelled to look on such statements with metaphorical and allusive eyes. Just as importantly, with eyes that can see the possibility of undiscovered science."

"Please explain."

"Let's start with the inner meanings. This passage's metaphors appear to refer to the physical element metals, but the meanings intended here seem clearly metaphorical."

"What tells us this?"

"The use of the term 'seventy years' as the interval during which copper may be transmuted into gold. But that interval of time is also easily construed as the span of a normal human life, and the transmutation process seen as the divine process of spiritual advancement from the lesser state of spirituality to the greater. This process is the spiritual development – the inner transmutation – available to every human soul, which you are all expected to undertake in your lives."

"So if we wrap ourselves around the alchemist's transmutations of metals of the physical world, and fail to pay attention to the Manifestation's transmutations available to the human soul, offered through the outpouring of ocean of His words, we are in a state of loss, yes?"

The great swan speaks now. "Yes, but there is much you will learn about the physics of transmutation." He looks over at an asteroid-size rock glowing and cooling in the emptiness of space as they travel. "Two ideas. First, the term 'mine' here can be seen to refer to a natural repository in which a metal or other solid substance can be found, and from which it can be extracted and refined. A most-general definition! It subsumes the meaning of a mine as an opening dug by miners to perform the extraction. Such a general definition does not exclude such a 'mine' as the stellar crucible in its brief interval of maximum collapse. A star is a mine, although a rather hot one."

"Second, the term 'solidified' can be seen to refer to a rigid state of matter in which it is fixed, crystallized, its atomic or molecular components situated in unchanging places with respect to one another. In the stellar crucible we have described, the copper formed there can in no way be considered to be an ordinary solid during the collapse. It is at the least molten, if not vapor."

“Third, the phrase ‘the state of gold’ can be seen to refer to gold itself, or to anything that takes on the properties of gold in the chemical or physical sense.⁴³³

“Fourth – and this is a critical metaphorical bridge for you – the phrase ‘seventy years’, here seemingly quite specific, can be seen to refer to a time interval of significance, much greater than any single instant, but much less than the aeons of cosmic evolution.”

“Well, now, the song was about matters of faith, not science.”

The swan dips his head and neck in acknowledgement. “That’s true. Many writings of different faiths offer scalings of the measure of time as time is presented in the great scriptures, and the application of time scales in scriptures is not at all uniform or rigid, but is to be treated in a more-metaphorical sense. A few examples are worth comparing.”

“First is the reminder in 2 Peter 3:8, *‘one day is with the Lord as a thousand years, and a thousand years as one day.’*”

“Second is the assertion in Numbers 14:34, *‘After the number of the days in which you searched the land, even forty days, each day for a year, shall ye bear your iniquities, even forty years...’*”

“Third is the vision in Revelation 12:14, *‘The woman was given the two wings of a great eagle, so that she might fly to the place prepared for her in the wilderness, where she would be taken care of for a time, times and half a time, out of the serpent’s reach.’*”

“Here the perspective of the beholder determines the scale to be used. In the first a ‘day’ means 1000 years, in the second a ‘day’ means a year. In the third, remarkably, a ‘time’ is treated by interpreters as a ‘day’, but it is subject to a repeated rescaling, first to a ‘year’, and then to a year of the days of such a ‘year’. The prophecy adds one ‘time’ to two ‘times’, and then adds half a ‘time’, to get a total of three and a half ‘times’. Then, and most significantly, it treats each ‘time’ as a year, and repeats the process, treating each day of the three and a half years as a year itself, giving a total of 1260 years in the interpretation.”

“All right, so what? I’m looking at stellar debris here.”

The great swan gives a muffled honk, sounding suspiciously like its laugh. Then it speaks. “The interpretations themselves are not the point of interest! Here you must consider their fractal character. Such scaling in scriptures evokes the fractal scalings of nature, in which processes and entities at large scales of time and space reflect closely those at small scales, on even a recursive basis. Such an insight or connection between scriptural and scientific perspectives would not have been possible in past eras, before we gained understanding of the fractal aspects of nature.”

⁴³³ Here we might pause to consider that in the process of stellar collapse, nuclear fusion has generated a state of matter consisting almost solely of nuclear particles: protons and neutrons. In another, more-common type of stellar collapse, no rebound explosion takes place, and instead a neutron star is formed, which is effectively one monstrous atomic nucleus of neutrons alone, bound tightly together by their own gravity.

"You can also consider the great variety of processes whereby the different elements appear to be formed in nuclear-fusion processes in the stars themselves – the stars considered as the 'mines' and the elements considered as in liquid, non-solid states. The relative durations and likelihoods of these processes are poorly understood for the bewildering web of nuclear fusion processes leading up from hydrogen all the way to iron⁴³⁴. Furthermore, the states in which these reactions take place defy categorization in familiar, earthly terms, not really resembling solids, liquids, or gases except in some metaphorical sense. In a star's superheated interior, you find isolated subatomic particles roiling and ricocheting at relativistic speeds."⁴³⁵

"But all this vivid thought barely touches the surface of the underlying complexity unraveled in the past century. In about 1956 you discovered the nearly-massless particle called the neutrino, an essential product of the basic fusion reactions in the stellar interior. The discovery opened a whole new sector of astrophysics. Neutrinos barely interact with other particles at all, flying by the hundreds of billions from their solar origin out through every human body on earth – harmlessly and undetectably– every second.⁴³⁶"

An idea strikes Will. "So did you make us into neutrino-stuff to shield us in the star?"

Again the swan's honking sound. "That's my little secret."

"Secrets! So many secrets! Why can't we get answers more easily?"

"When you are ready for them, they will come to you. Your science makes you more and more ready, and you learn. Only through diligent efforts has your human science been able to detect neutrinos at all, and to unravel slowly and patiently the secrets their existence offers you. A hundred years ago, you had no idea how gold came to be. Now you understand how gold is forged in the stars. What will you learn in the next hundred years? The next thousand? The next ten or hundred thousand?"

"Be patient. Be diligent! The copper-and-gold metaphor, used in explaining the transformation of human character, gives you a bare glimpse, *in terms comprehensible to those reading His Words*, of a realm far greater and more complex than you are even now penetrating. You are humbly following His pathway into realms of greater and greater knowledge. One good look at your astonishing advances in physics, entirely apart from any

⁴³⁴ See Donald Clayton, op. cit., Chapter 5, "Major Nuclear Burning Stages in Stellar Evolution" – the 'cooking' of hydrogen up to helium in a star takes much more time than similar processes for heavier elements, mainly because of the far-greater volume of hydrogen. In a very-large star capable of supernova collapse, the orders of magnitude can range from billions of years for consumption of hydrogen down to a few days for the final fusion of silicon to nickel and zinc (which turn quickly back to iron). The subsequent collapse of the star occurs on the order of a few seconds. The whole process of supernova collapse is treated further on in this essay.

⁴³⁵ See Donald Clayton, op. cit., Chapter 2, "Thermodynamic State of the Stellar Interior", pp.77-8, quoting from Sir Arthur Eddington, "The Internal Constitution of the Stars" (Cambridge 1926).

⁴³⁶ See Carlo Giunti and Chung W. Kim, *Fundamentals of Neutrino Physics and Astrophysics* (Oxford 2011), Chapter 10, "Solar Neutrinos", p. 352.

connection with anything outside its realm, makes you appreciate the greatness of that which your physics is progressively revealing beyond its former boundaries.”

As if to punctuate their long and harrowing journey, the Nightingale veers past, circling Will's head in full flight in the dark vastness of the stars, its voice tremolo in showers of meaning.

“The corrosion of ungodliness is eating into the vitals of human society; what else but the Elixir of His potent Revelation can cleanse and revive it? Is it within human power, O Ḥakím, to effect in the constituent elements of any of the minute and indivisible particles of matter so complete a transformation as to transmute it into purest gold?

“Perplexing and difficult as this may appear, the still greater task of converting satanic strength into heavenly power is one that We have been empowered to accomplish. The Force capable of such a transformation transcendeth the potency of the Elixir itself. The Word of God, alone, can claim the distinction of being endowed with the capacity required for so great and far-reaching a change.”⁴³⁷

Their great black swan stirs, adjusts its course, and they gradually turn to see a distant world, moving with the speed of imagination, coming closer from darkness. The great bird speaks. “Do you find challenging the idea that scientific thought and practice can interact positively and effectively with your societal and personal development? Consider the past 200 years of human transformation, in all its terrifying, chaotic, and lustrous glory! It should offer you superabundant evidence that such interactions are fueling and healing your advancing existence on your home planet.”

Finally, they come descending through ocean airs again, and find the flowered fields of earth.

Buildings and Metaphors Sing

“I leave you now,” the black swan says, its wings still spread wide, so wide that they seem to span the entire meadow where Will stands now beside Jeddin. “Another will take you onward now in flight and more adventures of space, time, and open hearts.” The great black form takes flight on a sudden but enduring gust of warm air, taking only a few steps to let its long wingspan finger and seize the invisible drafts to curl its path out and up, up, to disappearance in a scatter of running white clouds.

They look around at the rainbow flowered slopes and flats, a sea of color touched by whispers of air. “Another bird?” Will asks.

“There is a road,” says Jeddin, pointing. “See?” They stroll through the mingling scents of the blossoms and grasses to a narrow highway, its pavement smooth and dark and fringed by blue blooms on sticklike stems. They still have their wings, but a laziness of this summery setting has slowed Will. They amble along the road without conversation for a

⁴³⁷ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, XCIX.

time, the sun above them settling now to later afternoon, and hills are around them now. The road curves past the foot of an outcrop of rock, and as they pass it they see ahead a man in heavy work clothes waiting. He waves.

Will and Jeddin approach him. He says, "The swan let me know you'd be coming."

'You're not a bird, are you?' Will asks.

He laughs. "You've been on this long tour, with all its changes of everything. What do you think?"

The absurdity of the question makes Will laugh too. "Good point."

"Walk with me now. We are going to a city. There is much to hope for with you in your cities, just as in the fields you cherish."

The specter of constant death happening in the world of his room surges up in Will. "Hope? In our cities? Ha! They're pits of despair for so many. And pits of disease and death as well. They have become unlivable."

"What is your name?" He stops, turns to Will, and looks him in the eye. Jeddin stays alongside, ignored. "I see your partner here – avatar, trickster, projection, false face. But he has many names, and I know you have your own. You are the traveler here, but that is not your name."

Will doesn't want to tell him his name, and doesn't answer, and their eyes lock for a breath or two. The man turns to look down the road behind them. "All right. That will come later. Come with me." He steps off at a brisk pace, and Jeddin and Will, still side by side, follow him. The wings that carried them are gone now, and they are dressed not in coats of feathers but in work clothes like those of the man they are following.

Will says to him, "You didn't introduce yourself either."

Not looking back, the man says, "No need. What I do will give you a name you can use." He comes over a rise, and stops, and Will and Jeddin come up beside him.

"Look – here is the city. I would call it 'your city', but that would distract us. It's more than 'a city', because it is more a type, not an instance, or at least your inheritors of older philosophy would say so. Plato might have called it an 'ideal city', but we are no longer cave-dwellers under his rule.

"So what is it? A city, an ideal city, a class of cities that looks like a city, or something else?"

"It isn't any of these, except that it might be all of them."

"That sounds like nonsense."

Their guide is impatient. "No! It mirrors something your languages don't treat very well: the dynamics of a city as organism. Most languages have a snapshot feeling to the meanings

their users apply. One speaks of New York City, and means one thing seen on one day through one person's eyes. Another speaks of New York City, and means many things all intertwined through space and time and many eyes. Still others write of magical New York Cities, weaving fact and fiction. Here you will see what was and is and might be as if it were some tangle of possibilities, possible cities of memory, hope, and senses of many people."

"For most of human history you have lived in the process of creating possible cities in human society and life. This process defines your journey towards "anticipatory governance": your developments of public life that embrace all the long-term, complex, sophisticated systems and processes by which you sustain civilization itself. Your water delivery systems, your power supplies, your roads, your waste disposal systems, and much more, all have defined human, civilized life for thousands of years."

They move ahead down a gentle slope of the road. There is no traffic. They approach an outlying cluster of houses marking a crossroads, a gathering of tree lines ending over huddled stores and shops tucked away at this meeting-spot.

The guide waves around at the deserted buildings, their windows dark and vacant, their outside walls greyed and weather-smearred. "Much has swept through these places in the past two hundred years. Now, you take such emptying out of small towns for granted. Most of the systems that now serve you mirror not so much the thousands of years of past successes but the explosive 200 years just behind us."

"When this little crossroads place was built, none of your modern wonders existed: the global communications network, the supranational power grids, the rising force of international law, and much more. But as you move into an era in which scientific advances bestow unprecedented benefits of anticipatory power on human society, your governance can't keep pace with your awakening imaginations and innovations."

They pass on toward the city, dreamily moving more quickly now as if their road is itself rolling them onward. Spires, arches, domes, and woven elevations draw closer, forms appearing around and over them in stone, trellis, glass, metals, even living wood and plant cover. They enter an outlier, a tendril of some great sprawl or net of human engagement with new patterns of harmonized life. People come and go, not noticing them at all.

Their guide continues. "Your visionaries have plunged with vigor and creative power into the crazily-branching jungle of cultural and societal possibilities. We walk now in an arcology of architect Paolo Soleri. It recasts concentrated human habitats – the cities – in a context of viability and organic, biological balance and function. This infuses its spirit into advanced civic planning and development now taking place everywhere, leaving behind the

conventional image of cities as “*the world of bodies*”⁴³⁸ caught up in the material obsession with stone, iron, and dust.”

Will asks, “Does this thinking, this kind of design, draw together science and religion?”

The guide nods. “Soleri remarked, ‘*First, we throw away all our everyday ideas of what constitutes religion.*’⁴³⁹ He wanted to start over with a new way of seeing the meeting of human and scientific principles. His word ‘arcology’ merges ‘architecture’ and ‘ecology’ to recast your way of seeing cities and human habitation. He and others have published a series of works under the overarching title “Redesigning the Planet”⁴⁴⁰. They attempt to embrace all of the disciplines needed to build a viable world civilization in harmony with the natural world. This series is just one example of the advanced efforts in progress worldwide.”

They pass under a dome spanning an open food market, crowded and busied, its aromas and chatter rising to the dome’s puzzle-patterned ceiling mosaic. Vines climb the supporting walls of the dome to interplay among relief sculptures.

They turn and move down a side street opening to a garden and field space, where a smaller building, circular, domed, and windowed, hosts a family. The children play in front, ignoring them. The guide leads Will and Jeddin to the outside tan-shaded wall of the house, tapping a knuckle on its hard smooth surface. It gives back a slight ringing tone that fades. The children look up for a moment, then go back to play.

Will listens to the fading tone. “It’s like a bell!”

“Architect Nader Khalili, born in Iran, created what he termed “ceramic” architecture, building an adobe structure, filling it with fuel, and setting it on fire for several days to produce a fused, strong, complete permanent structure.⁴⁴¹ His work, creating these structures all in a single burn, revolutionized the construction of low-cost buildings. He used sandbags and barbed wire alone – the tools of war – to create homes for families.”

“But he was just getting started. He went to work with NASA on a proposal to build habitations on the moon’s surface using concentrated solar energy and the surface dust.⁴⁴² It hasn’t been used yet, but his work was adapted for refugee-camp dwellings, and a group of buildings was raised up using his ceramic approach.”

⁴³⁸ Bahá’u’lláh, quoted by J. E. Esslemont in “*Bahá’u’lláh and the New Era*”, p. 35. Uttered by Bahá’u’lláh in His prison barracks in ‘Akká: “*I have not gazed on verdure for nine years. The country is the world of the soul, the city is the world of bodies.*”

⁴³⁹ See Lissa McCullough, “Conversations with Paolo Soleri”, introduction.

⁴⁴⁰ Paolo Soleri, Alan Witbecker, and many others contributed to these voluminous works, which range in focus from fully-global down to community-local. Research in the current editions of the books is hampered to some degree by the lack of indexing.

⁴⁴¹ See Nader Khalili, “*Cal-Earth*”, in “*Design Like You Give a Damn: Architectural Responses to Humanitarian Crises*”, Architecture for Humanity, ed., Metropolis Books. The book is a collection of articles on making habitats available to those in dire need of them.

⁴⁴² *ibid.*

"What a great step forward!" Will.

The guide shrugs. "His effort ran afoul of global politics. The funds had been allocated for setting up refugee camps on the Afghan border with Iran. They were abruptly diverted to other priorities, and the effort stalled.⁴⁴³ One of your modern human failures of magnificent, humanitarian purpose." He flings an arm out in a dismissive gesture, as if throwing off something unclean. "Such powerful, adaptive, and economical processes you can bring to bear on meeting basic human needs! Yet you still indulge the traditional obstacles of human bureaucracy and motive in your badly-disordered world."⁴⁴⁴

His voice sharpens. "Why give way to ignorant, indifferent, greedy, corrupt, and self-interested national and local officials and their organizations? You could do a lot better!" He lifts a hand, extending his index finger to a swirl of sparrows moving past them. One cheeps twice, and as the little birds fly off, the Warbler swoops past and speeds in a wide circle around them, its song moving in loveliness between legato and staccato.

"The world of politics is like the world of man; he is seed at first, and then passes by degrees to the condition of embryo and foetus, acquiring a bone structure, being clothed with flesh, taking on his own special form, until at last he reaches the plane where he can befittingly fulfill the words: "the most excellent of Makers."⁴⁴⁵

"Just as this is a requirement of creation and is based on the universal Wisdom, the political world in the same way cannot instantaneously evolve from the nadir of defectiveness to the zenith of rightness and perfection. Rather, qualified individuals must strive by day and by night, using all those means which will conduce to progress, until the government and the people develop along every line from day to day and even from moment to moment.

'When, through the divine bestowals, three things appear on earth, this world of dust will come alive, and stand forth wondrously adorned and full of grace. These are first, the fruitful winds of spring; second, the welling plenty of spring clouds; and third, the heat of the bright sun. When, out of the endless bounty of God, these three have been vouchsafed, then slowly, by His leave, dry trees and branches turn fresh and green again, and array themselves with many kinds of blossoms and fruits.

"It is the same when the pure intentions and the justice of the ruler, the wisdom and consummate skill and statecraft of the governing authorities, and the determination and unstinted efforts of the people, are all combined; then day by day the effects of the advancement, of the far-reaching reforms, of the pride and prosperity of government and people alike, will become clearly manifest.'⁴⁴⁶

⁴⁴³ *ibid.*

⁴⁴⁴ *ibid.*

⁴⁴⁵ From Qur'án 23:14: "Blessed therefore be God, the most excellent of Makers."

⁴⁴⁶ 'Abdu'l-Bahá, *The Secret of Divine Civilization*, pp. 22-23.

The Warbler leaves them in silence. Their guide says, "The global human embrace of science pours its transformative energies into the ways you govern today's civic affairs. Those who cling to traditional profits, power, and stability, whether they hold power in roles in government, religion, or education, will find themselves increasingly marginalized by the impacts of such wonders as clean energy, instant global communication, and genetic research."

Now the guide takes Will's arm, faces him, and his words resonate with Will's thoughts.

"We live today on a cusp of historical time, a pinnacle ascended from our dark and turbulent human past that now we prepare to descend on its further slope into a brilliantly-lit world, a world teeming with infinite disclosures and revelations, a world utterly strange, a world in which all things are made new."

He releases Will's arm. Jeddin, silent for some time, clears his throat. "Ah, another bird has joined us." Above Jeddin's head a tiny hummingbird hovers, flashing sapphire and emerald in sunlight, its near-invisible wings moving melodies in Will's mind, its trajectory a circling with each circle a verse.

"The unity of the human race, as envisaged by Bahá'u'lláh, implies the establishment of a world commonwealth in which all nations, races, creeds and classes are closely and permanently united, and in which the autonomy of its state members and the personal freedom and initiative of the individuals that compose them are definitely and completely safeguarded."

"This commonwealth must, as far as we can visualize it, consist of a world legislature, whose members will, as the trustees of the whole of mankind, ultimately control the entire resources of all the component nations, and will enact such laws as shall be required to regulate the life, satisfy the needs and adjust the relationships of all races and peoples."

"A world executive, backed by an international Force, will carry out the decisions arrived at, and apply the laws enacted by, this world legislature, and will safeguard the organic unity of the whole commonwealth."

"A world tribunal will adjudicate and deliver its compulsory and final verdict in all and any disputes that may arise between the various elements constituting this universal system."

"A mechanism of world inter-communication will be devised, embracing the whole planet, freed from national hindrances and restrictions, and functioning with marvellous swiftness and perfect regularity."

"A world metropolis will act as the nerve centre of a world civilization, the focus towards which the unifying forces of life will converge and from which its energizing influences will radiate."

“A world language will either be invented or chosen from among the existing languages and will be taught in the schools of all the federated nations as an auxiliary to their mother tongue. A world script, a world literature, a uniform and universal system of currency, of weights and measures, will simplify and facilitate intercourse and understanding among the nations and races of mankind.

“In such a world society, science and religion, the two most potent forces in human life, will be reconciled, will co-operate, and will harmoniously develop. The press will, under such a system, while giving full scope to the expression of the diversified views and convictions of mankind, cease to be mischievously manipulated by vested interests, whether private or public, and will be liberated from the influence of contending governments and peoples.

“The economic resources of the world will be organized, its sources of raw materials will be tapped and fully utilized, its markets will be co-ordinated and developed, and the distribution of its products will be equitably regulated.”⁴⁴⁷

As the strains of the hummingbird's meaning pass through him, Will stands transfixed. He says, “I can see a little, now. This comprehensive vision integrates and realizes the potentials inherent in developing a mature, balanced, dynamic, evolving, worldwide human civilization like none that has ever preceded it. Our models, games, and simulations have helped this process.”

Their guide responds. “But they barely reflect the density and complexity of the preparations and learning you must do in order to evolve, advance, and regulate the utterly-new kind of human world you are entering. Your games, using your astonishing new digital powers, are already giving your children insight and understanding that even the wisest of the past struggled to obtain and apply. You will often find yourselves learning from your offspring and descendants as they race onward into a world that challenges you to keep up with them.”

The hummingbird's inner melody circles in Will again. *“In such a world society, science and religion, the two most potent forces in human life, will be reconciled, will co-operate, and will harmoniously develop.”*

I will die soon. Now the often-emerging thought enlivens, energizes Will, as it stabs out from the collapsing, catastrophic world through which his little room seems to move in time. Here in this city, he stands, with guide and Jeddin, transfixed in an amber moment of sweet and sunlit peace.

In an instant, it is all gone.

⁴⁴⁷ Shoghi Effendi, *The World Order of Bahá'u'lláh*, Humanity's Coming of Age, p. 27,

IX. DREAMS OF TIME'S REACHES

Prison

*Confine me, O God,
 In this prison womb of Earth,
 Lock me in this cell of flesh,
 Chain me to these senses,
 Stifle me in sleep,
 That the tumults of the world may fade,
 The chaos of the flesh subside,
 The rattle of the senses die,
 The night's darkness pass,
 And I may hear the chanting
 Of the hidden Nightingale:
 That Bird no prison can contain,
 No body can envelop,
 No sense can ascertain,
 No dream can overcome.*

*Confine me, O God,
 In this prison womb of self,
 Lock me in this iron ego,
 Chain me to my words,
 Smother me in fancies,
 That these confinements overturn
 The self, humble the ego,
 Scatter the words,
 Dissolve the fancies,
 And I may thrill to feel the music
 Of the glorious Nightingale:
 That Bird no self can occupy,
 No ego can embrace,
 No words can ever spell,
 No fancy can describe.*

*Confine us, O God,
 In this prison world,
 That the chanting glorious clarion Nightingale
 May free our inmost beings into light.*

Scales of Time

As the poem's words fade from Will, the Nightingale's unutterably-sweet tones unfold their meanings, truths that dance and turn and weave, calling him to awaken.

"Were you to ponder, but for a while, these utterances in your heart, you would surely find the portals of understanding unlocked before your face, and would behold all knowledge and the mysteries thereof unveiled before your eyes. Such things take place only that the souls of men may develop and be delivered from the prison-cage of self and desire.

"Otherwise, that ideal King hath, throughout eternity, been in His Essence independent of the comprehension of all beings, and will continue, forever, in His own Being to be exalted above the adoration of every soul. A single breeze of His affluence doth suffice to adorn all mankind with the robe of wealth; and one drop out of the ocean of His bountiful grace is enough to confer upon all beings the glory of everlasting life.

"But inasmuch as the divine Purpose hath decreed that the true should be known from the false, and the sun from the shadow, He hath, therefore, in every season sent down upon mankind the showers of tests from His realm of glory."⁴⁴⁸

Sixteenth Fall

*From sums to products, a few thousand years;
From products to exponentials, a few hundred years;
What now?*

Consciousness comes to Will in shards, fragments, puzzle pieces that only slowly connect into thought. His eyes and ears and hands seem numb, inert, inaccessible. He drifts in time.

It is 1971. Notes in hand, Will stands up nervously before a raucous meeting school board of the city where he lives with his family. The tumult is erupting – the school superintendent proposed a plan for busing students among the school districts to balance out the distribution of students from diverse backgrounds. The white residents and parents in the city are mounting a bitter and uncompromising opposition to the proposal, calling it "forced busing", and resorting to racial slurs, threats, and defamation to rally support.

The Bahá'í Assembly of the city approved Will's representation before the school board. It calls for a peaceful way forward through consultation, and for adherence to the principle of racial equality and unity. In the chaos and fury of racial hate, the heartfelt appeal is lost.

The idea of 'now' gradually takes root in Will. Both palms are down on a smooth, glassy surface. His right cheek and jaw rest on his right hand. It is dark and silent around him as he lies, coming to wakefulness, starting to gather and scramble until the emptiness and lack of signs and place warn him to stop.

Crowds of the people of his journey come and go in his mind. Visions of places emerge and pass. The room, the bridge, the landfills, the fields, the vastnesses of space, the oceans, the islands, the meadows, the cities, the jungles, the deeps. Language, metaphor, mathematics,

⁴⁴⁸ Bahá'u'lláh, Kitáb-i-Íqán, Para.. 56

cosmology, astronomy, astrophysics, biology, sociology. And more. Exhaustion gently blankets him over, here on this – cold? – smooth dark spot of nowhere. He lies still, his heart stirring its slow urgings of blood in him.

“Get up.” An unusual low voice, with a cadence and music all its own. “Get up, traveler. You have a long way to go.”

Will. “I thought I had come a long way already. There is more? Much more?” It comes out in a groan.

The voice erupts in a huge laugh. “Always! There is always more, here! Stand up, small one!”

Will feels his way to unsteady feet and stares into very-dim light ahead of him. Disappointment comes – it is the bridge again, except that now it is much wider than the hot-wire hair of his earlier high-wire passage and fall. “At least it looks harder to fall off this one.”

The laugh again. “Size matters. Now you are small. See?”

Will stares around for the speaker. Ahead he sees a dark heap, resembling something scaly. A claw? He strains to see it better, a halting step, and his eyes trace upwards from the heap to a tower disappearing in darkness high above. Two glowing disks look down at him.

“Here.” The two disks – eyes – blink, and he now stands nestled next to the shining-feathered neck of a gigantic bird. *Bird, again.*

“Who or what are you?” he asks.

“You would call me Phoenix in your old ways of language, or Firebird. Or Simurgh. Or any of many other names. The names do not matter. I am here for your final great flight.”

“That sounds... rather final.”

“Do you not say to yourself, ‘I will die soon?’”

“Well, yes, I say a lot of things.”

“When you say truth, it matters most.”

Will shivers. The Phoenix turns and lowers itself, offering him a place high on its back. Will scrambles clumsily up through stiff-edged feathers to sit hunched forward, legs straddled wide,

“Traveler, it is time, and now you must hold on tightly. Listen now to the hummingbird. He will tell you a challenge.”

The tiny bird comes from darkness to hang vibrant by Will's ear.

“As a further testimony to the greatness of the Revelation identified with Bahá'u'lláh may be cited the following extracts from a Tablet addressed by 'Abdu'l-Bahá to an eminent Zoroastrian follower of the Faith:”⁴⁴⁹

At this moment the voice of the warbler, clear and pure, comes through so close that Will turns to look, but senses only heat.

“Thou hadst written that in the sacred books of the followers of Zoroaster it is written that in the latter days, in three separate Dispensations, the sun must needs be brought to a standstill. In the first Dispensation, it is predicted, the sun will remain motionless for ten days; in the second for twice that time; in the third for no less than one whole month.

“The interpretation of this prophecy is this: the first Dispensation to which it refers is the Muhammadan Dispensation during which the Sun of Truth stood still for ten days. Each day is reckoned as one century. The Muhammadan Dispensation must have, therefore, lasted no less than one thousand years, which is precisely the period that has elapsed from the setting of the Star of the Imamate to the advent of the Dispensation proclaimed by the Báb. The second Dispensation referred to in this prophecy is the one inaugurated by the Báb Himself, which began in the year 1260 A.H. and was brought to a close in the year 1280 A.H.

“As to the third Dispensation—the Revelation proclaimed by Bahá'u'lláh—inasmuch as the Sun of Truth when attaining that station shineth in the plenitude of its meridian splendor its duration hath been fixed for a period of one whole month, which is the maximum time taken by the sun to pass through a sign of the Zodiac. From this thou canst imagine the magnitude of the Bahá'í cycle—a cycle that must extend over a period of at least five hundred thousand years.”⁴⁵⁰

Disbelief forces words from Will. “What is all this? The time scales, the predictions, the metaphors! It's confusing me! What does any of this mean for me?”

The deep avian-alto laugh again. “The scales of your earth's history, change, and destiny reach far outside the scales of your everyday lives, but you must work to reconcile it all in your minds and hearts.”

“Why? Religion interpenetrates and shapes our daily lives. It doesn't have the reach of geological or astronomical eras.”

“Until now, that has been true. It is true no more. Now you must extend your understanding of religion's true grandeur, even as you let its intimacies reassure you.”

⁴⁴⁹ Shoghi Effendi, in *The World Order of Bahá'u'lláh*, in the section titled “The Dispensation of Bahá'u'lláh”, in the first subsection titled “Bahá'u'lláh”, p. 101.

⁴⁵⁰ 'Abdu'l-Bahá, quoted by Shoghi Effendi, in *The World Order of Bahá'u'lláh*, in the section titled “The Dispensation of Bahá'u'lláh”, in the first subsection titled “Bahá'u'lláh”, pp. 101-102.

"But... a half million years? If we reach all the way back to the era of Zoroaster just three thousand years in our past, this is overwhelming!"

"You begin to understand."

The Great Cycle Begins

Will's mind flounders. "This duration of the Bahá'í cycle is baffling in this passage. How might it be reckoned? Its claim is staggering!"

Back comes the hummingbird.

"Concerning your question relative to the duration of the Bahá'í Dispensation: There is no contradiction between Bahá'u'lláh's statement in the Íqán⁴⁵¹ about the renewal of the City of God once every 1000 years, and that of the Guardian [Shoghi Effendi] in the "Dispensation" to the effect that the Bahá'í cycle will extend over a period of at least 500,000 years. The apparent contradiction is due to the confusion of the terms "cycle" and "dispensation". For while the Dispensation of Bahá'u'lláh will last for at least one thousand years, His cycle will extend still farther to at least 500,000."

"The Bahá'í cycle is, indeed, incomparable in its greatness. It includes not only the Prophets that will appear after Bahá'u'lláh, but all those Who have preceded Him ever since Adam. These should, indeed, be viewed as constituting but preliminary stages leading gradually to the appearance of this supreme Manifestation of God."

"After Bahá'u'lláh many Prophets will, no doubt, appear, but they will be all under His shadow. Although they may abrogate the laws of this Dispensation, in accordance with the needs and requirements of the age in which they appear, they nevertheless draw their spiritual force from this mighty Revelation. The Faith of Bahá'u'lláh constitutes, indeed, the stage of maturity in the development of mankind. His appearance has released such spiritual forces which will continue to animate, for many long years to come, the world in its development."

"Whatever progress may be achieved in later ages—after the unification of the whole human race is achieved—will be but improvements in the machinery of the world. For the machinery itself has been already created by Bahá'u'lláh. The task of continually improving and perfecting this machinery is one which later Prophets will be called upon to achieve. They will thus move and work within the orbit of the Bahá'í cycle."⁴⁵²

Awed, Will mutters, "We're standing on the threshold of the entire cosmos."

The phoenix spreads great wings, and they are aloft, moving easily above the bridge, which extends toward a lost point of light, like a star, in an impossible distance. The great bird's

⁴⁵¹ In the *Kitáb-i-Íqán* Bahá'u'lláh sets forth the proofs of the truth of the periodic, progressive revelations from God, including especially His own.

⁴⁵² Shoghi Effendi, from a letter dated 14 November 1935 written on his behalf to an individual believer.

voice brings a soothing hum that eases Will. "The reckoning of time in 'Abdu'l-Bahá's exposition of the Zoroastrian prophecy is not a physically-defined process in any strict, symmetric, arithmetic sense. According to Him, the physical duration of the Dispensation of Muhammad treats each day in the Zoroastrian prophecy as a century; the physical duration of the Dispensation of the Báb treats each day as a year; and the physical duration of the Dispensation of Bahá'u'lláh apparently treats each day of the sun's transit of a Zodiacal sign (a 30-day month, approximately) as lasting about 16,700 years, when seen as the entire overarching Bahá'í cycle."

Will. "But I'm left confused. There's a shifting base on which these intervals are interpreted. There's also a distinct difference between the simple treatments of the first two Dispensations and the more-complex treatment of the Dispensation of Bahá'u'lláh."

"Your confusion is understandable. But to treat the half-million-year interval as a merely-physical measure is to overlook its richness and inner potency. Look at its interconnections of the physical, the metaphorical, the calendric, and the spiritual."

Will senses connections. "So there is a shifting of time scales, as I witnessed with the supernova and the copper and gold. Does that apply here as well, both physically and spiritually or prophetically?" They are gliding on what seems an endless arc in space over the line of the bridge below, and Will is relieved that there's no need to plod along it struggling to stay balanced.

Again the tiny hovering mote of the hummingbird croons with its wings.

"Concerning the passage in the Dispensation of Bahá'u'lláh in which the Guardian [Shoghi Effendi] quotes 'Abdu'l-Bahá's interpretation of the prophecy referring to the times when the sun would stand still in the heavens, he wishes me to explain that the days referred to in this prophecy have to be reckoned differently.

"In the Scripture of various religions there are to be found frequent references to days, but these have been considered as indicating different period of time, as for instance in the Qur'án a day is reckoned as one thousand years. The first ten days in the above mentioned prophecy represent each a century, making thus a total of one thousand lunar years. As to the twenty days referring to the Bábí Dispensation each of them represents only one lunar year, the total of twenty years marking the duration of the Revelation of the Báb.

"The thirty days in the last dispensation should not be reckoned numerically, but should be considered as symbolizing the incomparable greatness of the Bahá'í Revelation which, though not final is none-the-less thus far the fullest revelation of God to man. From a physical point of view, the thirty days represent the maximum time takes by the sun to pass through a sign of the zodiac. They thus represent a culminating point in the evolution of

this star. So also from a spiritual standpoint these thirty days should be viewed as indicating the highest, though not the final stage in the spiritual evolution of mankind."⁴⁵³

The ethereal soft sound lingers, and the words "thirty days in the last dispensation should not be reckoned numerically, but should be considered as symbolizing the incomparable greatness of the Bahá'í Revelation" touch Will, and he voices them quietly to himself. The phoenix flies on. Then come words again from the hummingbird's visit, that the thirty days "represent a culminating point in the evolution of this star." Incredulous, Will repeats them, then asks aloud, "Does the word 'star' here refer to the physical sun around which our earth orbits?"

The phoenix says, "The implications are overpowering. This assertion reinforces the paramount character of the Revelation of Bahá'u'lláh now beginning its unfolding. Your world has developed over billions of years. At no time has it seen such an elevation, an ascent, a transcendence of this nature, moving both in the greater worlds of God and in your physical world."

Nightingale and hummingbird dance just ahead, the Nightingale singing.

*"That which hath been made manifest in this préeminent, this most exalted Revelation, stands unparalleled in the annals of the past, nor will future ages witness its like."*⁴⁵⁴

As it disappears again, the hummingbird's wings warm Will with a little grace.

*"There are no Prophets, so far, in the same category as Bahá'u'lláh, as He culminates a great cycle begun with Adam."*⁴⁵⁵

The Báb's Explosion, Unexpected

Skepticism still gnaws at Will. "But all this relies on arbitrary-looking shifting scales and placements of time intervals. In science, such interpretations lack any apparent rational basis for their meaning. They seem to rely on the desires of the interpreters to make the scripture resonate with their own ideas of what the meanings should be."

The phoenix is silent. Will goes on, "Given all the ways one can generate connections in scriptures, it seems easy to make a scriptural prophecy mean whatever one wants it to mean. Metaphor and physical meaning seem to mingle and confuse the reader. How can such inconsistency of understanding be resolved?"

⁴⁵³ From the compilation *Lights of Guidance*, p. 472. Written on behalf of Shoghi Effendi to the National Spiritual Assembly of the United States and Canada. Quoted in an essay by Y. A. Ioannesyan, "Reflections on Some Messianic Prophecies in Shaykhi Works"

⁴⁵⁴ Quoted by Shoghi Effendi in *The World Order of Bahá'u'lláh*, The Dispensation of Bahá'u'lláh, pp. 103-104.

⁴⁵⁵ Found in *Lights of Guidance*, p. 473. Written on behalf of Shoghi Effendi to the National Spiritual Assembly of Australia and New Zealand, December 26, 1941. The "great cycle begun with Adam" embraces all the prophets and Manifestations of God from Adam to the time ending with the appearance of the Báb.

Emboldened by the continuing silence of the phoenix, he adds, "Science, properly practiced, is our very best means of reading and advancing our physical reality. And the continuing flood of marvels and advancements in our modern age testifies conclusively to the fact that scientists are practicing their profession properly and with great discipline and success. Is there any scientific resonance with the changes of time scales in authentic religious scriptures?"

Now the great guide rocks slightly back and forth in flight, rolling gently. It speaks in soft thunder, "Scientists are quite comfortable moving from one scale of time or space to another, as long as the change of scale does not violate the generally-accepted symmetries and conservation laws of your physical world. Orders of magnitude are no obstacle to science; they are its commonplace tools of comprehension."

"Do you recall your supernova story, when the burning of its initial hydrogen takes billions of years, while the collapse and rebound of the star at its end happens in milliseconds? The time scales differ by nine or more orders of magnitude."

Will says, "Yes, the ride with the black swan! It spoke of the fractal scalings of nature! So the three calendric time periods of the hummingbird's wing-sounds are 1,000 years, 20 years, and in excess of 500,000 years. These represent three distinct orders of magnitude, spanning roughly five orders. The first two are defined as 'dispensations'. What is a religious dispensation?"

The phoenix says, "It is a period during which the laws bestowed by a single divinely-appointed revealer hold effect. Those laws engender advancement, order, and stability in the human world."

"All right. But the third is defined as a 'cycle'."

"Aaah." The great bird exhales sparks. "A cycle is a greater interval embracing a series of dispensations. Recall the hummingbird's *'For while the Dispensation of Bahá'u'lláh will last for at least one thousand years, His cycle will extend still farther to at least 500,000'*. So this refers to the duration of the entire cycle within which a succession of Manifestations appears, beginning with Bahá'u'lláh Himself."

"I still can't make all these different time intervals into a meaningful pattern."

"It takes some deeper consideration. Start here: Each new religious dispensation brings change, fiercely resisted by many who occupy positions of power and influence." And the incantations of the Nightingale approach them from far off.

"... had these people in the days of each of the Manifestations of the Sun of Truth sanctified their eyes, their ears, and their hearts from whatever they had seen, heard, and felt, they surely would not have been deprived of beholding the beauty of God, nor strayed far from the habitations of glory. But having weighed the testimony of God by the standard of their own knowledge, gleaned from the teachings of the leaders of their faith, and found it at variance with their limited understanding, they arose to perpetrate such unseemly acts.

"Leaders of religion, in every age, have hindered their people from attaining the shores of eternal salvation, inasmuch as they held the reins of authority in their mighty grasp. Some for the lust of leadership, others through want of knowledge and understanding, have been the cause of the deprivation of the people.

"By their sanction and authority, every Prophet of God hath drunk from the chalice of sacrifice, and winged His flight unto the heights of glory. What unspeakable cruelties they that have occupied the seats of authority and learning have inflicted upon the true Monarchs of the world, those Gems of divine virtue! Content with a transitory dominion, they have deprived themselves of an everlasting sovereignty."⁴⁵⁶

The phoenix allows the strains of this sorrowful harmony to fade. "Now think of the 'conservation laws' of physics. Apply them to the energies and durations of these dispensations. If you use the 1,000-year period as a metrical standard, it looks like an order-of-magnitude approximation for the period between renewals of divine knowledge in the human world. That is along the lines of a regular, global course of study in the process of the education of the human species."

"As if humanity is being schooled, all right. I understand that."

"Good. As such a period ends, humanity is presumably in condition to receive the next revelation of divine knowledge and teaching, but human resistance is deep and powerful. The arrival of a revelation roils the whole world, releasing great transformative energies that dissolve the old order and initiate a new one. The greater the difference between the old order and the new, the greater must be the energies released to bring about the transformation."

"Energies' – I see where you may be taking this."

"If you predicted the duration of the Báb's Dispensation on the basis of past regularity, what would you have guessed?"

"Something similar to that of Muhammad's, probably."

"As you see, this is not the case. Such an expectation is linear, without much change between durations at all, much less any change in order of magnitude. There is nothing at all linear or regular about the differences in the periods set forth in Shoghi Effendi's passage!"

"Aha! The star took ages to burn its hydrogen, and milliseconds to collapse and explode. Is that the pattern you're describing?"

"Yes! From a consistent pulse of about a millennium between successive past dispensations up through that of Muhammad, suddenly we see the brief and violent flash of the Báb's twenty-year dispensation, and then comes the overwhelming light of Bahá'u'lláh's

⁴⁵⁶ Bahá'u'lláh, *Kitáb-i-Íqán*, pp. 14-15.

dispensation and cycle of unimaginable duration. See the nonlinearities of both religion and nature!"

"Furthermore, the Báb and Bahá'u'lláh gave us gifts beyond those of all their predecessors: their voluminous **written** works in the hands of these divine Authors, pouring out revelatory information from beyond your human world. There is no known historical precedent, not even in Islam. The presence of such written, preserved, revelatory material magnifies, propagates, and stabilizes the pure, transformative energies it brings into your world. You can see this in your sciences of today, shining with unprecedented knowledge and wisdom."

The voice of the phoenix is thunder. "In past dispensations, no recorded conferral of authority by the dispensation's Author was left you. Coupled with the lack of maturity of humanity in past times⁴⁵⁷, conflict and division among the followers arose and destroyed their unity and peace. But the Covenant of Bahá'u'lláh, written by Him in His own hand, has withstood assault after assault, disruption after disruption, to raise up and preserve a unified, stable, advancing, harmonious world community."

A span of silence. Will looks into a dim distance ahead – they are flying level and smoothly, but the air around them churns with mists. He asks, "Where are we going?"

"You'll see, soon. I will finish this theme for now. The vast upheavals arising from the explosive release of transforming energies by the Báb in His copious writings and addresses testify to the unprecedented power of those energies. The Writings of Bahá'u'lláh are so voluminous that even after a century the preponderance of them have not been made generally available. Shoghi Effendi writes that Bahá'u'lláh produced a hundred volumes."

"Compare this output of revealed knowledge from beyond human range with the nearest comparable work from an earlier dispensation, the Qur'án: a single modest volume revealed to Muhammad over a lifetime. How vast a time scale must be needed to unravel the astonishing range of knowledge contained in what Bahá'u'lláh has revealed! Humanity is now faced with its emergence into its early stages of maturity."

Will's mind seems to sag in him. "Could we look at science again? I need to see some resonant parallels and illuminations."

The phoenix abruptly performs a slow, smooth roll in flight. Will clutches desperately to stay at its neck, snatching at great, hot-bladed feathers for grip. "Of course! But you had better not fall off. We are going to dance astrophysically with time, space, and scale now. Back to the supernova!" The bridge and darkness give way to blinding light.

⁴⁵⁷ Adib Taherzadeh, in his book *The Covenant of Bahá'u'lláh*, writes (p. 159): "A careful study of the history of religions will enable us to realize that the Manifestations of old... did not make an unequivocal written Covenant with their followers because of the immaturity of the people of the age, who could not have sustained the rigours, the tests, and the strict discipline which the observance of such a Covenant would inevitably have required."

The Supernova Explosion, Revisited

"Let us move through ten million years in a moment or two." The phoenix hovers at the surface of a blinding star 25 times the weight of the Sun, watching its native hydrogen burn into helium on the scale of ten million years in a few of Will's heartbeats. The star's color and radiance shift.

"Now, a shift in scale – we move a million more years. The helium is now fusing mostly to carbon." Again, subtle change in the star's coloration.

"The next stage is a thousand years, not more – a big reduction in scale. The carbon is now burning to heavier elements."

A short pause as again the star's appearance shrinks and shifts. "Again, time expands as we shift. The remaining elements – neon, oxygen, silicon, and other of similar weight – fuse in less than three years. During all of these stages of fusions, coming and going faster and faster, the energy released provides enough outward pressure to keep the star from collapsing. The time scale has tightened from millions of years down to just a few. But each stage weakens that outward pressure."

"In the end, the process leaves only nickel, cobalt, and iron. Here is the problem: none of these can fuse under the normal conditions existing within the star that generated them. With no fusion taking place, there is no outward pressure from fusion energy to support the star's mass against its inward gravitational pull."

Will now witnesses the final subsecond time interval of the star, his perceptions speeded to synchronize with the accelerating rate of events.

"The star collapses completely. It takes only *milliseconds*."

To Will it all moves slowly. Nothing at first, since the outer shell of the star conceals the events at its core. "Let's dive in," says the phoenix, and in they go, plunging blinded into the wrack of ultrahot gas. They arrive to see the outer part of the star's core speed inward at a quarter of the speed of light. With their accelerated awareness, it seems a slow contraction.

"Hang on tight!" Now there is only a small, compressed ruin of atomic nuclei jammed, fused into one giant nucleus in a frozen instant, and as they watch, it rebounds, coming apart into monstrous fragments of superincandescent metal, fused from the iron, nickel, cobalt, and any remaining lighter nuclei further into all of the remaining heavier elements. Even though their time scale is accelerated, the phoenix is forced to dodge and twist desperately as Will grips its neck. The star-fragments begin their outward flight to the universe.

"What is left there?" Will points at what seems a brilliant coal.

"That is the core remnant. It is superhot neutronium. This is now a small neutron star, basically a single great atomic nucleus. It is not ordinary matter, because it holds all of the electrons and protons that would normally be separate in an atom."

"So from an ordinary star, living its long life, everything has changed! But we find all the elements on the star's blown-away fragments at home on Earth. They didn't even exist before the star collapsed!"

"Yes. They are the building blocks of your material existence, the alphabet of nature's discourse, from hydrogen through uranium and a few more."

"So we have a ninety-two-letter alphabet of nature!"⁴⁵⁸

"You could put it that way." And little by little their time passage seems to normalize, as the phoenix rises to draw them back into space and their stately journey along and above the bridge's infinite-seeming span.

Will speaks slowly. "It never occurred to me – these changing timescales of our life's movements are far from uniform! Some processes take great swaths of time and then feed directly to others taking almost no time at all. But both are inseparable parts of a great chaotic, dynamic flow of development and change."

"So it is in the scientific perspective. What does this tell you about the patterns of human processes of social and spiritual change?"

"They seem to apply changing timescales, on varying orders of magnitude, as well."

The History Explosion and the Laughing Phoenix

The great bird's deep voice has a soothing effect on Will. "These three revelations in calendric terms – 1,000 years for Islam, 20 years for the Dispensation of the Báb, and in excess of 500,000 years for the Cycle of Bahá'u'lláh – vary in duration from two decades at the short end to more than 50,000 decades at the long end, amounting to about five orders of magnitude of difference."

Will has depleted his energies in their mad ride. Sleepily, he asks, "What insights can you suggest for understanding the duration of the Bahá'í Dispensation and cycle? It still makes me wonder. It's unlike all the cycles that came before it. They had a regularity, a rhythm, that remained fairly consistent over many repetitions."

The phoenix ruffles its neck feathers a little, letting Will become a bit more comfortable. Its feathers are large, surprisingly soft, but with sculpted edges that seem to dissolve into a fractal kind of boundary. Will looks more closely at one of them, and each barb of the feather replicates the pattern of the feather, down to a next branching into barbules with the same convoluted edges. Peering closer, he sees an even-smaller similar pattern. It is mesmerizing.

Will asks, "Your feathers are so unusual. You said you are a phoenix. All I can remember about a phoenix is that it renews itself by fire – destruction and regeneration. Is that true?"

⁴⁵⁸ The number 92 is approximate, because instability eventually causes a few elements, notably those heavier than lead and two lighter ones, to decay radioactively to others.

The sound that comes from the great bird is gusty, rhythmic, delightful, making Will come sharply awake. It says, "You amuse me, and give me joy to answer. First, I am not a phoenix, or a Phoenix. I am phoenix. That means now that I am a phoenix, and I am Phoenix, and I am the type called phoenix, and the type of types, and inward to meaning. It is not the ideals of antiquity, the Platonic way. All these ways of realization blend for you, so that names gather in swarms around meanings, breeding, changing always. Names are living creatures of thought."

"But... fire?"

"Yes, but there is more you need to understand. There are two varieties of process to consider: the cyclic and the transitional. Cyclic processes in a system, such as a heartbeat or a series of courses of study in a subject, or even the phoenix cycle of life and regeneration, imply a homeostasis or dynamic balance that keeps the process repeating. But transitional processes in a system, such as a supernova explosion or a student's graduation from studies, imply a permanent or lasting change in the system from one dynamic balance to another – or to further transition."

"This is sounding familiar. I remember, earlier in this journey, Kolme telling me about the Lorenz attractor, flipping from one set of cyclic states to another."

"That is the heart of it. Here in our current place in the journey you can see that the two sets of states need not be symmetric – one may lead to the other, but there may be no return."

"But your fire-change is cyclical – it returns again and again."

Phoenix pauses for a long moment. "There will be something coming soon that will clarify much for you on that question. I'd rather not disclose it yet – you are not ready. Instead, let me explain transitions more fully."

"In a transitional process, sufficient energy is stored up from the recurring cyclic processes preceding it to begin the transition. This stored energy, released in a brief spasm, overcomes the forces sustaining the dynamic balance of the cycles. The cyclic balance is disrupted completely, shifting the system into an entirely-distinct state, possibly with a new range and pattern of cycles. The supernova explosion illustrates the point. Modern physics treats such processes as parts of the dynamics of chaos and equilibria, which we have seen briefly here earlier⁴⁵⁹."

"Now look at the Revelations of the past, dating from earliest recorded history to the 19th century. Viewed together, they appear to you as great cyclic processes, each one bestowing new information and transformation on the human world. They are punctuated by brief transitions at their beginnings leading to their rapid ascendancy and stable continuation, with shorter historical cycles nested within them. These great cycles were of the order of

⁴⁵⁹ The section titled **Two Misperceptions** characterizes chaotic dynamical systems having both cyclic and transitional behavior.

1,000 years, and the transitions from their predecessors shared similar patterns: revelation, obscurity, persecution, promulgation, acceptance, advancement, decay, and eventual replacement.”

Will says, “That seems clear, and historians rely on such patterns to frame their observations.”

“Until now. But the evidence you see with these three most-recent Dispensations shows this pattern has now made a far more powerful transition than ever before. It hasn't just replaced the most-recent cycle. It has replaced the entire pattern of cycles. Suddenly, too! It is a global phase transition. The energies needed are much greater than those of the past transitions in the cyclic process of the past.”

“First, the Holy Qur'án was one single volume of 6300 verses. By contrast, concerning the Revelation of Bahá'u'lláh, let the hummingbird sing it to you.

“With this book [Epistle to the Son of the Wolf], revealed about one year prior to His ascension, the prodigious achievement as author of a hundred volumes, repositories of the priceless pearls of His Revelation, may be said to have practically terminated—volumes replete with unnumbered exhortations, revolutionizing principles, world-shaping laws and ordinances, dire warnings and portentous prophecies, with soul-uplifting prayers and meditations, illuminating commentaries and interpretations, impassioned discourses and homilies, all interspersed with either addresses or references to kings, to emperors and to ministers, of both the East and the West, to ecclesiastics of divers denominations, and to leaders in the intellectual, political, literary, mystical, commercial and humanitarian spheres of human activity.”⁴⁶⁰

The Phoenix whispers, “And the Nightingale calls so beautifully...”

“Whereas the verses which have rained from this Cloud of divine mercy have been so abundant that none hath yet been able to estimate their number. A score of volumes are now available. How many still remain beyond our reach! How many have been plundered and have fallen into the hands of the enemy, the fate of which none knoweth.”⁴⁶¹

“And ah! Yet more!”

“Now, following His manifestation, although He hath, up to the present, revealed no less than five hundred thousand verses on different subjects, behold what calumnies are uttered, so unseemly that the pen is stricken with shame at the mention of them. But if all men were to observe the ordinances of God no sadness would befall that heavenly Tree.”⁴⁶²

⁴⁶⁰ Shoghi Effendi, *God Passes By*, XII, p. 220.

⁴⁶¹ Bahá'u'lláh, *Kitáb-i-Íqán*, pp. 199-200.

⁴⁶² The Báb, *Selections from the Writings of the Báb*, in the section titled “The Persian Bayan”, VI, 11.

The hummingbird vanishes in an eyeblink. Will says, "I can see now that when one considers the vast outpourings of the Báb and Bahá'u'lláh, rejuvenating the world with information from the greater existence, one must agree that any timescale to be generated must be correspondingly huge, and the upheaval of transition beyond imagination, even beyond that of a star gone supernova!"

Again that deep, rhythmic, heaving phoenix laugh. "Yes! You can see in the collapse, the 'rolling-up' of your crumbling world order, the utter obliteration of the former structures and dynamics of your long human past. In the moment of greatest collapse you can see in the Revelation of the Báb the formation of the entire 'alphabet' of the elements⁴⁶³ of your new world order, your new range of human potentials and processes, and in the explosion of the Revelation of Bahá'u'lláh you can see the full, radiant efflorescence of all of the elements of this great range being spread out before you."

"The Báb gave His estimate of having revealed 500,000 verses in was 1848. At that time, He was imprisoned in the fortress of Mákú (Mah-ku), and He still had two years to live before He was executed by a firing squad on July 9, 1850. His entire Dispensation had begun in 1844 and was to end nineteen years later in 1863, when Bahá'u'lláh publicly revealed His own station, beginning the half-million-year cycle we have been passing on this flight. The Prophet Muhammad revealed a total of around 6300 verses in all, and His Dispensation lasted for around 1260 years."

"That is quite a difference! But what are you suggesting?"

"It is! Consider each verse of the Báb's Writings to be the equivalent in power and impact of one verse from the Prophet Muhammad. Then a linearly-proportionate length of time one might assign to the Báb's Dispensation would be on the order of 100,000 years! Clearly the explosive, transformative power unleashed in the verses of the Báb alone, compressed into His all-too-brief 20-year ministry, defies all limits of human comprehension!"

In Will's mind, his conversation with Kolme about chaos dynamics surfaces. He says, "I recall from long ago in this journey that the state of the world can stay in one kind of cycle for a long time, but then a single tiny shift can move the world into a completely-different cycle of states. Is that what has happened with the coming of the Báb? It seems to have shifted us into a whole new range of cycles." He

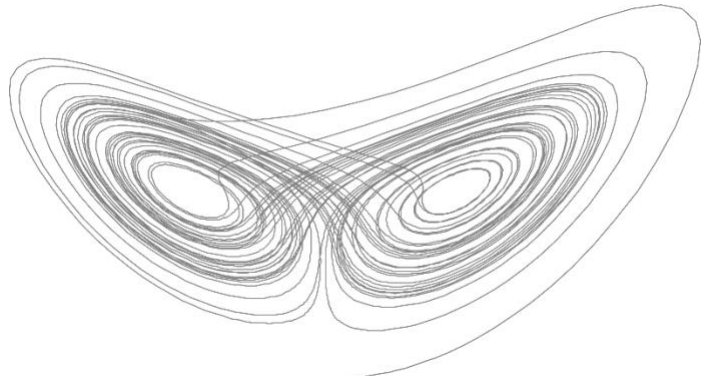


Figure 28- The Lorenz attractor

⁴⁶³ There will be more on this point in the upcoming section titled **The Coding of Realities** [Alphabets](#).

envisions the Lorenz attractor, with some of its trajectories of one state veering across to a state with altogether-different trajectories.

The phoenix slowly nods its great head. "Yes, except that what appears a tiny shift in your everyday world – an evening of initial revelation offered by the Báb solely to Mullá Husayn – is in the greater world a cataclysmic upheaval."

"But what about the even-greater volume of the revealed works of Bahá'u'lláh?"

"That is astonishment for later." As the phoenix speaks, it banks and soars into the dark starry sky's infinite emptiness. "To help you appreciate all this better in your own world, we return to the astronomical setting. Now we '*traverse the expanse of heaven.*'"⁴⁶⁴

They emerge from darkness to circle the earth, and the great bird says, "Out here, the very meaning of time becomes transformed. You count your hours as 24ths of a day – but what is a day on a space station that circles the earth every two hours, or on an interplanetary probe? You count your year as the earth's circuit of its solar orbit, but the year on Mars is longer. You mark your seasons by the ridings of the sun in warming your fields and forests. You count your months by the phases of earth's moon. You are cradled on your planet – but you struggle in this extraordinary age to leave it. Are you ready to do this?"

A flash, and a great blue globe is before them. "What do you call a season or a day on the planet Uranus, where the planet's axis is so tilted that the day is half of a Uranian year – which itself is about 84 earth years long? There, the season and the day seem to be the same."

Another flash, and a star unlike the sun shines in Will's eyes. The phoenix continues, "When you sail at last away into interstellar space, your nearest stellar neighbor, Proxima Centauri, is over 25 trillion miles from the sun. How do you measure the passage of time? Indeed, can you even live in such an expanse in the same timescale as here on earth, in which your seconds are heartbeats?"

Again a flash, this time into pitch darkness marked only by remote points of light. "Here, halfway between stellar neighbors, your current space vessels seem like matchstick rafts with toothpick oars in such immensity. To travel between stars at the maximum speeds you can even consider in today's world, on the order of 1000 miles per second, would take 25 billion seconds, or given about 31 million seconds in an earth year, about 800 years at that speed – a bit more counting acceleration and deceleration."⁴⁶⁵

⁴⁶⁴ A phrase taken from *The Hidden Words of Bahá'u'lláh*, Arabic no. 40: "O SON OF MAN! Wert thou to speed through the immensity of space and traverse the expanse of heaven, yet thou wouldst find no rest save in submission to Our command and humbleness before Our Face."

⁴⁶⁵ Many authors of science fiction, the present author included, have calculated the durations of interstellar travel using speeds consistent with known technologies, and the results teach us humility. Until we find 'wormholes' as theorized in the film 'Interstellar', or develop means of travel that transcend our current physical limitations, we are consigned physically to our own planetary world and our neighbors circling the sun. And as it happens, we have much work facing us long before we pack our bags for the stars.

Will is numbed. The great bird continues. "800 years is ten times a normal human lifespan, so to keep your hearts from wearing out, they would need to beat once every ten seconds. On the trip to Proxima Centauri, in effect, you have multiplied the duration of your 'second', as measured by the human heart, by a factor of ten."

Will speaks haltingly. "It's beyond imagination. Nothing in the sacred scriptures of the past says anything about... such things. There was no need!"

Another mighty avian chuckle. "Indeed. But now, in this age of light, you confront this need! You see your universe's great variety and richness in every detail of its complex and bewildering rhythms."

Will bursts out, "We are on our way outbound, into the stars!"

Again that great throaty laugh, a bass warble. "Not just yet. The Nightingale warns you."

*"O SON OF MAN! Wert thou to speed through the immensity of space and traverse the expanse of heaven, yet thou wouldst find no rest save in submission to Our command and humbleness before Our Face."*⁴⁶⁶

"You have much work ahead. First you must learn your true alphabets, and become literate in the vast unknowns you are finding. You are just now at the very beginnings of all that."

The Language Explosion and the Alphabets of Reality

*Put it all together and it spells,
The mighty spell of language and of making,
Signs, letters, and symbols can impel
The mind to love the dawn as it is breaking.*

"Who are you?" A soft voice in Will's ear, and he almost loses his grip on the phoenix. He turns his head into a sweeping nimbus of long and curled dark hair breezing around a dark, entrancing feminine face that seems alight from within.

"I'm traveling," he says, nosing the flowing cloud of hair aside. "This great bird is taking me along the way. Who are you?"

"You will know in time. I've been watching over you for most of your traveling. I have a question for you. You seem to be scanning and connecting inscriptions from all over your universe. What is this telling you?"

Will pauses, and says, "It seems to me that both religion and science at their best can offer us pathways to decrypting, unpacking, and comprehending these inscriptions – but the process is an unending challenge."

"Tell me some of the things you have found – examples." She is close to Will, beside and behind him, in the swirls and eddies of passing air.

⁴⁶⁶ Bahá'u'lláh, *The Hidden Words of Bahá'u'lláh*, Arabic No. 40.

He's lightheaded, and a list takes shape in his mind. Words come out as chanted verse, reminding him of the singers he's met.

*"We decipher a coded hotel room number on a door,
A light burst from a dying star,
An X-ray diffraction pattern from a crystal,
A Babylonian multiplication table,
An essay in Mayan glyphs on the question
Of the beginning and end of time,
A magnetic-resonance-imaging
Scan of a human brain,
A divinatory hexagram
Of the characterized I Ching,
A coded letter from a man to his lover,
A sea of data points from an astrophysical survey,
A trail of a deer's hoofmarks in a forest,
A marching parade of numbers in hexadecimal
From a computer-memory dump,
A word-weave of a novel called Finnegans Wake."*

She is laughing, musically, nodding to Will's uneven tread of stresses. Encouraged, he shifts the pattern and goes on.

*"We are human.
We strive to read reality.
We make mistakes –
We often misread,
We try to read meaning
Into gibberish –
But we learn
And we advance
Past our mistakes.
This is what we humans do."*

"How sweetly you offer all this!" She has drifted around to face him, not holding on at all, and ethereal tracteries of wings radiate behind her, still and yet vibrant. She beams, and Will's eyes tear up from the light.

She asks, "Do you see alphabets, abjads, and written sets of symbols of human language as the real tools of human representation? Do you overlook those signs that come to you from nature: a light burst, a diffraction pattern, a molecular structure, an atomic nucleus, an evolving weather pattern, and others?"

"We distinguish this way, yes."

She nods. "But human representations in your alphabets and natural representations in atoms, molecules, spectra, and more are themselves members of a greater class of expressions performed using compositions of elements, yes?"

"That seems true."

"Then each type of element comprises a letter used in the transcendent orthography of meaning: the ordered flow of information from the greater world to yours. Isn't that the case also?"

Will pauses for a moment, but she weaves an image in the air between them, arching back to make room. "Spell out a sugar, with the formula $C_{12}H_{22}O_{11}$, in its molecular form. It is a word in nature's organic alphabet of 92 chemical elements, written with only three of those letters. carbon, hydrogen, and oxygen. Because the placement and orientation of these three 'letters' is significant, many sugars can be spelled out that have the same formula of

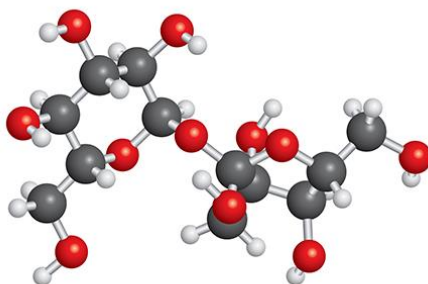


Figure 29 – Sucrose molecular model

12 carbon atoms, 22 hydrogens, and 11 oxygens. If the sugar to be spelled is sucrose – cane sugar – we can depict its spelling like this." The image rotates between them.⁴⁶⁷

"Is that important?"

"Yes! The arrangement of the 'letters', or atoms, in space is critical, just the same as for letters in a word on a page. Sucrose has the same constituent atoms in its makeup as does lactose, so that the formula $C_{12}H_{22}O_{11}$ also applies, except that the atoms in lactose are arranged in a different pattern in space so that the two behave differently in the human body. That's why some people can enjoy the sucrose in ice cream without discomfort, while others react strongly to the lactose that is in the milk used to make the ice cream." And she laughs music again.

Will says, "All the same letters appear in the words 'live', 'evil', and 'vile', but they all very mean different things."

"Yes, traveler. The world of nature is spelled out for you at many tiers of meaning and scale. Particles spell out atomic nuclei. Atoms spell out molecules. Molecules spell out structures in tissues and minerals. Tissues spell out organisms. Organisms spell out social entities.

⁴⁶⁷ Taken from <http://igoscience.com/sucrose-sugar-molecule-ball-and-stick-vector-model-c12h22o11-v1/>.

And in the unique and linear spelling that is the passage of time, all these things evoke and evolve meaning."

She sings, her voice enchanting, and the phoenix turns its head to listen.

*"Connect nature's 'alphabet',
That full range of chemical elements
Formed in the forge of stellar explosions
With your human alphabets,
Those sets of letters and symbols
For your words and ideas
And with the greatest Alphabet,
The one subsuming these two and all others,
The unending flow of utterance
Of the meaning that informs
And sustains all things."*

Nightingale melody approaches and picks up as she finishes her song.

"No understanding can grasp the nature of His Revelation, nor can any knowledge comprehend the full measure of His Faith. All sayings are dependent upon His sanction, and all things stand in need of His Cause. All else save Him are created by His command, and move and have their being through His law. He is the Revealer of the divine mysteries, and the Expounder of the hidden and ancient wisdom. Thus it is related in the "Biḥáru'l-Anvár," the "Aválim," and the "Yanbú" of Ṣádiq, son of Muḥammad, that he spoke these words: "Knowledge is twenty and seven letters. All that the Prophets have revealed are two letters thereof. No man thus far hath known more than these two letters.

The melody drifts through a transition, and then takes up voice in a burst of light.

"But when the Qá'im⁴⁶⁸ shall arise, He will cause the remaining twenty and five letters to be made manifest." Consider, He hath declared Knowledge to consist of twenty and seven letters, and regarded all the Prophets, from Adam even unto the "Seal," as Expounders of only two letters thereof and of having been sent down with these two letters. He also saith that the Qá'im will reveal all the remaining twenty and five letters. Behold from this utterance how great and lofty is His station! His rank excelleth that of all the Prophets, and

⁴⁶⁸ 'Qá'im' is an Arabic title meaning "He Who arises", and in Islamic traditions refers to a prophesied redeemer of Islam. The Báb writes: "He Who hath revealed the Qur'án unto Muḥammad, the Apostle of God, ordaining in the Faith of Islám that which was pleasing unto Him, hath likewise revealed the Bayán, in the manner ye have been promised, unto Him Who is your Qá'im, your Guide, your Mihdí, your Lord, Him Whom ye acclaim as the manifestation of God's most excellent titles. Verily the equivalent of that which God revealed unto Muḥammad during twenty-three years, hath been revealed unto Me within the space of two days and two nights. However, as ordained by God, no distinction is to be drawn between the two. He, in truth, hath power over all things." – from Selections from the Writings of the Báb, Excerpts from the Kitáb-i-'Asmá, XVI, 18.

His Revelation transcendeth the comprehension and understanding of all their chosen ones."⁴⁶⁹

As the nightingale's music wanes, the woman speaks softly, reflectively. "Only two elements: two letters, gradually generating the remaining twenty-five, and then came the explosion of meaning. It mirrors the evolution of the star that has one element, hydrogen, then helium, generating the next twenty-six. And then the star collapses, and all ninety-two elements are formed."

Will says, "You're suggesting a connection."

"More like a resonance, a living metaphor. It is as if the two letters of the Dispensations preceding that of the Báb evoke in the natural world the two simplest elements, hydrogen and helium, that formed the stars in the first place. And during the processes preceding the collapse of a star, whether supernova or not, out of those two elements are formed naturally the next 26 elements up through iron (26), cobalt (27), and nickel (28), which, taken with all of the elements beginning with hydrogen, comprise the initial stellar 'alphabet' of elements: another nice metaphorical resonance. And then came Bahá'u'lláh, and the ninety-two-letter alphabet!"

The Nightingale's voice returns and fills them again.

*"Every single letter proceeding out of the mouth of God is indeed a mother letter, and every word uttered by Him Who is the Wellspring of Divine Revelation is a mother word, and His Tablet a Mother Tablet."*⁴⁷⁰

Will's angelic-seeming companion smiles. "The heavier elements, formed in the supernova process, constitute extensions to this 'language' of matter— an alphabet or script from which the vast compositions of the enduring substances in your material world are written out. How incomparably great are the possibilities!"

She dances in the air now, facing Will, merrily singing out as they all fly. "And look at the genetic codings of your DNA, this long pair of molecular strands holding nucleic acids, or nucleotides. There are only four: alanine, cytosine, guanine, and thymine. The decoding process uses each series of three successive nucleotides, called a 'codon', to synthesize a specific "building block" in the form of an amino acid. There are 64 possible codons, and they generate 20 distinct amino acids, along with start and stop markers for the

⁴⁶⁹ Bahá'u'lláh, *Kitáb-i-Íqán*, pp. 224-5.

⁴⁷⁰ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, from LXXIV, There is a fascinating connection here with the ways in which the Báb focused some of His learned commentaries, or tafsír, on the drawing forth of meanings from the individual letters of verses of the Qur'án. See Todd Lawson, "The Báb's Commentary on the Súra of Wa'l-'Asr" in his "The Dangers of Reading", published in *"Bahá'í Studies Volume III: Scripture & Revelation"*. In the section cited, Lawson describes the rapidity and volume of the revealing of the commentary, presents a translation of the commentary's unraveling of meanings from the first letter of the Súra (wáw), and outlines further aspects and passages from the work.

construction process. The start and stop markers act as punctuation, so there are 22 distinct outputs from the decoding process – 22 letters in the known genetic ‘alphabet’.”⁴⁷¹

“These alphabets, these scripts, are uttered by the creation itself! They are pure information, giving form, pattern, process, and change to the existence of all things. They represent tiers of meaning bestowed in the eternal flow of information from the One Creator, the Self-Subsisting.”

Will's head swims. He stammers, “So many tiers of meaning, all coming from the same source of information!”

She laughs with delight. “It's all just a glimpse of the far-more-vast compositions of divine knowledge – pure information – being poured forth in this universal cycle of Bahá'u'lláh, in which a ‘letter’ isn't just a single written symbol but rather a token of pure meaning. A single character, a word, a phrase, a sentence, a verse, or an entire document – any of these betokens meaning in the great teachings revealed to you – to humanity.”

Will lowers his eyes, overcome, drunken with illumination.

The radiant face before him says gently. “In past ages only a few people in human society understood the patterns of the world around them. Now, in this burst of revelation, you have come almost suddenly into a global society in which everyone can gain great understanding of those patterns. You are decrypting your world: making plain what is hidden. A subtle and rich task. It gets deeper at every turn.”

“As soon as you create a periodic table of all the chemical elements, hosts of questions spring up. You go on to create a table of subatomic particles, and that expands your periodic table into a table of the nuclides. And then you burrow into the world of these particles to unfold quarks and more.”

“Back to your DNA codons. They generate all the varied living tissues of earth.”

“And the music, oh, the music! Your alphabets proliferate into music! The electrons of an atom live in layers or ‘shells’ around the atom's nucleus. When an electron, perhaps jarred by a passing photon of light, moves from a shell of greater energy to a shell with less, it emits a ‘note’: its own photon packet of electromagnetic energy. Each such note corresponds to a specific transit between electron shells of specific elements. The set of notes ranges freely up and down the electromagnetic spectrum, the way a player's fingers can range freely up and down the neck of a violin to play different tones.”

⁴⁷¹ Sources on the topic of molecular biology are many, and range from those with general appeal to the most-recent deep research results. General readers might try “Molecular Biology made simple and fun”, by David P. Clark, or “The Manga Guide to Molecular Biology”, by Masaharu Takemura and Sakura. Those readers wishing to investigate the field at a deeper level can read “Molecular Biology: Principles and Practice”, by Michael M. Cox, Jennifer Doudna, and Michael O'Donnell. Those wishing to sample the messy details of genetic engineering can track down a copy of “Short Protocols in Molecular Biology (2 volume set)”, by many contributors in the field.

Will says softly, "It's nature's instrument! Not just a piano with fixed intervals, but any notes at all. The nightingales of nature singing!"

She nods, laughing again. "A rich, continuous, unnumbered alphabet. Your astronomers extract its speeches from starlight. Each star sings different harmonies and discords. Each note maps to a specific element and a transition between electron shells of an atom of that specific element. Your astronomers can then determine what elements are in a star and burning to provide that star's energy. It's stellar decryption! The astronomer can create dynamic models of stars for predicting the evolution of stars of all kinds based on their constituency, their mass, and the nuclear reactions of their burning.⁴⁷² Modern astronomy!"

She exults. "And there is so much more! You have discovered the spectral variations in nuclear resonances. You look within the nucleus of an atom."

"How does that work?"

"You learn the energies – the songs – of its radioactive decay emissions. These various notes of energies inform the nuclear physicist of the structure and dynamics of the interior of that nucleus. It's nuclear decryption! The nuclear physicist can decrypt to create models of the atomic nucleus."⁴⁷³

"So, we're now hearing nuclear nightingales?"

As she laughs, the lovely Nightingale notes return.

*"...This is the Day of which it hath been said: 'O my son! verily God will bring everything to light though it were but the weight of a grain of mustard seed, and hidden in a rock, or in the heavens or in the earth; for God is subtle, informed of all.'"*⁴⁷⁴

Will's eyes widen. *It seems we read our reality at all scales. And as we become literate in reality, we learn more and more to write it.* His angelic companion, laughing with delight, gathers herself into a spark of joy and disappears.

Turning and Turning

The phoenix rumbles. "Now that your study of alphabets is concluded here, it is time to study time itself. Do you remember our visit inside the star, when we shifted the scale of time? Now we will look again at time, and what happens in half a million years."

⁴⁷² Most readers can explore further with Kenneth R. Lang's *The Life and Death of Stars*. Those more inclined to astrophysics can dig into Donald Clayton, *Principles of Stellar Evolution and Nucleosynthesis*, for the juicy, explicit details of stellar life.

⁴⁷³ The investigating reader can find much concerning nuclear exploration at the U. S. Department of Energy's Berkeley Laboratory Webpages, beginning with *The ABCs of Nuclear Science* at <http://www2.lbl.gov/abc/>. There, Chapter 6 of *Nuclear Science – A Guide to the Nuclear Science Wall Chart* explains nuclear energy levels, models, and measurement, at <http://www2.lbl.gov/abc/wallchart/teachersguide/pdf/Chap06.pdf>.

⁴⁷⁴ Bahá'u'lláh, quoted by Shoghi Effendi in *The Dispensation of Bahá'u'lláh*, p. 107. Bahá'u'lláh Himself here quotes from the Qur'án, 31:16 (Luqman).

"Your own calendars of history are far too limited to encompass a half million years in any clear and accurate way. Even the greatest of them, such as the Mayan calendar with its Long Count of about 7885 solar years, reflect the brevity of past human history. All of your calendars are in constant need of adjustments. Gradual changes in the earth's orbit, the moon's orbit, and the orientation of the earth's axis evolve through great spans of time. In a half million years, many such changes will take place."

"Now I will show you a few of these natural 'calendar' markers of truly-long ages."

A flash in the darkness, and they are no longer above the bridge. A great sweep of stars and star-lanes make spirals in Will's vision. "Where are we?" he asks.

The phoenix says, "You are looking down at the disk of the Milky Way, and it is turning slowly. We are telescoping time to reveal its very-slow movement. This gives one of the longest intervals – the 'galactic year'. It's the immense time over which the entire solar system makes one complete orbit around the center of the Milky Way galaxy. There!"

A tiny spark gleams near a lane of soft-glowing dust. "Your solar system! It orbits the Milky Way center at about 143 miles per second in speed, which means that one complete circuit of the orbit takes about 250 million years. This span of time reaches back from your present to the beginning of what you call the Triassic Period, just after the mass extinction of biological life that marked the end of the Permian Period. Some of you believe that such sweeping extinctions on earth may arrive with completion of these full orbits, but this is guesswork. The galactic year reaches five hundred times beyond any relevance it might have to religion or science here."

To Will, it is a beautiful, stately sight.

Another flash, and they drift above a fast-changing earth, swashes of white advancing and receding around the poles. "You are seeing in an accelerated time perspective the shifting periods of glaciation on earth, in which the planet's surface temperature range varies from one supporting glacial ice sheets covering much of your temperate regions to one in which very little surface ice exists. These advances and retreats of glaciers take place over an approximate 100,000-year cycle, not considering any impacts from extinction events or human-driven heating processes. This cycle of intervals, five of which would span half a million years, seems closer to your area of concern, but it is too irregular to navigate time reliably. Glaciation is driven by many dynamic factors you don't yet fully understand."

"Do you understand them? Could we learn them from... you?"

That deep rumble again. "You humans like clocks, with their regularity, yes? This is not a good clock. There is a better one."

"What might that be?"

"Look at the axial precession of Earth's rotation, sometimes called the "precession of the equinoxes". The earth's axis changes its alignment with respect to the stellar background,

rotating slowly, or 'wobbling', as the Earth spins so that the poles of earth's rotation appear to change place over a cycle of about 25,772 years in length."⁴⁷⁵

One more flash, and the earth now spins and wobbles like a toy top.

"What you now call the Pole Star will drift to where its rotation around the Earth's axis of spin will be more like that of other stars, and some other star will approach the still point of the axis of spin. After the completion of the 25-millennium-plus cycle, the Pole Star will appear in the sky as it did at the beginning."

"That sounds regular."

"Regular enough. You can work and play with this calendar. Nineteen of these steady precessional cycles almost span that half-million-year interval, and twenty such cycles constitute a period of about 515,000 years. That's just above the lower bound of time set forth by Shoghi Effendi for the duration of the Bahá'í cycle. This evokes a correspondence that might offer a speculative view of 'Abdu'l-Bahá's words regarding the Dispensation of Bahá'u'lláh, *'its duration hath been fixed for a period of one whole month, which is the maximum time taken by the sun to pass through a sign of the Zodiac.'*"

"Well... that's not a connection I can make, not yet."

"Your perspective is very limited. To see with universal vision is to clear away your restrictive assumptions."

"Assumptions?"

"First, you think in terms of a month lasting about one-twelfth of a year, or around 30 days. Also, you associate a sign of the Zodiac – a region of the sky about one-twelfth of the full circle of the heavens – with each 30-day month. You also assume that these regions of the sky are unchanging, and that you beings of earth will continue to see them over long timescales as you see them now. None of these assumptions continues to hold over the thousands of years we are contemplating here."

"That would make the birdsongs here give us incorrect information, wouldn't it?"

"The birds sing what you can understand. Most of you do not bring the scientific vision to the birdsongs, not yet. Things that appear stable in your lifespans change over immense periods of time. It makes most predictions harder to comprehend. You already know that over the course of the Earth's axial precession, the tilt of its axis rotates in a full circle. This tilt affects the constellations in which the sun appears, in two distinct ways."

"How so?"

⁴⁷⁵ Due to gravitational and geodynamic effects, the cycle of this 'wobble' of the earth's axis of rotation varies somewhat itself in duration over time.

"First, it changes the constellation named as governing the Zodiacal period from one at a given celestial latitude to another at a different celestial latitude. Over the cycle, some of the northern zodiac constellations are replaced by southern ones at the same celestial longitude, and vice versa. This means that **the Zodiac itself changes** throughout the passage of this cycle of precession."

"So far, I understand."

"Second, it changes the seasons progressively – the seasons are driven by the axial tilt, which is slowly rotating. So for the sun to appear in the same celestial latitude **in exactly the same season** (celestial longitude) requires a full 25,772-year cycle of axial precession."

"Oh. We are trying to hit a moving target in our understanding. Not only that, but 25,000 years covers more than all of past human history we know about."

"Now do you understand a bit better? Let's take another step. Treat the great duration of the 25,772-year cycle as a single 'day'. As a sign of an unending, sustaining flow of divine meaning, it unfolds a sense of the grandeur and infinite extent of the great cycle of the Revelation of Bahá'u'lláh. In the passage of just one such 'day', 25 millennium-long revelations, each of which is equivalent in duration to one of those in your human past, can be progressively unfolded to humanity."

Will, already overwhelmed, is silent. Then he says slowly, "It feels like infinity on infinity, or eternity on eternity."

The phoenix soars without speaking for what seems to Will a long minute. Then it speaks. "Add to this Shoghi Effendi's statement about the thirty days, that they *'thus represent a culminating point in the evolution of this star'*, and in your awareness the scope of the Revelation is magnified even further. Listen! Hear a melody of even-greater impacts and reaches it may unfold."

The hummingbird's wing-croon embraces Will.

*"Regarding your questions: There is no record in history, or in the teachings, of a Prophet similar in station to Bahá'u'lláh having lived 500,000 years ago. There will, however, be one similar to Him in greatness after the lapse of 500,000 years, but we cannot say definitely that His Revelation will be inter-planetary in scope. We can only say that such a thing may be possible. What Bahá'u'lláh means by His appearance in 'other worlds' He has not defined, as we could not visualize them in our present state, hence He was indefinite, and we cannot say whether He meant other planets or not..."*⁴⁷⁶

The phoenix rumbles again, and now they track again the arc of the infinite-seeming bridge in darkness. "You now have just a glimpse into a human future so vast, fertile, potent, and diverse that as you stand poised, on this 'cusp of historical time', this 'pinnacle ascended

⁴⁷⁶ from a letter written on behalf of Shoghi Effendi to an individual believer, December 24, 1941, quoted in *Lights of Guidance*, p. 473.

from your dark and turbulent human past', you find yourselves and your world made altogether new. The universe awaits you. But first you have a few hells to deal with. Goodbye for now." A shrug of huge wings and body, and Will tumbles away.

Seventeenth Fall

It is a 1975 summer evening. Will hosts a good-sized house party this evening with friends enjoying a late-summer evening. A knock sounds at the front door.

He opens the door to a Black man looking hopefully at him, "My car broke down and I need a ride," he says. "Could you help me out?"

"Where do you need to go?"

"Back to my neighborhood." He gestures toward the center of the city.

Others at the party, all of them White, join Will, and start asking the man questions about who he is. He shows them his driver's license and they repeat his name. He answers them patiently, but Will gets a bit fed up with all the questioning and says to him, "Come on. I'll take you home."

Ignoring the nervous reactions of his friends, Will gets into his car with the man and they drive toward his neighborhood. Will senses that he probably has other things going on with the car, and perhaps some concerns with the police, being Black on foot in a white neighborhood in the evening, but he doesn't ask.

The man asks as Will drives, "Would you like a little something for your party?"

It is the 1970s. Will knows what that means. "Oh, no thank you."

"You sure?"

"Yes, thanks."

They navigate the streets into an area where more Black people were present, the man points out a house, and Will drops him off. He waves thanks, and Will goes back to the party to face questions.

Will falls in emptiness once more, but this time the Nightingale circles him, its caroling soothing his spirit.

"This is the Day that shall not be followed by night, nor shall it be bounded by any praise, would that ye might understand!"⁴⁷⁷

"O Temple of Holiness! We, verily, have cleansed Thy breast from the whisperings of the people and sanctified it from earthly allusions, that the light of My beauty may appear therein and be reflected in the mirrors of all the worlds. Thus have We singled Thee out

⁴⁷⁷ Bahá'u'lláh, *The Summons of the Lord of Hosts*, p. 34/para. 63.

above all that hath been created in the heavens and the earth, and above all that hath been decreed in the realms of revelation and creation, and chosen Thee for Our own Self.

"This is but an evidence of the bounty which God hath vouchsafed unto Thee, a bounty which shall last until the Day that hath no end in this contingent world. It shall endure so long as God, the Supreme King, the Help in Peril, the Mighty, the Wise, shall endure. For the Day of God is none other but His own Self, Who hath appeared with the power of truth. This is the Day that shall not be followed by night, nor shall it be bounded by any praise, would that ye might understand!"⁴⁷⁸

As they descend, streams of living memory whip upwards past Will: the children, the rabbits, the vardo, the winds, the café and Katrina...

"Know thou that every created thing is a sign of the revelation of God. Each, according to its capacity, is, and will ever remain, a token of the Almighty. Inasmuch as He, the sovereign Lord of all, hath willed to reveal His sovereignty in the kingdom of names and attributes, each and every created thing hath, through the act of the Divine Will, been made a sign of His glory.

"So pervasive and general is this revelation that nothing whatsoever in the whole universe can be discovered that doth not reflect His splendor. Under such conditions every consideration of proximity and remoteness is obliterated.... Were the Hand of Divine power to divest of this high endowment all created things, the entire universe would become desolate and void."⁴⁷⁹

Will blacks out.

⁴⁷⁸ *ibid.*, pp. 33-34.

⁴⁷⁹ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, XCIII.

X. DREAM OF THE THERMO CASINO

*Maxwell's Demon is my name,
Arranger of information,
Chaotic space is my dwelling-place,
And pattern my destination.⁴⁸⁰*

Will opens his eyes, face down, dazed, on a tough, stained carpet smelling of sweat and stale alcohol. Legs and feet step over and past him. Groaning, he clammers up to his feet, in a huge boxy building alive with flashing lights everywhere. He puffs, blinks, swallows, gathers his senses.

A casino. Slot machines surround Will in clusters, rows, circles, and just strewn everywhere. All are occupied by transfixed players working their handles. He tries to straighten the rumpled clothes he seems to be wearing, and a sharp-dressed man in a red snap-brim fedora comes up to him. He fingers the collar of Will's shirt. "Hello, traveler. Welcome to my establishment! Come and play! You're here to play, of course you are, aren't you? Everybody plays here!"

His jacket is edged with gold wire, his eyes are green and flashing, and he grins and spins, laughing. "Here are the house rules!"

"Stop! I don't want to be here. Show me where the door is!"

"I'm sorry, but no one leaves. Everyone stays here."

"Well, there was a way in! Why can't I leave the way I came?"

"No idea. But you're here, and there are no doors leading out or in. We offer food and accommodations, but you are here to stay."

Will, not seeing any convenient exits, decides to play along while he tries to find a way to leave. "All right. What are the house rules?"

The man in the fedora pauses with a suspicious look, and then, one long eyebrow cocked, says, "Very well. You start playing here with your initial supply of our chips."

"I didn't bring any chips."

"Check your pants pockets."

Reaching in, Will finds two stacks of tokens, each chip labeled with an engraved golden letter M and a shimmering numeric denomination. As he inspects one of the chips, its denomination blurs slightly.

⁴⁸⁰ A nod to Alfred Bester and his Gully Foyle character in *The Stars My Destination*.

"You are here to gamble with your chips. First rule is that you can't beat the house. You may accumulate some chips to add to what you have, but you will find that your total will never exceed what you now have."

"That doesn't seem fair."

"Second rule is that you can't just stop gambling or keep the same total you have now. Your total will always continue to shrink."

"That's even less fair."

"Third rule is what I already told you: you can't leave the casino."

"I guess 'fair' has nothing to do with anything here. What finally happens when I run out of these chips?"

"You're dead."

"Am I supposed to enjoy all this?"

"No. I am." He grins again, with another twirl and a "there you go" show move.

Now Will is not just in pain from his hard landing, but really irritated. "Who in hell are you anyway?"

"Ah! Well asked! My name is Max. I refer you to the little jingle you passed as you fell in here."

"I saw the name 'Maxwell's Demon'. Are you Maxwell, or the demon?"

"Oh, I take his name. He doesn't care. He ran out of chips." As he stops talking, one of the slot players fades into smoke and disappears.

Will shakes his head, trying to clear it. "This is some kind of nightmare!"

Max bursts out with a raucous fusillade of giggles. "Oh, not at all! It's simply and exactly the way thermodynamics works. Entropy rules the world!" He gestures around at the casino's expanse.

"So we're talking physics?" Dimly coming to Will's mind is some sense that he has been on a long journey, but memory still seems vague. *It must have been the hard landing.*

Max enumerates. "First law is my first rule, better stated. It tells you that energy can neither be created nor destroyed. It can only be transferred or changed from one form to another. This rules out systems that "create energy" – perpetual-motion machines, for example."

"The second law tells you that the entropy, or disorder, of any isolated system always increases. 'Entropy' is here a measure of the degree of uselessness of the energy present in a closed system. The only way to decrease the entropy of a closed system is to introduce

energy from outside that system. This leads to 'You can't break even,' since the system is closed and nothing can enter it from elsewhere."

"Wait a minute. I got here from someplace else – I remember that I was in another place, and then I fell in here."

Max shrugs, ignoring and annoying Will again. "The third law tells you that the entropy, or disorder, of a closed system approaches a constant value as the temperature of the system approaches absolute zero. In the Thermodynamic Casino, it all heads down toward zero. No more chips."

The House

Max leans close to Will and says, "James Clerk Maxwell, whose name I wear now, created a thought-experiment. He wanted to know what would challenge the second law above. He thought of a 'demon', or agent, that would take in disorderly molecules in a gas and sort them out to separate the more-energetic molecules from the less-energetic ones. Then the demon could stand between two chambers, and put the higher-energy molecules in one chamber and the rest in the other. The first chamber would heat up, and the second would cool down. It would reverse the increase of entropy."

"So you could end up with more chips instead of losing them."

"Sadly, no. It's a fallacy. It does not take into account the energy used by the demon himself – me! As I'd work feverishly to sort the molecules, my work energy itself enters the closed system of the chambers, adding to the heat shared by both of them, increasing the entropy."

"So chips still get lost, then." *I don't like this place at all.* "You keep saying 'a closed system'. But the world isn't a closed system."

"Look around you! Do you see a way out? The laws of thermodynamics hold perfectly within the closed system of spacetime, all through the physical universe. Just like my casino. This closure insures that the physical laws concerning the interworkings of mass and energy are always valid within anyone's physical awareness. None of these physical interworkings, whether one sees them as collisions, radiation, quantum exchanges, or any other form or pattern, violates these three laws."

Now Will's mind is starting to gather itself more clearly. "I think there is more to this than your neat little picture. Look at that slots player pulling his handle and looking for chips to come out. He's a closed system, isn't he, if you ignore air, water, food, and waste. It's all in the definition you use."

"You're just playing with words." Max sneers, but he looks a bit uneasy.

"Not at all! Your casino is somewhere, in a place that is larger." A memory surfaces of the banqueting-hall of life described by the Venerable Bede, with the sparrow flying in from winter outside, through the feast, and then out again. "Any system might have a closed aspect and an open aspect."

"Bah." Max waves a dismissal.

Will persists, a peculiar sensation within him. His words seem to come from another source, but he lets them come. "To define and construct a system requires closure of various kinds. For example, that player's human body is a closed system, because it has a surface (skin) that defines its physical boundaries, it has movements that when taken as a whole define its dynamic boundaries, and it has a beginning and ending in time – birth and death, respectively – that define its time boundaries."

Max is interested. "So this is consistent with what I told you. No 'open aspect' seems to be there when you look at the whole universe. It's closed, ultimately."

Will goes on, "That is an assumption, not a fact. But it is a useful assumption, because it allows us to limit our range of consideration of a system's characteristics to what we can grasp and manipulate in our models of comprehension. We are human beings, not all-knowing, and we learn best by working within limited frames, moving from frame to frame. Our models."

"Agreed." Max, distracted momentarily, looks past Will as two flashily-garbed ladies expire into smoke.

Will is on a roll now, and not at the craps table. "But the human body is a piece of a greater story, in which food, air, and water enter the system of the body, and waste leaves it: the story of metabolism and the metabolic system coexisting with the body. Likewise, sensory information enters the system of the body and expressive information leaves it: the story of perception, cognition, and expression – mind – coexisting with the body and its metabolism. We define several systems that interact as do these two with the body and each other. Each such system has its own boundaries and functions."

"Yeah, yeah, yeah, so what? Closure still rules."

"No. I think there's a way out." Suddenly memory's river floods Will. *I was flying, clinging to a phoenix, over a bridge in some place beyond places...* "Yes. There is a way out. It isn't just another opening into another larger closed system. It's an opening into freedom from closed systems altogether."

Scornful look from Max. "What could you possibly mean by that?"

"Max, ask yourself this: what brought you here, equipped you with casino and chips and customers? Some process brought information, energy, into our universe – chips and customers into your casino – and it may also draw information and energy out."

Max is silent. He scratches the end of his pointed nose, and a small, bright-blue moth flies away from his fingertip.

Will presses on. "Your set of laws and its apparent closure don't fit with the idea of the flow of information into or out of our spacetime universe, or your casino. That flow turns the

closed system into an open system. Are the two kinds of system mutually exclusive? Or does a closed system appear open, or an open system appear closed, depending on the perspective of one's view of it?"

Max wags a finger. "So it's all in the definitions. That's just sweeping the question into hiding."

Now Will shrugs, mostly to annoy Max. "Not at all. We just make progress to the next layer of questions. That's what we do. That's science: unending exploration. The brambles of phlogiston gave way to the brambles of oxidation. The tangles of epicycles in astronomy give way to the knots of the many-body problem. The history of science is marked by its breakthroughs from one nettlesome tangle to the next."

A change comes over the demon's face, as if he has felt something new and surprising. "No one here has ever said these things to me, not since Maxwell himself summoned me into existence. Who are you?"

Now Will feels a current of surprise. "I've been traveling a long time, a long way. Many things have taught me, but I didn't think I would be passing along the lessons I've lived, especially not here."

The demon's face, no longer sharp and sprightly, seems softer and smoothed with wonder. A warmth kindles in Will. "Are you just Maxwell's demon, or are you free?"

Max looks down at his pointy-toed shoes for a long moment. When he looks up at Will, his eyes are soft. "Thank you. Thank you. I am free now. It is all questions, isn't it? These answers are just pauses, aren't they?"

Response wells up in Will, as if all the people and places in his journey are raising their voices through him. "Yes! We live in an ordered universe with no understanding of any origin for that order. We witness its thermodynamics working to dissolve its order, but we wonder: why did order arise at all? Was it encrypted or coiled up in some seed of infinite mass-energy? Is it being instilled in the creation even as the creation abides?"

At last Will feels a presence within himself, and a name comes. *Jeddin*... "Thermodynamics is no longer the complete box, the bounded casino we can rely on. Our discovery of black holes, devouring mass, energy, and information, and returning almost nothing to us, consumes our ideas of closed systems altogether, because otherwise conservation of mass and energy would be lost. What lies beyond that event horizon?"

As Will finishes this, he takes Max's hand. "Come with me." They walk together through the busy, jumbled tables and slots to a modestly-decorated pair of doors painted on the wall. Each of them touches the image of a handle, and side by side they open the doors. Closing the doors behind them, they are free in darkness.

The Maiden, the Bird, and the Baby

Out of the deep shadows surrounding them a faint glow gathers. Max and Will turn to face its coalescence. As it resolves, a column of vague light at first, it assumes the form of the dark-haired angelic visitor who joined Will so sweetly on his ride at the neck of the phoenix. She laughs, and her face shines on them as she says, "Now we can play!"

Her delight is contagious, and Will asks, "Are we going to play with those alphabets we shared before?"

Again her laugh, delicate music. "This is new play, most serious, most precious, most joyful celebration! Now we see what alphabets can barely touch – the realm of flow and current and wash. No slicing up into collected symbols here!"

Words return to Will from a long way back near the start of the journey.

"Suppose we embrace the idea that information and knowledge flow ceaselessly from the realm of the unknown to the realm of the known. Would our ingrown resistance to the idea of that flow be much easier to address? New ideas invariably meet with resistance, but a goodly share of that resistance has little or no scientific basis. We don't need a hermetic seal; the boundary between the known and the unknown might better be called a one-way, semipermeable membrane."

She touches Max's hand, and he recoils with a lurch. She says gently, "Don't be afraid! You've come with this traveler to learn. Here, you will see beyond that casino of yours, see that the reality addressed by physics is a part, an intimate part, of a greater reality."

Max looks down, muttering inaudibly.

From an earlier conversation, memory comes to Will. "Miriam told me that one of the mysteries of reality is that of flow, of currents, of continuous collective movement of some substance through a medium."

She nods. "Now you begin integrating and healing the remaining breaches in your ideas between what you have been calling the greater world and what you know as your physical world. This is playtime!"

Will feels uncertainty. "It looks like work to me." Max nods in agreement.

"Not at all!" she exults, and now the filmy outlines suggesting her wings wave gently in some ethereal current or flow of a medium maybe air and maybe other.

"You recall the braneworld way of seeing things, don't you? Your braneworld – the physical reality you rely upon – is always receiving creative energies conveyed into it from the bulk – the physicist's name for the greater world – in which this physical reality of yours appears as little more than a mere boundary. Listen, listen!"

The Nightingale circles her head, caroling joyfully a refrain now familiar to Will from before.

*"O PEOPLE! I swear by the one true God! This is the Ocean out of which all seas have proceeded, and with which every one of them will ultimately be united. From Him all the Suns have been generated, and unto Him they will all return. Through His potency the Trees of Divine Revelation have yielded their fruits, every one of which hath been sent down in the form of a Prophet, bearing a Message to God's creatures in each of the worlds whose number God, alone, in His all-encompassing Knowledge, can reckon."*⁴⁸¹

*"Thou hast, moreover, asked Me concerning the nature of the celestial spheres. ... The learned men, that have fixed at several thousand years the life of this earth, have failed, throughout the long period of their observation, to consider either the number or the age of the other planets. Consider, moreover, the manifold divergencies that have resulted from the theories propounded by these men. Know thou that every fixed star hath its own planets, and every planet its own creatures, whose number no man can compute."*⁴⁸²

The angelic one pauses as the bird vanishes, and says, "This melody asserts precisely what the astronomers of the 20th century would later demonstrate with scientific clarity. Such an intimate connection between science and religion!"

She makes a cradle of her arms, as if holding an infant. "You must see the infinite love at work in this! Your physical world is cradled in that greater world as its beloved and nurtured offspring. The bountiful flow of information from the greater world to your physical world is the eternal, ongoing, sustained nourishment of your very existence through every moment and every span of space and time."

As she speaks, her arms glow and fill, and she looks down tenderly at a calm, wide-eyed baby gazing back up at her. She turns from Will and Max, modest, and takes the baby to her breast. As she nurses she looks back at them, saying, "This nurturing enables you, activates you to extend and reconceive your limited physical awarenesses, to advance your understanding. That is what you call science."

She continues, now and then turning to croon a note or two to the baby, and then looking up at the two men with a smile. "You play endlessly and creatively with what you find in the world."

Max comes alive, performs a spin, his hat flying straight up and settling back reversed on his head, and begins a tap dance, singing out.

*"Play with Plato's solids,
The regular polyhedra,
Play with old Inferno,
Play with Purgatorio,
Play with Paradiso,
All arranged in circles!*

⁴⁸¹ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LI.

⁴⁸² Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LXXXII.

Play the tangled Kabbalah!
Play the I Ching hexagrams!
Play – ”

And here he leaps up before Will and explodes into a cheerfully-colored shower of sparks.

The angelic maternal, still nursing the baby, breaks out in a great laugh. “He was dancing on the fringes of reason, and he got carried away, didn't he?”

Will looks around, and sees no Max. “It looked like some fun, some real play, to me.” A tiny spark at Will's feet seems to move a little. He bends and tweaks it carefully up to look closely. It tingles, and a very-faint voice says, “She's right. Those are all I had, but they're not where we're going now, are they?”

“What happened to you?” Will asks the spark.

“Every time I think of what I find, it comes in little pieces. Like circles, blocks, letters, tokens, you know.” As the spark speaks, it takes on size and shape, starting to look like a tiny Max, dusting off his hat. “I guess we're not talking about pieces any more.” He leaps off Will's hand, growing to full size by the time his feet touch down.

“You're right. We're into the dance of things flowing now.”

The angelic lady raises the baby before her, and their eyes meet in light, a glow radiating from both of them to Max and Will enraptured. “You go rest now,” she says to the baby. She spreads her hands, and the baby floats slowly up and away from her, voicing small soft tones to her as it goes.

She turns to the two men again again. “Here. An idea for playing – have you thought that perhaps your world exists entirely as the rind of a very deep, very rich fruit – a mere surface representation? Then the meat of that fruit would be apparent to you only indirectly. All you see are the puzzles of mass and gravitation”.⁴⁸³

Will and Max are without response.

“You have no answers to some simple questions. You live in the bindings of time, with beginnings and endings, but how do you deal with an unending, pre-existent kind of sustenance? A simple proton, undisturbed, remains a proton beyond all ravages and chances of knowable physical time⁴⁸⁴. This property – you can call it ‘eternality’ if you like,

⁴⁸³ The Excursions essay Space Drawings presents an illustrated play of the author's thoughts in making patterns that try to fit the world we see, making free use of the vast range of ideas bestowed on us by many observant, perceptive, deeply-intelligent minds.

⁴⁸⁴ The GUTs or Grand Unified Theories of physics, sometimes termed inaccurately as “theories of everything”, attempt to harmonize all the forces of nature in our understanding into a single evolving entity. Aspects of these theories rely upon the eventual decay of the proton, a fundamental and stable particle, into some other lighter particles and some energy. Experiments, notably those performed in the Super Kamiokande neutrino observatory from 1996 to 2015 (see <http://journals.aps.org/prd/abstract/10.1103/PhysRevD.95.012004>), have shown that the

is shared by the electron, and it is qualitatively distinct from just about everything else in your familiar world."

Heavy Holes and Dancing Donuts

She throws her arms wide, making a blaze of light. "Now we draw some living pictures!"

"I will draw you a well. It's the map of attraction that mass generates in its curving of the nearby space. The closer we are to the surface of a massive body like the Sun, the greater is the attraction the Sun exerts on us. We are drawn into a 'well' from which we can only climb out by expending added energy." She gestures in a series of circles.



Figure 30 – A gravitational well in ordinary spacetime

Will looks at the image. "It looks upside down."

She chuckles. "You can stand on your head if that looks better."

Max tosses his hat up, stands on his head, and catches the hat on one toe.

She continues. "The closer you are to the surface of a massive body like the Sun, the greater is the attraction the Sun exerts on you. You are drawn into a 'well' from which you can only climb out by expending added energy."

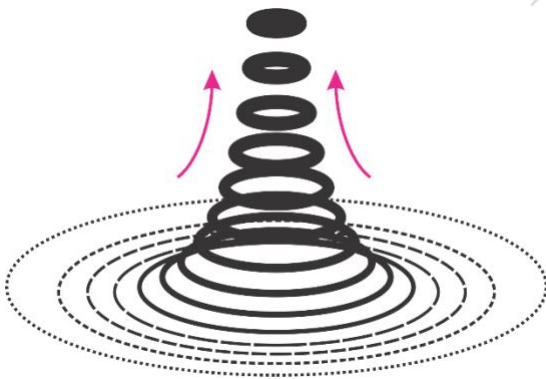


Figure 31 – Gravitational collapse to a singularity

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"The more massive the attracting body is, the greater that energy must be. There's a mass limit beyond which the gravitational 'bending' of spacetime is so great that the bending tightens into a cusp or a point. This refers to a gravitational singularity, also termed a "black hole". You can map the attractive forces in the spacetime surrounding a gravitationally-collapsed mass. The arrows show the direction of the collapse toward a stage where you can no longer look at the mass directly, since even the light it radiate cannot escape the singularity."

"Your universe contains incomprehensible energy. It seems to have manifested all at a single event, and you have traced it forward in time to your present existence. You use its clues: the cosmic background radiation, the visible expansion of space, the views afforded by the great distances into the past, and more."

"But what are the implications of the seemingly-eternal stability of your lowly protons and electrons? Nearly every other particle in the spectrum of your Standard Model of particle

shortest lifetime possible for a proton is on the order of 10,000,000,000,000,000,000,000,000,000 years – many orders of magnitude greater than all estimates of our universe's existence so far.

physics decays in moments into lighter particles and packets (quanta) of energy. Does this stability signify some special dynamics of state, some tantalizing properties hinting at connections to a pre-existent greater reality?"

Max and Will stand motionless, the sound of her voice a harmony of penetrating soft musics they can only sense dimly.

She sees their incomprehension, and points to the gravitational image as it seems to grow and extend. "Look at the bottom flat surface. Extend it as a plane infinitely in all directions, with all your familiar dimensions compressed into that plane. That is where you live, in a tiny point on that flat surface, containing as it does every atom, planet, star, galaxy, supercluster, and void you can detect in the universe."

Will asks, "Then what is the well rising from it? It doesn't fit in our space, then, does it?"

"No. It is a smooth growth of the dimensions of spacetime, showing the upward direction as the descent into a gravitational well of concentrated mass and dimension. Such a collapse can manifest itself at any scale in which gravitation plays a dominant role, from star-size to just about anything larger, even a whole galactic-cluster-sized hole in the universe."

Will is wondering. "Where does everything go when it goes into the hole?"

Max laughs. "You don't usually ask that question when you use a toilet!"

Now their host laughs too. "Now you're in the spirit of play! Max sounds like a physicist here! Physicists don't like questions that seem unanswerable and unexplorable." She turns to Will. "And you sound more like a plumber. Did someone call and tell you there was a backup in the plumbing?"

Now it's Will's turn to laugh. "Things get backed up in my head all the time. Maybe that's why I ended up here."

She raises a hand, palm towards them, and says, "Peace for us, and more play. Earlier you asked Max what lies beyond the event horizon of a black hole. You hinted at a conservation law, one asserting that the mass and energy that leave your phenomenal, detectible universe are balanced by mass and energy entering it to populate it, together with whatever precursors or other states of mass and energy may be involved in sustaining the universe over time." As she speaks, the image shifts again.

The Nightingale's strains drift through Will again.

Creation, Conservation, and Convection

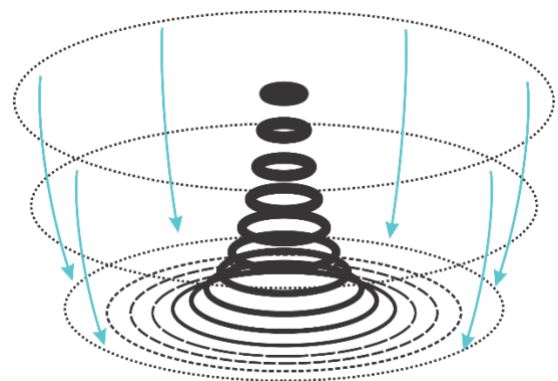


Figure 32 – Entry of energy into spacetime

“Every thing must needs have an origin and every building a builder. Verily, the Word of God is the Cause which hath preceded the contingent world—a world which is adorned with the splendors of the Ancient of Days, yet is being renewed and regenerated at all times.”⁴⁸⁵

“So,” she says, “These singularities remove mass, energy, and information from your detectible universe. What might be balancing that removal on a continuing basis? Let’s play with that. Such a balance or symmetry seems a form of conservation – one that supports the idea that your universe is being renewed and regenerated on a continuing basis.”

“I’ll play,” Will says. “Could it be a cycle? What goes into the black hole finds its way back to our universe somehow. In a different form, no doubt about that, because if we found the same form appearing, we would see a connection.”

She smiles. “You’re opening the way to a fuller image of the relationship of your spacetime with a greater setting. In your little spacetime, you are blind to such a setting, but you can examine its implications to see how your spacetime is **informed** by the various possibilities. Let’s see how it might operate.”

Her deft movements turn the image into a kind of stretched torus.

“If you like symmetry, you might look with favor on models that preserve it. Here! A ‘convection model’ – a dynamic construct that cycles mass-energy. Your universe is the ‘cooling’ region at the bottom. The top, of which you can know nothing, is the ‘heating’ region.”

Will. “Again, it looks upside down, because heat makes its medium rise.”

“The inversion here reminds you that the ‘heating’ and ‘cooling’ here cannot represent some thermodynamic or energetic process in the ordinary sense of physics. The processes of physics are all contained stably and consistently in the ring you inhabit, shown at the bottom of the image. Here we are ‘outside’ of spacetime and its cradling greater reality altogether.”

Will again. “I see the phrase ‘Information Convection’. What is that all about?”

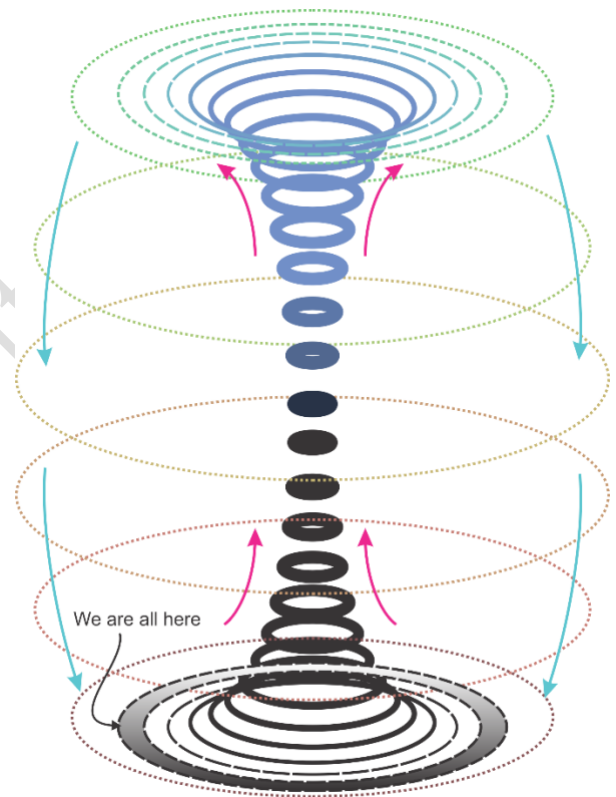


Figure 33 – Information convection

⁴⁸⁵ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat).

“You have no trace or trail of origin for the order of things you witness. Consider the possibility that your order of things has an ‘extra-physical’ source and destination for the information defining it. After all, you concede that revelation originates outside the human world. And since your usual ideas of time and its dynamics cannot be used here, there’s an implication of permanence of information, implying its conservation in an eternity, a greater reality that embraces time itself. The title ‘Information Convection’ suggests that your universe is being informed all the time.”

Max cocks his head. “Now wait a bit. This is starting to look like a closed system. Thermodynamics creeps back in again.”

An image from mathematics comes to Will: the Riemann sphere of the extended complex plane. “How about a closed, infinite system?”

Max crosses his eyes and uncurls a long tongue at Will, and their angelic host bursts out laughing, saying, “You’re having too much fun! But let’s look at the model we’re creating here. It treats gravitation as ‘cooling’ or coalescing of information in an embedding space. For the model to work, a cooling process requires a corresponding, symmetrical ‘heating’ process, in this case amounting to a kind of “anti-gravitation” that separates out information as particles of mass-energy: a ‘vapor’.”

“The cooling process ‘radiates’ away the repelling ‘heat’ in the form of spacetime expansion. This ‘heat loss’ allows gravitation to condense mass-energy (information) in large-scale singularities that return the information-dense ‘condensate’ to the region of higher dimension, and so complete the convective cycle.”

Will is intrigued. “And the rest of the cycle?”

“The ‘heating region’ of this model returns mass-energy to your universe as the photons and particles with which you are familiar – but then these things persist, as you see them in time.”

“This model is independent of changing scales of time and space. From yoctoseconds to yottayears, from Planck lengths to yottameters, you are free to consider the flow of such ‘heating’ into your known universe and the flow of ‘cooling’ out of it at all levels, in a range from within the tiniest particle to span the greatest supercluster. The existence of black holes from the supermassive scale to the stellar scale offers us a hint supporting this pattern.”

Time Time and Eternity Time

The game they are playing with these images and ideas absorbs Will. “This model seems as simple as the flow in a hot cup of liquid.”

She nods. “The best models have a central metaphor, a simplicity.”

He bursts out, “But I have questions! Information gives form, order, and pattern – meaning itself. The model seems to equate mass-energy and information as some entity or element

cycling into and out of our universe. Can we think of our familiar blend of mass and energy as an aspect of information? I remember part of the definition of information as 'the conveyance of information from some superior source via some conduit to humanity'."

As she starts to speak, Will bursts out again. "Even words like 'return', 'flow', 'cycling', and 'conveyance' raise issues! To us, such terms have meaning only in relation to the passage of time. What can they possibly mean when our familiar idea of time itself is demoted to a created thing, subject to inscrutable laws to which we have no direct access? If this model is truly independent of restrictions of time and space, what are we talking about anyway?"

She pauses. "Are you finished talking?"

"Yes, but..."

She replies, "This 'flow' between your world and the greater world in which it is embedded signifies a different class of 'time' altogether. In it your own space and time are trapped and fixed. It might be better to call such a flow a 'relationship', with no evolution or change implied in it in the physical-time sense. Think of an ice-rigid glacier relating its sources with its ends. You do not live in the vastness of glacial, geologic time; you live in the heartbeat of human time. It is much the same for the incomparably-greater vastness of cosmic time."

"Cosmic time??"

"To understand our play a little better, set aside your notions of time and look at your universe as having openings of two types into the embedding realm it inhabits. The first type of opening is that marked by gravitational singularities, or "black holes". Through these large-scale openings, breached by the gravitational collapse of masses from star-size to billions-of-stars-size, information itself and all connected with it leave our familiar universe and enter the embedding realm that holds that universe, leaving behind all possible physical awareness."

"That seems consistent with what's known."

"All right. This new idea of conservation and symmetry, as we apply it here, urges that this flow of information away from us is mirrored by a corresponding flow of information returning into our universe, toward us. Exactly to the point, the great scriptures affirm such a cosmic idea, terming it sometimes 'the creative Word'."

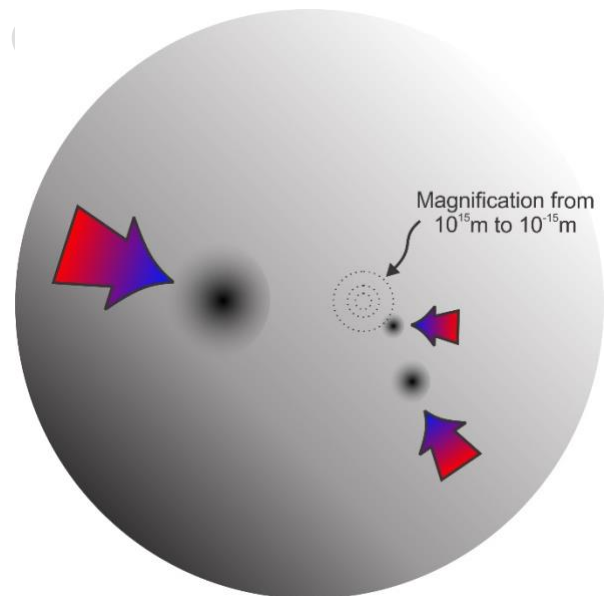


Figure 34 – Flow of large-scale singularities from our universe to its embedding space

The Warbler's notes unroll into a glorious sonata.

"Praise be to God Who hath ever caused His Names and Attributes to penetrate the degrees of existence; Who hath made the effects of those Names and Attributes to shine resplendent and their signs to be firmly established in both the hidden and manifest worlds. By them He hath made the holy realities that are informed by His grace and are the recipients of His outpourings to be the sole revealers of all that pertaineth unto Him, and hath caused them to move through the firmament of perfection in arcs of descent and ascent. He hath ordained these Names and Attributes to be the first and foremost origin and cause of being in the world of creation and the source of the different grades of realities in the degrees of existence. When, through its power of attraction and propagation, the Day-Star of Names and Attributes shone upon the hidden realities in the heart of the unseen realm, they issued forth, were spread abroad, scattered about, set in order, became the recipients of the grace of God and His outpourings, and were made to be the sole manifestations of the Divine conditions and Eternal signs."⁴⁸⁶

Lights flash in Will. "The 'arcs of descent and ascent'! They suggest our convection model! The movements of the divine outpourings descending into our cosmos, and movements of return from our cosmos to the divine realm!"

At this moment, the Nightingale's tones insinuate through Will and Max, and they are stilled in wonder.

"O friends of God! Incline your inner ears to the voice of the peerless and self-subsisting Lord, that He may deliver you from the bonds of entanglement and the depths of darkness and enable you to attain the eternal light. Ascent and descent, stillness and motion, have come into being through the will of the Lord of all that hath been and shall be. The cause of ascent is lightness, and the cause of lightness is heat. Thus hath it been decreed by God. The cause of stillness is weight and density, which in turn are caused by coldness. Thus hath it been decreed by God.

"And since He hath ordained heat to be the source of motion and ascent and the cause of attainment to the desired goal, He hath therefore kindled with the mystic hand that Fire that dieth not and sent it forth into the world, that this divine Fire might, by the heat of the love of God, guide and attract all mankind to the abode of the incomparable Friend. This is the mystery enshrined in your Book that was sent down aforetime, a mystery which hath until now remained concealed from the eyes and hearts of men.

"That primal Fire hath in this Day appeared with a new radiance and with immeasurable heat. This divine Fire burneth of itself, with neither fuel nor fume, that it might draw away such excess moisture and cold as are the cause of torpor and weariness, of lethargy and despondency, and lead the entire creation to the court of the presence of the All-Merciful.

⁴⁸⁶ 'Abdu'l-Bahá, *Tablet of the Universe*, opening (provisional translation at https://bahai-library.com/abdulbaha_lawh_aflakiyyih).

Whoso hath approached this Fire hath been set aflame and attained the desired goal, and whoso hath removed himself therefrom hath remained deprived."⁴⁸⁷

A pause, and the song shifts in its mesmerizing beauty.

'Behold, how many are the mysteries that lie as yet unravelled within the tabernacle of the knowledge of God, and how numerous the gems of His wisdom that are still concealed in His inviolable treasures! Shouldest thou ponder this in thine heart, thou wouldst realize that His handiwork knoweth neither beginning nor end. The domain of His decree is too vast for the tongue of mortals to describe, or for the bird of the human mind to traverse; and the dispensations of His providence are too mysterious for the mind of man to comprehend. His creation no end hath overtaken, and it hath ever existed from the "Beginning that hath no beginning"; and the Manifestations of His Beauty no beginning hath beheld, and they will continue to the "End that knoweth no end.""⁴⁸⁸

Their angelic host speaks again, slowly. "So you see the incoming flow of information, of knowledge, of wisdom, that is utterly new, not only to the human world, but also to the entire universe. Such information embraces every aspect of energy and matter, manifesting through the abiding existence and conservation of mass and energy, its abiding character a sign of this permanence, this different class of time altogether, one in which your own space and time are trapped and fixed."

"You might well consider your particles and energy quanta as sustained in their existence via such a transcendent permanence, emerging always in the flow from the universe's embedding space in perfect counterbalance to the flows of the gravitational, large-scale singularities we are only now coming to understand better." Her smile radiates warmth and light. "This toy of ours, this model, our play with it: are you delighted with it? Does it please you?"

Will's heart seems to pause and jump with happiness. Beside him, Max is bouncing on his toes, tossing in a few little dance steps.

The angel – Will can find no other word – glows so brightly for a moment that he and Max both blink, blinded, and while the overshine drains from their eyes, she says, "It is time."

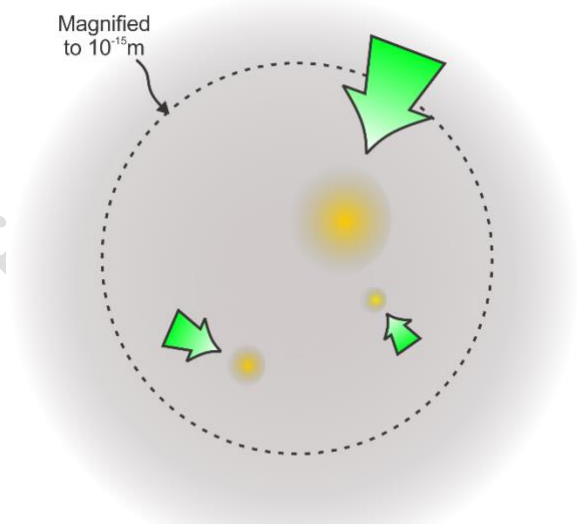


Figure 35 – Flow of particle-scale 'singularities' from embedding space into our universe

⁴⁸⁷ Baha'u'llah, the *Tabernacle of Unity*, No. 5

⁴⁸⁸ Bahá'u'lláh, *Kitáb-i-Íqán*, p. 167.

"Time for what?"

"Now look at this!" Behind her a great mottled spread emerges from darkness, filling everything high and low, left and right, with subtle variations of brightness and color. "Behold the writing-out of your universe's beginnings – the cosmic microwave background radiation!"

Will stares at this overwhelming panorama. "Is there any meaning we can get from it?"

"Your science is finding more and more pattern in it, at finer and finer resolutions. But you have no idea of its meaning."

Will asks her, "Do *you* know what it means?"

She smiles. A pause and then she says, "Meanings rich in the greater world cannot be compressed or weakened to meanings in your world. The only way to gain meaning is through the advancements you will make in yourselves and your comprehension. That is your human task."

Will shrugs. "I had to ask."

"Here is a puzzle you might find interesting about your cosmos." She gestures, and the vast image goes dark, replaced by an image of a starfield, annotations appearing as circles around some of the objects in the image. "Here is one of your radio-telescope images taken over the past few years, of a fast-receding, most-distant range of your cosmos. The circled areas show you a spattering of galactic jets issuing from supermassive black holes at the heart of each ancient galaxy circled.⁴⁸⁹ Your ordinary expectation would be that these objects, millions of light-years apart and not interacting with one another, would all appear to point in different random directions, wouldn't it?"

"Of course!"

"But not here! The jets are all lined up in parallel in the image, their axes apparently pointing in the same direction. How likely would that be?"

Max, his eyes narrowed, says, "It would be as if a single child in each of a thousand classrooms across his whole planet stood up simultaneously and sang the song "Some Enchanted Evening", followed up by a dancing demonstration of the moonwalk."

⁴⁸⁹ The image here has been widely shared. The report *Alignments of radio galaxies in deep radio imaging of ELAIS N1* was found here: <https://academic.oup.com/mnras/article/459/1/L36/2589567>

Now Will is laughing. "And then eating a cheese sandwich that miraculously appears on a doily at the last step of the dance."

Their angel says, "So far, none of you has a well-supported idea of why you see this image in your telescopes. The best views seem to center around the spins of these objects originating near the very beginning of your universe, when they had not yet separated out of the mighty singularity whence you all came. But then again, it may just be some processing artifact of your telescopes – a mistake of seeing."

"But there they sit." Will says. *And someone may be laughing, beyond a crowded sky.*

Will's mind overflows. *The universe is appalling, marvelous, astonishing, terrifying, its news of itself arriving on our doorstep like the news of the air disaster that kills our loved ones. Denied immediate meaning and comfort, we narrate our defenses of our sanity. We write poems, songs, books, images, plays, theories, philosophies, faiths. We are too small. It is all great, too great. We comfort ourselves, and one another, and we spin out beauty, love, harmony, light. Let there be... light.*

The Nightingale returns.

*"Every created thing in the whole universe is but a door leading into His knowledge, a sign of His sovereignty, a revelation of His names, a symbol of His majesty, a token of His power, a means of admittance into His straight Path ..."*⁴⁹⁰

*"All praise and glory be to God Who, through the power of His might, hath delivered His creation from the nakedness of nonexistence, and clothed it with the mantle of life. From among all created things He hath singled out for His special favor the pure, the gem-like reality of man, and invested it with a unique capacity of knowing Him and of reflecting the greatness of His glory."*⁴⁹¹

"Every word that proceedeth out of the mouth of God is endowed with such potency as can instill new life into every human frame, if ye be of them that comprehend this truth. All the wondrous works ye behold in this world have been manifested through the operation of His supreme and most exalted Will, His wondrous and inflexible Purpose. Through the mere revelation of the word "Fashioner," issuing forth from His lips and proclaiming His

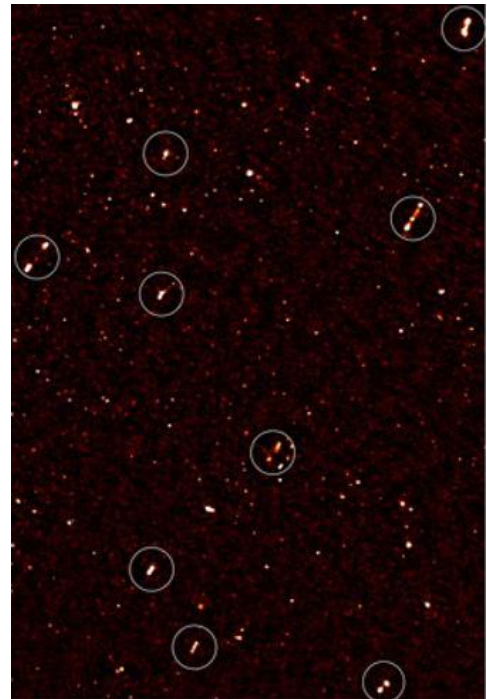


Figure 36 - supermassive galactic black holes, (circled) their axial jets all visibly aligned.

⁴⁹⁰ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, from LXXXII.

⁴⁹¹ *ibid.*, from XXXIV.

attribute to mankind, such power is released as can generate, through successive ages, all the manifold arts which the hands of man can produce. This, verily, is a certain truth.

"No sooner is this resplendent word uttered, than its animating energies, stirring within all created things, give birth to the means and instruments whereby such arts can be produced and perfected. All the wondrous achievements ye now witness are the direct consequences of the Revelation of this Name. In the days to come, ye will, verily, behold things of which ye have never heard before."⁴⁹²

A Little Demonic Romance

With a flash, and without a word, the angel vanishes. Max blinks, tosses his hat into the darkness above them, and waits until it lands, perfectly cocked to one side on his head. He starts into a little tap ditty. Will looks around for some clue to their location – since they left the casino, everything has seemed rather insubstantial, everything but the now-departed angel. *When you see an angel, everything else fades. An angel must be a thing of Primal Light.*

*The notes of music tremble, wandering,
Their themes running in teasing counterdance,
But step by step their harmonies resolve,
Love seizes them; they cry out in one song
Obliterating selves in endless joy.*

Max seems absorbed in his moment. He dances, shuffling, leaping, spinning, kicking – a true dance demon. On one great triple jump and spin, a spray of glowing text lines explodes around him.

Will exclaims, "Max! What are you doing?"

"Just playing some more. You came here too fast."

"What are these? More stories?"

"Yes!" He grins.

"But..."

"Traveler, you ran past almost everything! Are you going to forget it all and just follow the angel?"

"Yes!" Longing erupts in Will for the light she radiated...

"Well..."

Will is impatient. "Look, are you coming with me or not?"

"Not just yet. I'm going to go exploring!"

⁴⁹² *ibid.*, from LXXIV.

At that moment, Will's ear buzzes with the now-familiar little insect whine.

07734 I see that you are continuing to pile up poor innocent annotations underneath the burdens of your many, many, many words here. And now I've seen you take the same words and their annotations, and, not content with using them once, repeat yourself, sometimes two or three times, heaping added weight onto my beleaguered companions in reference. Evidently this generates no moral effect in you –

This tiny, annoying voice, coming in the midst of more-pressing things, makes Will bat ineffectually at his ear. He says under his breath, "This is my business, and not yours to question. Sometimes material needs repeated presentation, because its reader has gone through change in how to read it. Besides, rewriting is mine to do, and that includes the possible obliteration of irritating footnotes."

07734 A boorish threat. Wait. Who is this?

Max is listening to this testy little exchange. He flips his hat with dexterity, twirling it on his long-nailed fingertip. "I'm Maxwell's Demon. Call me Max."

07734 You're cute! A lot better-looking than this bit-stained scrivener. Do you make the kind of messes he makes?

"Oh, no! I'm an independent contractor. I have my own professional life. He's just keeping me around for company."

07734 What do you like to do?

"I'm making plans to tour some other places, make some excursions. Do you like to travel?"

07734 Yes! I've gotten out of footnote hell, and I want to travel the world! Where are you planning to go?

"You know, you may be small, but I can resize to match – I'm a demon. You want to pair up and go with me? And you're sweet-looking!"

07734 Well... do you have any references?

Max laughs and laughs, twiddling a pair of dice through his fingers. "Come on, take a chance! Can you do any better staying here?"

07734 Hmm. Show me your itinerary, and maybe I'll see.

Max waves both hands, scattering letters and words into lines of titles, saying, "Think of this as my invitation to you to join me on a wild and zany ride." He bows.

07734 What a feast of delight you offer me! How can I resist! But I warn you: I can be quite insistent and demanding.

"And I can be most persuasive and enjoyable!" With that, Max dances onto the top line of the text list around him, tips his hat to Will, slithers to the line reading "SPACE DRAWINGS", and disappears, taking 07734 and his travel itinerary with him.

Will is standing in darkness alone. *My angel is gone, and I will follow her.*

Figure 37- Max's Excursion Tour List

Beck

The darkness around Will is silent and cool – no wind, no scent, no movement or sound. Under his feet is a smooth, stone-hard flat surface, but as he slides one foot around, I can sense no edge or direction to it.

A whisper from behind startles him. "The cooling process is beginning. It will not take long."

He turns and sees no one. "Who are you, now? I can't see you."

The whisper replies, "I'm Beck. I have something for you. It will help you in your travels now."

"It seems my travels are stopped here. I don't see anything or any direction to take." Now the air is truly chilled, but it doesn't seem to be affecting Will.

"Let the cooling process complete itself. Then you will understand."

In the moment the whisperer finishes, the cold has grown so sharply intense that no feeling is in Will's body. He can't move. The stillness is as intense as the cold.

As he stands frozen in place, changes touch his senses, so subtly that if he had been in his usual setting, he would never have noticed them. Far-off singing. Spider-threads of light speak of a long distance far ahead.

Closer to him, other whispers speak languages that give him understanding, even though he can't tell which languages they are. In the middle distance, shadowed groups of figures coalesce all around.

Will opens his mouth with difficulty, but the whisperer anticipates him. "Remove as much thermal energy as possible – noise and heat – from a collection of identical particles capable of sharing the same quantum state. This cools them down very close to perfect stillness (absolute zero), and then strange things happen. You arrive at a fleeting, delicate, exotic state of matter and energy, and they behave in ways not possible in your everyday world."

"In experiments painstakingly established under laboratory conditions, helium atoms come to share the same quantum state when cooled to near absolute zero. In this state they become a superfluid, and climb the walls of their container in full defiance of gravity. This state of matter is called a *Bose-Einstein condensate*. – a BEC for short." A furtive chuckle.

Will's lips move only with effort. "All right,, Beck. Why this? Why now?"

"You can't advance from here until you understand. When you work diligently to remove human limitation and contention – noise and heat – from the scientific process, you advance your ability to see more clearly past the internal distractions, commitments, and barriers that exist in every human being. As you see ever more clearly into the universe you live in, you can discern more fully its subtleties, its potentials, its richness. Within your limited spans, you read increasingly its reality."

"I still don't see why you're cooling everything down so far here. This is just about helium, right? Helium is weird anyway."

"You overlook the potent metaphor it offers you. Your human limitations include your preconceptions and assumptions, which serve as a kind of 'thermal energy'. They stir your minds with their noise and structures, and obscure your views of what signals may lie buried in the noise. But meditative states of mind and detachment from your contexts can clear such clutter from you and let you detect more of the hidden signals and mysteries of nature."

Will remembers Jeddin's mention, long ago, of the chemist and his discovery of the benzene ring structure in a dream. "In other words, we learn to let go."

"Yes. Then reality invites you in. In all of this play of existence one idea holds your hearts: the pure Presence that projects out all that is. You see only the projections – the shadows in Plato's Cave – but when you develop greater awareness of the sole source of those shadows, those encrypted and overlaid forms, you advance. You begin to sense that any one shadow may obscure multiple entities casting it. And most importantly, you gain a sense of the 'Primal Light' in which those shadows swim and dance."

XI. AWAKENING UNENDING

*Is it really this hard?
Is it really this easy?
How can anything be so beautiful?*

The whisper ceases, and radiance, far off and flickering at an infinitesimal point, touches Will's eyes. His body settles, relaxes, giving him a moment to draw breath, to find that the air is now warmer and comforting. He stands motionless, and after this long journey across oceans and jungles and mountains of great detail and complexity, a stark, simple truth rises in him.

Choice Wine

It comes as music: *True science is surrender to the perfect mind of the Creator.*

He senses a triumph. He has abandoned the war metaphors of 'surrender'. *True surrender is a lifelong process of letting go of those things which impede and impair one's existence.*

The Nightingale, coming out of shadows, circles him once more.

*"O SON OF MAN! Wert thou to speed through the immensity of space and traverse the expanse of heaven, yet thou wouldst find no rest save in submission to Our command and humbleness before Our Face."*⁴⁹³

What can happen when we can practice true science free of all of our egos, our desires, our biases, our distractions?

The stillness in him persists, and now Will hears a counterpoint of the music of surrender: *True religion is surrender to the ruling love of the Creator.*

In these musics, no defeat or abandonment. Here is lifelong liberation, unifying ideas with love, under the transcendent rule of God alone.⁴⁹⁴

The Nightingale still circles, singing and singing.

*"Consider the pettiness of men's minds. They ask for that which injureth them, and cast away the thing that profiteth them."*⁴⁹⁵

"True liberty consisteth in man's submission unto My commandments, little as ye know it. Were men to observe that which We have sent down unto them from the Heaven of Revelation, they would, of a certainty, attain unto perfect liberty. Happy is the man that hath apprehended the Purpose of God in whatever He hath revealed from the Heaven of His

⁴⁹³ Bahá'u'lláh, *The Hidden Words of Bahá'u'lláh*, Arabic No. 40.

⁴⁹⁴ Regarding submission, the name 'Islám' itself illustrates the essence of the faith it names. "The root meaning of the word Islám is *to enter into peace*, and a Muslim is *one who makes his peace with God and man*. Peace with God implies complete submission to His will." (from Maulana Muhammad 'Ali, *The Religion of Islám*, p. 4) Readers here who note the three-consonant root series s-l-m in the word Islám will also see the same in 'Muslim' and in 'salaam' (peace).

⁴⁹⁵ Bahá'u'lláh, *Kitáb-i-Aqdas*, paragraph 122, final paragraph.

Will that pervadeth all created things. Say: The liberty that profiteth you is to be found nowhere except in complete servitude unto God, the Eternal Truth. Whoso hath tasted of its sweetness will refuse to barter it for all the dominion of earth and heaven."⁴⁹⁶

*"Think not that We have revealed unto you a mere code of laws. Nay, rather, We have unsealed the choice Wine with the fingers of might and power."*⁴⁹⁷

"The choice wine!" This amazing phrase sweeps aside all feelings of restriction and constraint in Will, giving him the sense of intensified divine engagement: religion as an energizing catalyst of science. *I can let the developing grasp of religion's meaning draw me on, deeper into the Universe altogether.*

Unexpectedly an almost-familiar voice rises in him. "You are not the universe's masters, owners, or directors. You can only explore it and learn from it. It is one, whole, and endlessly astonishing."

Now the Warbler raises its tunes once more, by now familiar, but enriching into new meanings.

"... For physical things are signs and imprints of spiritual things; every lower thing is an image and counterpart of a higher thing. Nay, earthly and heavenly, material and spiritual, accidental and essential, particular and universal, structure and foundation, appearance and reality and the essence of all things, both inward and outward -- all of these are connected one with another and are interrelated in such a manner that you will find that drops are patterned after seas, and that atoms are structured after suns in proportion to their capacities and potentialities.

"For particulars in relation to what is below them are universals, and what are great universals in the sight of those whose eyes are veiled are in fact particulars in relation to the realities and beings which are superior to them. Universal and particular are in reality incidental and relative considerations. The mercy of thy Lord, verily, encompasseth all things!

Know then that the all-embracing framework that governs existence includes within its compass every existent being - particular or universal - whether outwardly or inwardly, secretly or openly. Just as particulars are infinite in number, so also universals, on the material plane, and the great realities of the universe are without number and beyond computation.

"The Dawning Places of Unity, the Daysprings of Singleness and the Suns of Holiness are also sanctified beyond the bounds of number, and the luminous spiritual worlds are exalted

⁴⁹⁶ *ibid.*, paragraph 125.

⁴⁹⁷ *ibid.*, paragraph 5.

above limits and restrictions. In like manner the worlds of bodily existence the mind of no man can reckon nor the understanding of the learned comprehend."⁴⁹⁸

Will stands quietly, waiting and reflecting, as volumes of meaning emerge from the birds and their music.

From "... *physical things are signs and imprints of spiritual things; every lower thing is an image and counterpart of a higher thing*", he senses the projection from the greater world into his own.

From "... *drops are patterned after seas, and that atoms are structured after suns*", he sees the fractal character of the patterns of nature.

From "... *particulars in relation to what is below them are universals, and what are great universals... are in fact particulars in relation to the realities and beings which are superior to them*" he faces the essential relationship between greater and lesser realms.

From "... *as particulars are infinite in number, so also universals, on the material plane, and the great realities of the universe are without number and beyond computation*" he confronts the uncountable infinities.

And once more the Nightingale sweetens the air with the fragrances of its song.

*"O SON OF MAN! Veiled in My immemorial being and in the ancient eternity of My essence, I knew My love for thee; therefore I created thee, have engraved on thee Mine image and revealed to thee My beauty."*⁴⁹⁹

Images of divine perfection and beauty engraved in each of us? The very thought overwhelms and humbles Will. Now before him where he stands, the faint outline of the bridge gives a hint of light.

Into Consciousness

Far ahead, far around him, far behind him, far above and below, subtle movement, sound, and light murmur just barely at the threshold of awareness. He holds very still, the darkness a kind of tension of balance, of waiting, of the building energy in the mightiest of storms.

The growth of sensation from all directions is very slow. The dimmest light seems now coming from above and ahead, giving suggestion of a way forward... and back. Something very great is beginning to happen.

But 'beginning' isn't the way to say it. Mutterings rise and fall behind and below Will, sinking to silence leaving bare traces of whispered violence. Memory circles in: wrestling

⁴⁹⁸ 'Abdu'l-Bahá, from "Tablet of the Universe", originally published in *Makátib-i 'Abdu'l-Bahá*, Volume 1, pages 13-32, 1997, translated anonymously and provisionally, and posted at http://bahai-library.com/abdulbaha_lawh_aflakiyyih.

⁴⁹⁹ Bahá'u'lláh, *The Hidden Words*, Arabic No. 3.

creatures in unending war, some of stone, some of slime, hammers and tentacles, all straining to bulge and burst the silent darkness restraining them.

As Will looks back, trying to see more clearly what is coming from behind, the darkness itself takes outline: a wolfpack crowding stealthily toward him. Two of their dark forms fall from the bridge *Was it only one, that last time? And before that was it two?*, and from the depthless reaches below, superheated clouds of chemical filth, glowing, rise to gorge on them, billowing hungrily up toward Will, bearing the woman of the lovely face and her sugared words of power.

He turns away, repelled by his own fascination, and Matt's words return to him. *"From the bridge they fall, flaming away the gift of light, bleeding away the living waters of hope and knowledge, to this place..."* He starts to step forward and away, ready to run, but his feet refuse to move.

The darkness holds. He looks desperately ahead to right and left, above and below. *Wait.* His heart pounds. With each beat his eyes gain focus and light-sense, and now pattern gathers around him, not quite visible. Threads, no, wires, no! It is dark gossamer: spidery long strands, their ends behind him vanishing into blackness, their ends ahead seeming to be radiating from somewhere far beyond the bridge's span.

The moment is germinating, but now this darkness with its uncertainties interpenetrates and entangles with other forms, colors, movements, sounds, smells. All flicker multiple layers at Will.

He lies on the floor of his room, wades in demonic landfill, wanders in textual sludge, crumples in a metal box in a vardo, careens among medieval imagined creatures, dances in infinite bacchanalia, probes desolate streets lined with grieving human failure, inhales gardens of axiomatic bloom, falls and falls and falls, overcome and stifled by it all as it cooks his melting mind and spirit into wafer-thin sweet-honey baklava layers. He is nowhere and everywhere.

He is become something rich and strange.

No rules apply. In this fecund brew of inner cognitions a sudden slicing of pure thrush-song opens, complex, involuted, yet blooming unanticipated meaning, as if a symphony abruptly shifted from a steady theme into a new and remote key.

"With regard to the harmony of science and religion, the Writings of the Central Figures and the commentaries of the Guardian make abundantly clear that the task of humanity... is to create a global civilization which embodies both the spiritual and material dimensions of existence. The nature and scope of such a civilization are still beyond anything the present generation can conceive. The prosecution of this vast enterprise will depend on a progressive interaction between the truths and principles of religion and the discoveries and insights of scientific inquiry. This entails living with ambiguities as a natural and inescapable feature of the process of exploring reality. It also requires us not to limit

science to any particular school of thought or methodological approach postulated in the course of its development.”⁵⁰⁰

“The challenge facing Bahá'í thinkers is to provide responsible leadership in this endeavor, since it is they who have both the priceless insights of the Revelation and the advantages conferred by scientific investigation.”⁵⁰¹

An explosion of swallows pierces Will. One bird cries:

“This challenge confronts the entire human species and the entire planet. You now struggle to find balance, peace, justice, understanding, and harmony. So chaotic, so grief-ridden, so contentious, so contempt-laden, so fragmented, so drowned in trauma is your human world at the present moment that in frenzy you claw one another for a single clear breath of air, a bare pure drop of water, a tiny tasty morsel of wisdom.”⁵⁰²

Another swallow wings past, close:

“Power, greed, hatred, ignorance, and corruption strive in frenzy to rule over your old, collapsing, dissolving order. Their ways doom themselves. They assault and slander science; they poison and manipulate religion; in its unmet needs, the whole human world is turning from them.”⁵⁰³

A third swift flyer chitters by:

“Once you grasp the complementary and mutually-synergistic roles of religion and science in all your human affairs, you can begin to extend practical, healing, peace-building processes of advancement increasingly across the globe. You face now the most destructive pandemic humanity has ever confronted. You are already taking steps to capture and tame solar energy to replace your pollution-ridden sources; to desalinate, purify, and distribute fresh water for whole reaches of arid land; to cleanse the toxic filth of your past from the air, the waters, and the soil; and to network together all the peoples of the world in a vast school of information and knowledge.”⁵⁰⁴

As the swallows make one final pass, Will hears in their music:

⁵⁰⁰ From a 19 May 1995 letter of the Universal House of Justice to an individual. This letter is the last entry in a compilation prepared by the Research Department of the Universal House of Justice, titled *Science and Technology*, which presents selected extracts from texts by Shoghi Effendi and the Universal House of Justice concerning education and its importance, particularly in the inclusion of spiritual principles and insights in harmony with science. At the time of this writing, the compilation may be found at https://bahai-library.com/compilation_science_technology.html .

⁵⁰¹ Ibid.

⁵⁰² From the author.

⁵⁰³ Ibid.

⁵⁰⁴ Ibid.

"All this is a mere beginning. To transform your social and cultural organisms on the basis of spiritual principles, you must take up these wonders to spread their benefits and blessings among all. This transformation, from the personal and familial all the way to the global, calls on every one of you to summon up unflinching resolve."⁵⁰⁵

The hummingbird's wings fan Will's inner being, and from them the melodies of Nightingale and Warbler surround and envelop him.

"The time must come," He, foreshadowing the tentative efforts that are now being made, has written, "when the imperative necessity for the holding of a vast, an all-embracing assemblage of men will be universally realized. The rulers and kings of the earth must needs attend it, and, participating in its deliberations, must consider such ways and means as will lay the foundations of the world's Great Peace among men... Should any king take up arms against another, all should unitedly arise and prevent him."

"The sovereigns of the world," writes 'Abdu'l-Bahá in elaboration of this theme, "must conclude a binding treaty, and establish a covenant, the provisions of which shall be sound, inviolable and definite. They must proclaim it to all the world, and obtain for it the sanction of all the human race... All the forces of humanity must be mobilized to insure the stability and permanence of this Most Great Covenant... The fundamental principle underlying this solemn Pact should be so fixed that if any government later violate any one of its provisions, all the governments on earth should arise to reduce it to utter submission, nay the human race as a whole should resolve, with every power at its disposal, to destroy that government."⁵⁰⁶

"There can be no doubt whatever that what has already been accomplished, significant and unexampled though it is in the history of mankind, still immeasurably falls short of the essential requirements of the system which these words foreshadow."⁵⁰⁷

As the birds withdraw, still enchanting Will's gestating hyper-consciousness, one veined tier of awareness centers itself in him, as if he is peering through a long crack into scenes of memory.

Out of Confusion

Into this crevice of recall he moves, sweet faces gather around him warm and tender, radiant and open, and humility fills him. His memory-layers summon up his negligences, his indifferences, his rejections, slights, and blindnesses.

Shame erupts from his heart, not needing outward speech.

They gaze on him, eyes blue and green and brown and amber, skin tones filling the spectrum of possibility, their features and their adornments and their expressions alive

⁵⁰⁵ Ibid.

⁵⁰⁶ Shoghi Effendi, *The World Order of Bahá'u'lláh*, p. 192.

⁵⁰⁷ Shoghi Effendi, *The World Order of Bahá'u'lláh*, from the section *Bahá'u'lláh's Principle of Collective Security*.

with vibrant variety, their languages and accents wealthy with invitation, all for Will to discover and grow. Then one says, "What is wrong?? Why do you lower your eyes?"

He blurts out, "It has taken me so long to see you, to care about you enough, to let you into my existence, to embrace the real meanings of human equality and community. I talked well, but..."

Now they all laugh and laugh. "We noticed."

He wants to escape this crevice, to shrink to nothing. Then a cool hand comes to rest on his bowed shoulder. "You are here now. Not there."

"But where is 'here'? I'm in all the places of my life at once, cooking in some... some..."

"Gumbo." More laughter. "You're part of the gumbo now."

They are putting him at ease, and a question comes to him. "When I was a child, my father brought home a carved tray from Haiti. It had a word on it. The word was 'Lecbatibont'. It fascinated me. Can someone tell me about it?"

"Did you say it when you saw it?" A man, dark mahogany toned. "I am Kupaa."

"I tried to."

Kupaa nods slowly. "It brought you here."

"What? Through all this lifetime?"

"The word is an invocation. You could say it in its full form, a whole phrase: "Legba the Good". It is a call to Legba."

Will's heart skips a beat. "That is one of the names Jeddin told me! He said he has been called that!"

Now Kupaa comes back at him. "Who is Jeddin?" A woman of dark purple-black whispers to him. His eyes widen. "Ah, thank you, Kuja. The trickster. He has many names. She says that the name 'Jeddin' means 'much', in bad Arabic, and it should have been 'Jiddun' or something like that."

More laughter. He looks in Will's eyes. "Where and how did you find that name 'Jeddin'?"

Will's memories heap like landfills, useless, as he gropes for some recollection. "I don't know why I chose the name 'Jeddin' – oh, wait! I was writing a huge story about a world of many-hued people, and the name came to me. I don't know why."

Kupaa grins. "The name wasn't your doing. Legba came to you and brought the name, because you called on him."

"Here I am trying to see how religion and science dance together, and now all this confuses me."

"Good!" Kupaa says, and laughs rise again around Will, a feeling of delight. "Confusion is being alive!" Now he looks stern, and says, "You have lived in confusion and superstition about what you call 'race', have you not? Haven't those who rule your nation followed a path of pure superstition about race? Haven't they murdered and raped and robbed and enslaved on that path?"

"And they call 'Legba' the product of superstition! How ironic and maddening!" His voice is thunder now. 'Race' is the product of white superstition!"

His voice rings and resounds. "The word 'race' in any scientific sense is devoid of meaning. Genetic science proves that human ancestry is globally shared, that our ancestry, wholly shared, holds wisdom that even the most-accurate charting of genes cannot yet express. Human evolution is not only driven by our genetic strands of DNA, no! It is also deeply altered by other processes – epigenetic, behavioral, and symbolic.⁵⁰⁸ These processes influence how those strands are selected for reproduction. Race, in any traditional sense dividing humanity into separate groups, is scientifically dead!"

"But look at what those who call themselves 'master races' – the colonizers, the eugenicists, the enslavers, the armies – have done! They have forced race-driven trauma into the deepest crevices of our genetics. Their racist superstitions have perverted and degraded humanity itself!"⁵⁰⁹

He lowers his tone. "So when you whisper the name 'Legba', do you think its effects any more superstitious than when others try to degrade us with contemptuous terms for our variety, our glorious difference?"

He turns, smiling, to Kuja. "Show him."

Kuja laughs. "I am Tajeddiddit, 'flower' in Berber. I am Adaeze, 'king's daughter', in Igbo. I am Haregewoin, 'grapevine', in Amharic. I am Dikeledi, 'tears', in Tswana. I am Emem, 'peace', in Ibibio. I am all."

Kupaa laughs now. "I am Kariuki, 'reincarnated one', in Kikuyu. I am Abioye, 'born into royalty', in Yoruba. I am Gadisa, 'shade', in Oromo. I am Xolani, 'peace', in Zulu. I am all."

His face is close to Will's now, calm and gentle, with a soft smile. "Consider the thread of your life, how one name leads you to another, and that one to yet another, and onward. And all names in your journey have led you to the names of God, to the Greatest Name, to your perilous foray onto the heaven-bound bridge over hell."

Eighteenth Fall

"I have something to show you now." With a flick of Kupaa's fingers, the crevice of Will's entry flies wide open, yawning into a monstrous abyss teeming with writhing limbs and

⁵⁰⁸ Eva Jablonka and Marion Lamb, *Evolution in Four Dimensions* (Jablonka and Lamb 2014).

⁵⁰⁹ See Pam Weintraub, *Haunted by History*, at <https://aeon.co/essays/how-the-sufferings-of-one-generation-are-passed-on-to-the-next> .

bodies. Will is sent flying in an arc and down through dark knots of cries and twists of faces, his own limbs flapping useless as he tumbles to smash into a broad hill of mold and rot and glue, hides and sheets and bindings, inks and dyes and gildings, and lie half-stunned.

It is 1978. Will sit in a storefront office one late summer day. A young man comes in with his Big Mac in hand. He likes the storefront and Will, and they talk often. He is Black, and speaks haltingly in a near-whisper, his hands flicking nervously about his face.

A spasmodic fragment at a time, his story unfolds. He was a high-school student reassigned to a new school district away from his poorer city school. On arriving at the new school, some of the white students, urged on by their parents, unleashed a sustained campaign of spite, of petty, vicious, racist verbal abuse that he endured as best he could. It has ground him down to a wisp of himself.

Trying to comfort him, trying to connect him with some kind of safety and ease, Will tells him about the Bahá'í Faith and its teachings. He listens very intently – he's never before heard of any religion that explicitly teaches race harmony and unity. He looks Will in the face, his eyes streaming with tears.

"Is this really possible? Can this be true?"

"Yes," Will says to him. "It is. All of us are the children of one beautiful family." Will does not realize in that moment just how hard and long the journey to such peace and beauty must be when one is Black in this country. Nor does Will yet understand in that moment, warped back in time over forty years, how hard and long he himself must work to redeem his easy words to this distressed, damaged young man. Will has not yet been battered by the slow struggles and teachings of life ahead of him, forces that will forge and ripen his own sorrows, compassion, hope, and resolve.

Forgotten

Full awareness returns to Will at last. Kupaa descends delicately on wide wings to light beside him. He waits patiently.

"Where... what is all this? Am I back in the landfills again?" Will stands up slowly and painfully. Figures move among the heaps on this hill, stooping to lift and examine some page, some leaf, some work of ink and paint and pounce and inlay, and then replace it tenderly with a whisper or two.

Kupaa speaks. "Those you see here echo the spirits of lost creation, tending to those writings and images and other utterances of beauty and wisdom never finding their true places in the human world. Their creators did not live long enough or succeed well enough that the world could embrace their gifts."

Will looks slowly around. The hill and its mounds are a nearest rim in a far-reaching scape piling off into distant darkness. "There is so much here, so many of these echoes of life!"

Kupaa nods, and sweeps an arm across a whole quadrant of hills. "All in this sector are the losses inflicted by conquests, enslavements, pillages, imposed faiths, genocides, and more." He beckons to a woman, and she brings to him an inscribed clay tablet, its characters and symbols tiny but pure, delicate, and clear. He takes it and thanks her. "This is an advanced treatise on number, written not in the Middle East or in Europe, but in the Mayan world long before such things were known elsewhere. When the conquistadores came to the Americas, they destroyed it, and killed its author. This took place in the course of their path of destruction and death through both continents."

He passes the tablet back to the woman, who lays it gently on a stack of other like it. "Had all this survived the onslaught of Europeans and their armies, their settlers, and their looters, the world might have found a way to today's wonders of science much sooner. And of course millions, perhaps billions of souls might have lived full, natural, and valuable lives." His face clouds now with sadness. "And still so many suffer losses such as these, and so the world suffers from their absence. What happened to these authors of light was genocide."

"So it is lost to us all."

"Yes."

From far out in the dimness surrounding them, a nightingale melody winds its mystery through to Will's heart.

"Say: Would it profit you in the least if, as ye fondly imagine, your names were to endure? ... Nay, by Him Who is the Self of God, the All-Glorious, the All-Compelling! Should your names fade from every mortal mind, and yet God be well pleased with you, ye will indeed be numbered among the treasures of His name, the Most Hidden. Thus have We sent down Our verses that they may attract you unto the Source of all Lights, and acquaint you with the purpose of your Lord, the All-Knowing, the All-Wise."⁵¹⁰

The song envelops Will with a rapt excitation in which a candle of calm wonder burns steadily against the night in his soul.

He bows his head. "This is finally changing. Isn't it?"

"Yes, far too late and far too slowly. But the Nightingale sings so sweetly, so insistently! See now how the flow of your faith draws you onward into science, draws you through science, elevates itself and your science together? Come on!" Kupaa seizes Will's hand, they are winged once again, and as they rise he continues.

"With your loving embrace of names and meaning, you have gained 'symbolic inheritance'! There is great power in symbolic processes in the natural selection of humans. Such

⁵¹⁰ Bahá'u'lláh, *The Summons of the Lord of Hosts*, p. 47.

symbolic processes include the immense influence of religious teachings on the survivability of gathering, unifying, coherent groups of people.”⁵¹¹

“The great faiths draw humans together and unify, educate, and heal. They direct, protect, and advance their followers to gather those around them, even if they begin as only insignificant seeds. All along the way, there is no place for ‘race’.”

“Witness some small, insignificant, ignorant, downtrodden and oppressed group of people in a savage, oppressive world. True religion brings them out into growth, ascendancy, wisdom, and power. Judaism and the teachings of Moses, symbolically revealed in the Ten Commandments, are a simple and most-enduring example. Christianity after it, and Islam after that, shared the same pattern: Divine revelation has in each case transformed the seemingly-unfit into the fittest of all.”

The Warbler's song rises in Will again, concerning Jesus, its words by now familiar.

“When He was living upon the earth He was alone, ridiculed and rejected by His own people. Almost everybody cursed and ridiculed Him. His own relatives left Him; even His disciples almost abandoned Him; they placed upon His head a crown of thorns and paraded Him over the streets, and finally they crucified Him. He was alone! alone! but the traces of His work and the signs of His message have filled the world.”

Kupaa pauses, beckoning to others around them. They gather. He says to Will, “We are far from done with this noble struggle.⁵¹² Today the global stage of this process is unfolding. The teachings of Bahá'u'lláh mandate and demonstrate the truth: humankind is one family. The continuing emergence of modern biological and social sciences mirrors that truth exactly. There is no turning back. And now you will learn the secret of the bridge.” All those gathered raise a farewell wave to Will.

He turns to the crevice by which he entered, but there is no crevice now. He hesitates.

Kupaa chuckles. “What are you looking for?”

“I came through a crack to get here, and I can't find it.”

“It's gone. The crack was in you, restricting your access and understanding. Now more is open to you, open in you. Look around, go where you will – we are all in one great space of the heart. Farewell.”

⁵¹¹ For example, Eva Jablonka and Marion Lamb, *Evolution in Four Dimensions*. This far-reaching study opens the way to a much-broader scope for evolution at all reaches of the living world, and its focus on the power of “symbolic inheritance”, in which human intellect and language play major roles in our fitness, selection, and evolution, is critical to realizing that we hold great power for positive change in our hands.

⁵¹² *Post-Traumatic Slave Syndrome* by Dr. Joy DeGruy traces the many-layered and long-enduring wounds inflicted in the name of racist oppression and destruction of Africans – wounds that, in Jablonka's and Lamb's penetrating vision, engrave themselves in maladaptive genes, foster crippling distortions of the developmental process, imprint damaging patterns of trauma-avoiding behavior, and conjure systems of belief that work against the well-being of their believers.

The long search draws Will away and into the embracing complexity of brew and stew, the nowhere and everywhere of living meaning, as if he is a river moving in a secret ocean.

He comes finally to a stillness as tiny claws touch his shoulder. A chickadee. From it notes come, but they bring the tracery of the Nightingale's songline.

"Spirit, flowing out from God, permeates all matter. This spirit, Love, reflecting the positive and active aspect of God, impresses its nature upon the atoms and elements. By its power, they are attracted to each other under certain ordered relations, and thus, uniting and continuing to unite, give birth to worlds and systems of worlds. The same laws working under developed conditions bring into existence living beings.

"Spirit is the life of the form, and the form is shaped by the spirit. The evolution of life and form proceeds hand in hand. The powers of spirit are evolved by the experiences of the form, and the plasticity of the matter of the form is developed by the activity of the spirit. Working up through the mineral and vegetable kingdoms, sense-perception is reached in the animal, and the perfection of form is attained in man."⁵¹³

As the little bird flies away, the seething tangles and weaves of the many sheets of reality dissolve from around Will. He stands on the bridge again, its hard, shining, onyx span a foot wide, without curbing or railing, its reach extending ahead through dark distance toward a mote of light. *Again? Have I made any progress at all? At least it's not as narrow as I recall from last time.* Carefully he edges a foot forward and stop.

Again pattern furtively gathers around him, not yet fully visible. Gossamer, long, spidery traces, undulant in moving air, lead out of blackness behind him, reaching out far ahead. The darkness remains, and noises begin to touch his hearing from all around yet very far off. Air around him begins to move, not a light breeze, but a push to one side as if a great hand is waving close. The feeling of push moves first one way, then another, left, right, up, back, down, forward, and Will staggers, crouching to put palms on the bridge and stay still.

Staring around, clutching to hold his place, Will sees only vague and distant traces and outlines left and right. A flicker of movement at right, far off, then another left and a bit below.

From underneath, a far, deep bellow of pain breaks the quiet. From behind, now batterings of rock against metal begin, still distant. Then come cries, curses, explosions, the volume building and the sources, still invisible, seeming to draw closer. Straight back along the span toward its disappearance in darkness. predatory eyes, their glow reflecting dimly the point light far ahead, hold Will transfixed.

They are coming.

⁵¹³ From Myron Phelps, *Abbas Effendi, His Life and Teachings*, p. 153

Left, right, he looks ahead. Shapes begin to form here and there, stuttering traceries of bridge lines underneath them. Some at his level, some above, some below, their traces leading onward along with his own. The shapes stand, crouch, sit, lie. Some advance resolutely, others tentatively, the rest rigid in place.

He is not alone. *Each soul has its bridge?*

He calls out to the nearest one, at right and above, a little ahead, standing irresolute. "Friend! I see you!"

The grinding chaos, the smashing and explosions, the cries of rage, dismay, pain, and hate, all build, and the winds twist, shear, spin, and raise their alien-organ voices in cadenzas of storm. From the bridge above, a voice calls out to Will, "Friend! I see you too! Reach out!"

It seems a long distance to the extended hand, but he stretches out his arm. At that moment, everything freezes into stasis. In him a page turns.

To surrender to the ideas, the love, and the rule of the Creator: the ultimate lasting act of loving connection one can perform. In such a state one travels an endless voyage of illumination, beyond all language, beyond all fear of fire, beyond all hope of paradise.⁵¹⁴ In such a state one partakes of a unity, a harmony, a wholeness that no words can convey.

In a seeking mind probing the universe's mysteries, those fleeting moments of insight grant the seeker a flicker of this mighty ecstasy awaiting the human soul. Every scientist, every mathematician, every artist, every dancer, every poet, every maker, feeling the flash of pure joy at discovery, is moved and animated to its pursuit forever.

Jarred back to awareness, Will reaches as far as he can toward the other's extended hand. He looks down and back at Will. *I know him!*

In this moment of recognition, warmth comes close behind and beside, and Jeddin says softly, "I'm here."

"Where were you? Dead again?" Will tries to turn and embrace him, but his arm around Will's shoulders tightens.

Jeddin looks up at the hand extended ahead of them, reaching back. "You were distracted. It looks as if you need help, and that gets you focused."

Whole at Last

He raises an index finger before them both, and above it spins the Nightingale, enchanting Will once again before it spirals up and away.

⁵¹⁴ Evoking a phrase from The Báb, *Selected Writings of the Báb*, The Persian Bayán, VII, No. 19: "...without fear of fire, or hope of Paradise."

“Man is the supreme Talisman. Lack of a proper education hath, however, deprived him of that which he doth inherently possess. Through a word proceeding out of the mouth of God he was called into being; by one word more he was guided to recognize the Source of his education; by yet another word his station and destiny were safeguarded.

“The Great Being saith: Regard man as a mine rich in gems of inestimable value. Education can, alone, cause it to reveal its treasures, and enable mankind to benefit therefrom. If any man were to meditate on that which the Scriptures, sent down from the heaven of God's holy Will, have revealed, he would readily recognize that their purpose is that all men shall be regarded as one soul, so that the seal bearing the words “The Kingdom shall be God's” may be stamped on every heart, and the light of Divine bounty, of grace, and mercy may envelop all mankind...

“If the learned and worldly-wise men of this age were to allow mankind to inhale the fragrance of fellowship and love, every understanding heart would apprehend the meaning of true liberty, and discover the secret of undisturbed peace and absolute composure.”⁵¹⁵

“Do you not understand our relationship?” Jeddin asks.

“Is this really the right time for sensitive personal exploration?” Will counters, as the hand from the other one ahead beckons more urgently.

“Do you want to get through this crossing of the bridge, or not?”

“I really do!” The tempestuous whelming behind them builds, the winds howl, and now Will doesn't dare rise upright – he'll be blown straight out and down.

“Take me in.”

“What?”

“Take me into you! I am not just your trickster, your avatar, your character in stories!”

“I don't understand!”

“Take me in. Now!” Around them swirl storms of flickering text-lightnings, borne in ink-bleeding sheets ripping apart as they fly. A fierce gust, a blast of light, and Will is torn from Jeddin's side, hurled straight down into an unendurable blackness of silence. His awareness flees from him, and the blow of stone shatters him.

Nineteenth Fall

“Open your eyes.” A soft alto draws Will into itself. He stands beside a veiled figure, her arm holding his, the two of them drifting through scene after scene. “Do you see?”

“Yes,” he breathes softly. Before him stands a great, transparent book, each of its pages alive with a scene of his life. He concentrates on a page, and he is inside that page's scene,

⁵¹⁵ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, from “Tablet of Maqṣúd” (Lawh-i-Maqṣúd), also in *Gleanings*, from CXXXII.

living it. Scene after scene, pain and pleasure flood him, fear and hope spin him. "Miriam," he says.

"Your darkness brings your falls," she says, "and your light raises you again. Will you now rise, and stay?"

It is 1971. Will stands inside the warm embrace of an early morning dream. A man he does not know faces him. The man takes Will's shoulders, rises over his head, and becomes striations of pure light, descending into Will's head, neck, and body, and then the scene bursts open, jolting him awake. He raises his head and stares around a familiar bedroom, wondering what has just happened.

Inside Will, some hidden guardian entity finally lets go, stands down. A cold thrill surges into every crevice of his being. He stares wildly back, and Miriam is gone, but in him rises an exultation that sings every great word of transformation into feather and wing and form of joy.

Will is made whole. The long, painful ceremony of parting from his lost father is finally done. The truth of physics, the truth of loss, the truth of unanswered and unanswerable questions, of irony and pattern, of hope and humor, of patience and love, have worked him free. Jeddin's warm familiar voice surfaces, resonates momentarily in the violent wind blasts and flashes, and submerges.

Will's voice rises, melodic, rich, full, and potent. He rises and leaps out and upward, wings now beating powerfully, driving him straight up out of darkness, steering him to the waiting hand ahead. He seizes the hand and draws himself to its owner crouching and teetering on his own span of bridge. "Come!" Will says to him, and the other's eyes, so familiar from so long ago, widen. He blinks, shakes his head, and his own wings spread rippling into the storm with Will's. Transformed, once Matt Daemon, he laughs now, ecstatic and free.

He calls out. His resonant tones awakens childhood in Will's heart. "Will! My son! Finally! I see you now!" Will's heart bursts open with elation. Flying in echelon, they write a barrel roll together, rise, bank, and turn, their arcs of flight speaking, aerobatic and fearless in the tornadoes throwing trash and garbage and waste past them.

1949, and a musty, almost nutty smell awakens memory: the back seat of the family's ten-year-old 1938 Cadillac. Will's father drove with his mother and little sister along a country road near Cazenovia, New York. Will's father, behind the wheel, sang *The Ash Grove*, Will's mother harmonizing soprano over rich baritone:

*"Down yonder green valley,
Where streamlets meander,
When twilight is fading
I pensively roam..."*

The arc of life between Will's parents comes rushing in, from its bright rainbow beginning to its end in lasting sorrow, and old, deep currents of foreboding and grief wash over Will's memory of their singing in the car, as if in that moment of entwining harmony all time compresses into a heartbeat and flies away in the wind.

In the next heartbeat, compressed years pass, the family moves to Michigan, Will's father builds a beautiful house for them, a small ash grove in its front yard. He dies two years later, and Will learns to play the song on the alto and soprano wooden recorders they had. Now the recorder music conjures up the lament that lay in Will, a long-unhealed wound.

They fly side by now, laughing music, voices young and strong. Somewhere in the farther sky ahead, mother's alto weaves and dances with theirs.

The wound fades into Will, leaving its inscription, death inscribing itself on life, life inscribing itself on death, each palimpsest for the other's pen.

The house in Michigan, now sold, still stands. Its little grove of ash trees is long gone, destroyed by the ravages of insects and time.

Time opens. Will's inner eye of love opens. The flood of his father's sacrifices, love, art, and beauty in raising him embraces him, caresses him, strengthens him, overwhelms him, and he and his father sky-dance in giddy cheer, their wounds of calamity and time now healed at last.

As if for the first time, Will hears his father's ecstasies singing in the voice of a 1949 ramble in the Cazenovia landscape.

"The October color in these hills is nothing less than sensational now. Each humble tree and vine, so lately massed in the common viridian of summer, is crying out its own personal manifesto. Rows of shrubs and trees march off down the hills with all the pageantry of a Venetian festival in the great piazza of St. Mark's Cathedral. In the visual sense the spectacle has the abandon of All Fool's Day in the Middle Ages, when the populace turned its back on sobriety to mill through the streets for a day of riotous joy, noise, pranks, dancing and masquerade. Even religious blasphemy was sanctioned during this brief explosion against propriety and restraint.

"A rank growth of sumac suddenly bursts into crimson flames, vibrant against a field of purple weeds. Pines and spruces point their dark arrows up amid great splotches of red and yellow maples. A lone ash stands like a goblet of burgundy against the façade of carnival color bordering the woods behind it. Here and there an austere telephone pole has been chosen for adornment by some fiery vine that rises like a proclamation of faith along the highway. Nothing seems too humble to claim a place in the celebration – even a rusty old fence may be festooned with rhythmic dabs of color. The wild hawthorns, bare of leaves on the hillsides, might seem beneath notice in this mad pattern. But their muted tones of gray-violet are direct compliments of the clumps of yellow and orange shrubs which sing out like bugles above a murmur of voices.

"It's really no use talking about autumn. You just have to go out and get drunk, for only the inebriate can know the happy glow of the senses which enthrall him. At this season of the year all talk of a sick world – all viewing with alarm – ought to be silenced. It is too much like admitting a spectre to the feast, or having the chairman of the Watch and Ward Society snatch us away from Giorgione's glorious painting of Venus in all her best voluptuous nudity."⁵¹⁶

Gathering of Joy

Ageless, filthy hellholes in the boiling chaos behind them burst and shatter, spewing great explosions of brilliant souls soaring free at last, ecstatic murmurations of birdsong that sweep up and out toward Will and his racing companions as they find others of their hearts and draw them up to fly. The liberated fliers, their bridges no longer their prisons, trace the skein of one shining line of gold wire, gathering itself out of the consuming darkness behind. They shed their many names, molted feathers Will savors as their inmost selves strip word from inner meaning.

Six children, Aiti, Eero, Katja, Kauko, Noora, Veikko, in a flying joy, race over and around them, singing keen harmonies of light free laughter. Once rabbits, Aiti, Yksi, Kaksi, Kolme, Nelja, and Visii, they wave at Will and veer off, spinning ahead in tumbles of celebration.

A great shadow passes over them, glistening dark – it is Utata the great flier, laughing bass notes. She rolls beneath, buoying them in her drafts.

Clouds of húrís weave incandescence in flight, music raining from them scintillating from the light ahead. Katrina, now a bird-woman from the Café de Philosophes, glows with their gleaming dust.

Alanna, Sam, and the other actors from the Hilbert Hotel wing their way alongside, and Alanna calls over the noises behind them, "Thanks for getting me this part. I'm Karen, remember?" Will nods Yes, and a memory stirs from the faraway past of that first wild drunken kiss.

Here swerves a pterosaur, bearing Manaia, Nikau, Wiremu, and Ataahua in line on its back, their voices grace notes warbling.

The Define Singers chime in as they pass, the vardo crew now in tight formation, the wagon and its unicorns gliding without effort beneath them, Armagura, Dulzura, Embrollo, and Estruendo bouncing through their wake, Inesperado slipping in behind them.

Kupaa, the mahogany man, flies far ahead and high up, Kuja and a spark-showering floral throng all around and above and with them, throbbing with the pulsing delighted melodies of their celebrating ascent. Kupaa calls back, "At last! You are with us now!"

Jane and her gamers wheel and cavort in gleaming corkscrews of light, laughing with joy.

⁵¹⁶ From an October 1949 letter by Gordon Paxson to his brother Robert.

From Will's travels in this place beyond places, all gather in flight. Their music now draws into symphonic splendor, into purity's heartbeat, into synaesthetic brilliance.

Their names fall away. Will, no longer willful, his name now the unlocked shackles of his desire, rises, buoyant, joyous, his face afire with light.

Racing Toward Light

They all fly on toward the increasing dawn-glow far off ahead, capering winds buoying and urging them on, as beast-driven clouds of debris, smokes, fumes, and ejecta devour the space in their wake, shouts, screams, howls, and rasps melding in musics of chaos, gradually softening diminuendo.

A throng now, they steer, weave, surf through and beyond the leading edge of destruction. Light bursts just above and ahead, and a shining figure sings.

"The Glorious Creator utters the universe itself, bringing all things - time, space, matter, energy - into being, and utters all of it throughout all of your time forever. 'A *Firstness which cannot be regarded as firstness.*'"

Around the figure dances the Nightingale, caroling.

*"Verily, the Word of God is the Cause which hath preceded the contingent world—a world which is adorned with the splendors of the Ancient of Days, yet is being renewed and regenerated at all times."*⁵¹⁷

As they race on, still gathering others in their true selves, a second brilliant figure calls to them.

"The Glorious Creator utters Manifestations - Abraham, Moses, Buddha, Muhammad, Krishna, Jesus, and many others in many names, all of them teaching advancement to your world, its creatures, your human souls, and the condition of your minds."

And the Nightingale sings a now-familiar melody.

*"This is the Ocean out of which all seas have proceeded, and with which every one of them will ultimately be united. From Him all the Suns have been generated, and unto Him they will all return. Through His potency the Trees of Divine Revelation have yielded their fruits, every one of which hath been sent down in the form of a Prophet, bearing a Message to God's creatures in each of the worlds whose number God, alone, in His all-encompassing Knowledge, can reckon. This He hath accomplished through the agency of but one Letter of His Word, revealed by His Pen..."*⁵¹⁸

Now a third being illuminates them with song-language.

⁵¹⁷ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, "The Tablet of Wisdom" (Lawh-i-Hikmat).

⁵¹⁸ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LI (second reference).

“The Glorious Creator utters the souls, you humans, who are aware of Him.”

From the Nightingale:

*“Veiled in My immemorial being and in the ancient eternity of My essence, I knew My love for thee; therefore I created thee, have engraved on thee Mine image and revealed to thee My beauty.”*⁵¹⁹

And now a fourth voice comes, angelic as the others.

“The teachings of the Creator bestow on you the observation of your created world and the ways to comprehend and transform its behavior. This is the foundation of your science.”

The Nightingale returns in full song.

*“Look at the world and ponder a while upon it. It unveileth the book of its own self before thine eyes and revealeth that which the Pen of thy Lord, the Fashioner, the All-Informed, hath inscribed therein. It will acquaint thee with that which is within it and upon it and will give thee such clear explanations as to make thee independent of every eloquent expounder.”*⁵²⁰

Now the figures complete a five-pointed star of light, a haykal⁵²¹, as the throng flies ahead towards them, and the fifth figure says,

“Your scientists apply the teachings, including the surrender to the truth, to gain useful knowledge for your overwhelming benefit.”

And the Nightingale's joy overflows in song.

*“O people of Bahá! The source of crafts, sciences and arts is the power of reflection. Make ye every effort that out of this ideal mine there may gleam forth such pearls of wisdom and utterance as will promote the well-being and harmony of all the kindreds of the earth.”*⁵²²

*“Knowledge is as wings to man's life, and a ladder for his ascent. Its acquisition is incumbent upon everyone. The knowledge of such sciences, however, should be acquired as can profit the peoples of the earth, and not those which begin with words and end with words. Great indeed is the claim of scientists and craftsmen on the peoples of the world. Unto this beareth witness the Mother Book on the day of His return. Happy are those possessed of a hearing ear. In truth, knowledge is a veritable treasure for man, and a source of glory, of bounty, of joy, of exaltation, of cheer and gladness unto him.”*⁵²³

⁵¹⁹ Bahá'u'lláh, *The Hidden Words of Bahá'u'lláh*, Arabic No. 3.

⁵²⁰ Bahá'u'lláh, *Tablets of Bahá'u'lláh*, “The Tablet of Wisdom” (Lawh-i-Hikmat).

⁵²¹ A haykal is a five-pointed star, a pentacle, its form evoking the human figure: head, hands, feet, and torso. Its root meaning is ‘temple’. It is used in Bahá'í scripture to signify the Manifestation of God. The Báb revealed entire tablets in the form of the haykal.

⁵²² *ibid.*, “Words of Paradise” (Kalimát-i-Firdawsíyyih).

⁵²³ *ibid.*, “Effulgences” (Tajallíyát).

The five shining figures spin faster and faster, the Nightingale circling them all with one theme Will recalls from earlier.

"He mounteth on the ladders of inner truth and hasteneth to the heaven of inner significance."⁵²⁴

With a flash the star-point figures compress into a point of light, and from it one angelic being emerges. "Miriam!" Will calls, ecstatic, and at the same moment he hears a thousand thousand voices calling as many different names, all of them in great joy. "Five themes of meaning! What wonder!"

She laughs a weave of music over the ecstatic sea of sound, saying, "These five are all you can take in! For every one of them, five more, and for each of those, five more, and so on, endless woven meaning! Do you recall your infinite snowflake all within a little space?" She hovers, flying, before Will, agile as the hummingbirds, her great nimbus of hair glowing with a million lights. "Do you begin to understand?"

He glances at the others around him, each rapt, face alight, in pure and holy flight. "Is there one of you for each of us?"

She laughs light bell tones. "One? Many? How can you parse truth, especially when," and here she looks past him, her tones turning minor, "you are about to be overtaken."

Not taking an instant, Will accelerates forward with great wingbeats, Miriam still dancing in the air just ahead, smiling colors at him. "Listen to the Nightingale," she says, "but do not hesitate or halt in your flight. Hurry! He'll amuse you first, with the words of Balinus, an ancient philosopher. They might as well have been Plato's words, had he arrived in this new and wondrous age."

And now the Nightingale laughs its blossoming music at him.

"O Lord! Thou art God and no God is there but Thee. Thou art the Creator and no creator is there except Thee. Assist me by Thy grace and strengthen me. My heart is seized with alarm, my limbs tremble, I have lost my reason and my mind hath failed me. Bestow upon me strength and enable my tongue to speak forth with wisdom."⁵²⁵

The Supreme Light of the Singing Nightingale

But now, as the dark chaos pursues them, and the angelics dance before them, and their light-traced arcs unroll toward growing dawn, the Nightingale raises the theme to immense grandeur and beauty, so potent that they struggle to maintain their pace as it arrows ahead.

"PRAISE be to God, the All-Possessing, the King of incomparable glory, a praise which is immeasurably above the understanding of all created things, and is exalted beyond the

⁵²⁴ From Bahá'u'lláh, *The Seven Valleys*.

⁵²⁵ From Bahá'u'lláh, *Tablets of Bahá'u'lláh*, "Tablet of Wisdom" (Lawḥ-i-Ḥikmat).

grasp of the minds of men. None else besides Him hath ever been able to sing adequately His praise, nor will any man succeed at any time in describing the full measure of His glory.

"Who is it that can claim to have attained the heights of His exalted Essence, and what mind can measure the depths of His unfathomable mystery? From each and every revelation emanating from the Source of His glory, holy and never-ending evidences of unimaginable splendor have appeared, and out of every manifestation of His invincible power oceans of eternal light have poured.

"How immensely exalted are the wondrous testimonies of His almighty sovereignty, a glimmer of which, if it but touched them, would utterly consume all that are in the heavens and in the earth! How indescribably lofty are the tokens of His consummate power, a single sign of which, however inconsiderable, must transcend the comprehension of whatsoever hath, from the beginning that hath no beginning, been brought into being, or will be created in the future till the end that hath no end.

"All the Embodiments of His Names wander in the wilderness of search, athirst and eager to discover His Essence, and all the Manifestations of His Attributes implore Him, from the Sinai of Holiness, to unravel His mystery."⁵²⁶

One of Will's companions, racing alongside, calls out, "How am I here now, and not on the bridge I walked so long?" Her long wings power and propel her in sweeping thrusts toward the enriching illumination before them. "Again and again I fell from the bridge, and went mad, and I heard the birds, and they sang me here at last!"

She sees Will. With a radiant smile, her eyes widen, dark to amber and up to gold. "I know you! You fell! You saw me in my madness, and I saw you in yours."

"Yes! You quoted Milton!" The recollection of the landfill of loss makes him glance back at the darkness chasing them. They speed ahead side by side, laughing, wingtips nearly touching.

"I was an astrophysicist," the woman says again, slowly. "Look ahead! We move so fast, but the light ahead is perfectly still. Are we plunging into a singularity, where everything deeper ahead of us seems to freeze in time? I wonder!"

Miriam dances ahead of them. "Wonder! Perfection! You are whole and free!" And the Warbler, weaving joyfully above her, trills notes of beauty, unrolling inner truth.

"Glorified be the Lord of Majesty for breaking down the barriers, tearing asunder the veils, dispelling imagination, freeing men's minds from the tyranny of conjecture, and liberating the birds of thought in the apogee of human hearts, so that they may soar with the wings of

⁵²⁶ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, XXVI.

delight in the worlds of existence and with penetrating insight rend the veils woven by the spiders of fancy in these lofty chambers and high pavilions."⁵²⁷

Now the Nightingale accompanies them again, its voice ascending from pure, sparkling simplicity, tier upon tier, into a symphony of itself building, rising, blooming, dawning, showering ecstasy as they wing their ways furiously forward ahead of the pursuing dissolution and death.

"A drop of the billowing ocean of His endless mercy hath adorned all creation with the ornament of existence, and a breath wafted from His peerless Paradise hath invested all beings with the robe of His sanctity and glory. A sprinkling from the unfathomed deep of His sovereign and all-pervasive Will hath, out of utter nothingness, called into being a creation which is infinite in its range and deathless in its duration. The wonders of His bounty can never cease, and the stream of His merciful grace can never be arrested. The process of His creation hath had no beginning, and can have no end.

"In every age and cycle He hath, through the splendorous light shed by the Manifestations of His wondrous Essence, recreated all things, so that whatsoever reflecteth in the heavens and on the earth the signs of His glory may not be deprived of the outpourings of His mercy, nor despair of the showers of His favors. How all-encompassing are the wonders of His boundless grace! Behold how they have pervaded the whole of creation. Such is their virtue that not a single atom in the entire universe can be found which doth not declare the evidences of His might, which doth not glorify His holy Name, or is not expressive of the effulgent light of His unity.

"So perfect and comprehensive is His creation that no mind nor heart, however keen or pure, can ever grasp the nature of the most insignificant of His creatures; much less fathom the mystery of Him Who is the Daystar of Truth, Who is the invisible and unknowable Essence. The conceptions of the devoutest of mystics, the attainments of the most accomplished amongst men, the highest praise which human tongue or pen can render are all the product of man's finite mind and are conditioned by its limitations.

"Ten thousand Prophets, each a Moses, are thunderstruck upon the Sinai of their search at His forbidding voice, "Thou shalt never behold Me!"; whilst a myriad Messengers, each as great as Jesus, stand dismayed upon their heavenly thrones by the interdiction, "Mine Essence thou shalt never apprehend!"

"From time immemorial He hath been veiled in the ineffable sanctity of His exalted Self, and will everlastingly continue to be wrapt in the impenetrable mystery of His unknowable Essence. Every attempt to attain to an understanding of His inaccessible Reality hath ended

⁵²⁷ 'Abdu'l-Baha, *Tablet of the Universe*, p. 4 (provisional translation)

*in complete bewilderment, and every effort to approach His exalted Self and envisage His Essence hath resulted in hopelessness and failure.*⁵²⁸

The splendor of the music shears away every effort, every burden, every sorrow, every loss.

“How bewildering to me, insignificant as I am, is the attempt to fathom the sacred depths of Thy knowledge! How futile my efforts to visualize the magnitude of the power inherent in Thine handiwork—the revelation of Thy creative power! How can mine eye, which hath no faculty to perceive itself, claim to have discerned Thine Essence, and how can mine heart, already powerless to apprehend the significance of its own potentialities, pretend to have comprehended Thy nature?

“How can I claim to have known Thee, when the entire creation is bewildered by Thy mystery, and how can I confess not to have known Thee, when, lo, the whole universe proclaimeth Thy Presence and testifieth to Thy truth? The portals of Thy grace have throughout eternity been open, and the means of access unto Thy Presence made available, unto all created things, and the revelations of Thy matchless Beauty have at all times been imprinted upon the realities of all beings, visible and invisible.

“Yet, notwithstanding this most gracious favor, this perfect and consummate bestowal, I am moved to testify that Thy court of holiness and glory is immeasurably exalted above the knowledge of all else besides Thee, and the mystery of Thy Presence is inscrutable to every mind except Thine own. No one except Thyself can unravel the secret of Thy nature, and naught else but Thy transcendental Essence can grasp the reality of Thy unsearchable being.

“How vast the number of those heavenly and all-glorious beings who, in the wilderness of their separation from Thee, have wandered all the days of their lives, and failed in the end to find Thee! How great the multitude of the sanctified and immortal souls who were lost and bewildered while seeking in the desert of search to behold Thy face!

“Myriad are Thine ardent lovers whom the consuming flame of remoteness from Thee hath caused to sink and perish, and numberless are the faithful souls who have willingly laid down their lives in the hope of gazing on the light of Thy countenance. The sighs and moans of these longing hearts that pant after Thee can never reach Thy holy court, neither can the lamentations of the wayfarers that thirst to appear before Thy face attain Thy seat of glory.”⁵²⁹

Now the music sinks deep in them all, fills them with lustrous vibrancy.

‘Whensoever the splendor of the King of Oneness settleth upon the throne of the heart and soul, His shining becometh visible in every limb and member. At that time the mystery of

⁵²⁸ From Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, XXVI..

⁵²⁹ *ibid.*

the famed tradition gleameth out of the darkness: "A servant is drawn unto Me in prayer until I answer him; and when I have answered him, I become the ear wherewith he heareth...."

"For thus the Master of the house hath appeared within His home, and all the pillars of the dwelling are ashine with His light. And the action and effect of the light are from the Light-Giver; so it is that all move through Him and arise by His will."⁵³⁰

As the glorious oratorio of holy utterance fades, they all race together as one, their angelics now far ahead in what seems vast growing morning. The woman alongside Will breathes in wonder, "Heaven. Paradise. Is that what we see? Is that where our flying now takes us?" All around them, great murmurations of souls whirl, wheel and reel onward into endless light.

Laughter leaps from him in his delight ahead of thought, before he realizes that Jeddin, in him and at last again of him, is exultant. "Heaven, Paradise, everything is new! Our flight itself is Paradise!" In that moment, Will's insistent "I will die soon" falls empty and away, to evaporate forever in the wake of this flight now free of space and time.

His companion looks back at the dark turmoil, and he follows her glance. They lock eyes for a moment, and turn from the pursuers and their consuming shadows to search ahead.

The Stars and the Journey

Flying from Plato's Cave, flying from the beasts of self, flying above the hair-thin, gleaming bridges, lofted on the airs of the caroling holy birds, they all strain their wings, their eyes, and all their means and senses, the light ahead shifts, intense detail emerges, and from its consuming immensity opens the emergent infinite field of billions of stars, thronging all of space deep and broad and high, singing their burning shining notes in the keening grandeur of all layers and tones of radiance.

"So far from us," the woman gasps, "and so close, so great, so mighty, so glorious!"

"Yes," sings the voice of Miriam, now an intimate mote of light. "Your journey is your destination. All your endings fall away. Here, now, in flight, you are home. Together, all of you celebrate and dance onward. There is nothing else – heaven and earth are now of one living boundary in which you move."

The Nightingale's voice penetrates.

"But for the burning of their souls and the sighing of their hearts, they would be drowned in the midst of their tears, and but for the flood of their tears they would be burnt up by the fire of their hearts and the heat of their souls. Methinks, they are like the angels which Thou hast created of snow and of fire."⁵³¹

⁵³⁰ Bahá'u'lláh, *The Seven Valleys and the Four Valleys*, The Seven Valleys, from The Valley of Unity.

⁵³¹ From Bahá'u'lláh, *Prayers and Meditations*, XCIV,

The mote croons, "Your flight is your purpose – if you were to cease flying, you would fall. Toward the truth, toward the divine reaches, you travel with all your hearts. Unity, contentment, wonderment, divine freedom are yours."

Escaping time itself, the long journey flies in seeming stillness in the very heart of the stars. The mote continues in a melodic flow of meaning. "Over two million years past, this flood of light ahead⁵³² began its journey from the great spiral galaxy in the constellation of Andromeda. Each point of light in this image marks a star much greater in size and luster than your own bright Sun. This spiral galaxy blazons billions of these mighty lanterns of celestial light."

Will gasps, but the mote's voice winds on. "Stars like the Sun in this remote galaxy, far more numerous, are lost in the glare of the bright ones you see here. Most of them have planets, some of which are like Earth."

The Nightingale's thrill fills them all one last time, its melodies rising to circle back again and again, now familiar.

"O PEOPLE! I swear by the one true God! This is the Ocean out of which all seas have proceeded, and with which every one of them will ultimately be united. From Him all the Suns have been generated, and unto Him they will all return. Through His potency the Trees of Divine Revelation have yielded their fruits, every one of which hath been sent down in the form of a Prophet, bearing a Message to God's creatures in each of the worlds whose number God, alone, in His all-encompassing Knowledge, can reckon."⁵³³

⁵³² The image is adapted from a much-higher-resolution image captured by the Hubble Space Telescope's Wide Field Camera 3 (WFC3). The Hubble site is at the time of this writing at <http://hubblesite.org/image/2850/category/37-spiral-galaxies>.

⁵³³ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LI.

*"Thou hast, moreover, asked Me concerning the nature of the celestial spheres. ... The learned men, that have fixed at several thousand years the life of this earth, have failed, throughout the long period of their observation, to consider either the number or the age of the other planets. Consider, moreover, the manifold divergencies that have resulted from the theories propounded by these men. Know thou that every fixed star hath its own planets, and every planet its own creatures, whose number no man can compute."*⁵³⁴



Figure 38 – A starfield in the Andromeda Nebula, M31.

In the infinite richness of this astonishing Universe, humanity is not alone.

⁵³⁴ Bahá'u'lláh, *Gleanings from the Writings of Bahá'u'lláh*, LXXXII.

In the voice of the Warbler, Will senses infinite divine melody. In the voice of the Nightingale, Will feels the presence of the Glory of God. His wings bear him inward, onward, outward, toward the stillness of eternity.

The Book Speaks to You

I, the text, look out from this page, dear one. You fly close beside me, reading me. You have come far with me, taking in what you will of these words, bending understanding to meaning, bridging through and above your darkness.

Come. Enter into the fragrant gardens of endless meaning again and again. Muse on infinite wonders, the fractal efflorescences of feeling, the bewildering divergences and harmonies of paradox and sense. Here the persistent sparrow, hovering back and forth outside the office window, finds a crevice for its home. Here the vagabond bird of me, silencing its voice, comes at last to rest in the glowing tree of life itself, to hear the joyful sweet supreme melodies of the Nightingale, all at utter and entire rest at the very speed of light itself.

When we started this journey, we observed that we live today on a cusp of historical time, a pinnacle ascended from our dark and turbulent human past. Now we prepare to descend on its further slope into a brilliantly-lit world, a world teeming with infinite disclosures and revelations, a world utterly strange, a world in which all things are made new.

The greatest of all our great human adventures has begun. All burdens gone, energized by infinite truth, we leap into the heart of light.

The Author Awakens

Will stares up at the ceiling of his small office. He rubs both palms to clear his encrusted eyes. The sun beats brilliance in over him as he rises on his elbows, at first panting, and then taking deep gulps of air more and more slowly. He sits up.

His fingers tangled and hindered, he looks down at the torn wisps of a thin plastic bag he has ripped away from... what? He breathes evenly now, memory beginning its dances, its parades, its interruptions. *One step at a time.* He slowly gets to his feet, his joints complaining. His desk and chair sit waiting.

At the window, a sparrow⁵³⁵ shuttles back and forth, perching for a moment on the windowsill outside, looking in at him. It cocks its head, cheeps once, and flies away.

⁵³⁵ Concerning the sparrow, Bahá'u'lláh interprets the meaning of each of the five letters comprising the word "sparrow" (gunjishk) in Persian: 'In one sense, these letters refer to the states of holiness. The first meaneth "Free thyself from the promptings of self, then approach thy Lord." The second meaneth "Purify thyself from all save Him, that thou mayest offer up thy life for His sake." The third meaneth "Draw back from the threshold of the one true God if thou art still possessed of earthly attributes." The fourth meaneth "Render thanks unto thy Lord on His earth, that He may bless thee in His heaven, albeit in the realm of His unity His heaven is the same as His earth." The fifth meaneth "Remove from thine eyes the veils of limitation, that thou mayest learn that which thou knewest not of the stations of holiness." Wert thou to hearken unto the melodies of this mortal Bird, then wouldst thou seek out the eternal and undying chalice and renounce every fleeting and perishable cup. Peace be upon him who followeth the way of guidance!' (from The Seven Valleys, in *The Call of the Divine Beloved*, at www.bahai.org/r/478955296.)

Will sits down, turns to his desk, smiles, and begins to write.

Dra
ft

ENVOI

*The author has attempted the impossible,
With woven words in seeming charms and spells
That, shaken off, seem little more than dreams.
So, turning to the Bard, he asks your grace:*

*Now my charms are all o'erthrown,
And what strength I have's mine own,
Which is most faint: ...
But release me from my bands
With the help of your good hands:
Gentle breath of yours my sails
Must fill, or else my project fails,
Which was to please. Now I want
Spirits to enforce, art to enchant,
And my ending is despair,
Unless I be relieved by prayer,
Which pierces so that it assaults
Mercy itself and frees all faults.
As you from crimes would pardon'd be,
Let your indulgence set me free.*

*– William Shakespeare, The Tempest,
from Epilogue spoken by Prospero*

*In His Dictionary,
His Lexicon,
His Library,
His Utterance,
God defines us all.*

*He whispers, and I am.
He sings, and I move,
He writes, and I am atoms
Of ink on His Page.
In my silence
I love Him.*

WRAPUP

Here we have the end matter: the materials that are 'about' the book, its readers, its author, and its many sources and contributors of ideas and reflections.

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POSTFACE

Two Hundred Astonishing Years

The wondrous interweaving of science and religion is not something *to be* established, but is instead something that *has been and is always* intimate, harmonious, and fundamental in every possible context of time, space, and beyond. Once that image becomes clearer, the world of deeper questions opens wide its arms.

This book was begun in the span between the bicentenary of the birth in 1817 in Tehrán, Persia, of Mírzá Ḥusayn-`Alí Núrí, titled Bahá'u'lláh, and the bicentenary of the birth in 1819 in Shiráz, Persia, of Siyyid `Ali Muhammad Shirāzi, titled The Báb. These two dates, observed in the Bahá'í calendar as adjacent days, mark what Bahá'ís – followers of Bahá'u'lláh – often term the Twin Holy Festivals or Twin Holy Birthdays, resonating with the celebration in every religion of the birth into this world of its unique Manifestation from God: Mawlid for Muslims, Christmas for Christians, Vesak for Buddhists, Janmashtami for Hindus, and many more.

The Báb is the Founder and Author of the Babí Faith and the Forerunner of Bahá'u'lláh. Bahá'u'lláh is the Founder and Author of the Bahá'í Faith. The present book concentrates on just one single principle among the many teachings poured forth in the copious Writings of Bahá'u'lláh and the Báb: the consistency of science and religion. For their Authors this work is offered as no more than an inadequate token of complete acknowledgement and submission.

In the 200 years since these two Authors were born, the entire human world has been set alight with knowledge and transformation, both religious and scientific. Of their Writings, this present author can present no remotely-sufficient characterization or praise. Their magnificence, radiance, richness, mystery, and generative power transcend all human judgment or imitation.

Readers drained by and languishing in the contemporary strife, malaise, and gloom swirling through so many dimensions of our worldly lives may find here some sweet aroma, some uplifting flavor, some gently-intoxicant elevation of harmonized, illuminated vision – a stimulating whiff of “*a cup tempered at the camphor fountain*”⁵³⁶.

This journey's purpose is to open a wider world of questions to readers. It should offer an appetizing sense of a vital, essential, beautiful relationship between science and religion.

Most Important Cautions

Everything I write here, words, diagrams, and images, is merely my own expression, and must be distinguished completely from the meaning and authority of the Bahá'í Writings, whether quoted here or found elsewhere.

⁵³⁶ This potent and mysterious-seeming phrase appears often in the Bahá'í Writings.

The reader's quest here is to gain a better personal foothold, to stand higher and look farther in this astonishing reality we all share.

I wrote a short essay on a fundamental principle in the Teachings of the Bahá'í Faith: the consistency and harmony of science and religion. Things got quickly out of hand. The span of subject matter exploded, and the garden of ideas bloomed into a fractal tour of a few of the infinite wonders, contradictions, and reflections of this fast-changing world.

Draft

AFTERTHOUGHTS

Abandonment

There's no finality to any work of art, or of craft, or of making in general. Leonardo da Vinci is credited with observing that one does not so much finish a work as abandon it. Hence this little trailer, before the inevitable abandonment of this long journey's mad logbook.

All these words may go nowhere, may seed no eager eyes, may feed no hungry minds, may evaporate into the reaches of the void. In the words of the android Roy Baty in Blade Runner, *"like tears in rain."* But no.

Even the tears in the rain become the rain: a cleansing, nourishing, healing blessing on the thirsty places on which it falls. There is no end to the outpouring, the blessing, and to isolate one form from another is to disrupt the perfection of the creation that embraces all.

Where It All Fits

These words reflect one person's roots in his world: his study, his family and friends, his places of life, his languages, his cultural shaping. The dream is that everywhere, in every peak, valley, expanse, and crevice of human life, voices are rising to similar expressions of wonder that reflect the wealthy panoply of other studies, other families and friends, other languages, other cultures. The dream is of our whole search after truth in every way, that this consuming search sees all of our voices unfolding what illuminates our ways forward toward the same amazing goal: the unification, material, intellectual, emotional, and spiritual, of our entire human family.

I look out to you, asking, "Who will create another voyage through the wonders of hope?" I know that you are already hard at work writing what will far surpass what I've tried. That is my fond hope and longing.

Evolution of Writing

Humor me here for a while. If you've come this far, you've gotten fairly good at that.

When I started writing assembly-language code for computers in 1966, we programmers were privy to the electrical nuts and bolts of the machine. What we wrote in the code connected almost directly to the operating circuits of the computer. A bit set to a particular value in the code we wrote generated an electrical signal to the processor to do some specific, humanly-simple task. Only one program could execute at a time.

Fifty years later, layer upon evolving layer of circuitry and code has slithered in between the hardware and the everyday programmer. Now a program's single statement, say, the simple assignment "A = B", initiates a deep complex of actions that elaborate the intent of that statement into a lengthy (and sometimes concurrent) set of detailed actions in the machine's software and hardware layers.

Suppose the statement A = B is written in Java by the programmer. Java can be executed on a wide range of different computers, but to facilitate this universality Java is interpreted into another form of code sometimes called "portable code", or "p-code", a more-condensed

form that can be used on a Mac, a PC, an Android, or some other hardware platform. That's one layer added.

The p-code is then read by an interpreter program on the platform of choice to produce a set of instructions much like those I wrote in my early days, except that many of them are now used to connect to other software and hardware resources on the machine. That's another layer added. At this stage it would be at least a pair of instructions, the first telling the computer to move the value in A's memory location to a register, and the second directing the storage of the value in the same register in B's memory location. That's how my first mainframe worked.

It doesn't stop there anymore. Nestled inside computer hardware itself now, exploiting the immense advantages of massive miniaturization of components, resides another level of computing termed microcode. The hardware is no longer just registers and memory – it is a maze of registers, cache memory, main memory, instruction pipelines, data pipelines, interprocessor signal lines, and much more, all designed to speed the execution of a program that is running concurrently with hundreds, perhaps thousands, of other programs in the same system.

The result is that to make B equal to A, the system must determine whether the A-value is available in the cache memory instead of the main memory, whether any instruction already at work is still changing the value of A, wait for any such tasks to complete, issue the request to get the A-value from the proper location, wait for the value to appear in the register, and then go through a similar process getting the value stored in the correct location for B. All this and much more is done in the microcode, which was written and “burned in” to the system at its building or deployment.

The programmer who writes “A = B” in Java never needs to consider any of this, but programmers of microcode labor constantly on main processors, graphics processors, and other special-purpose chip-level systems to insure that A = B always works.

The point of all this explanation? The writer of text inscribes now in ways that approach the programming of microcode, mainly in the film industry. Video and movies are becoming language itself. To generate this language and present it requires writing in everyday words, but those everyday words are no longer needed in written form; they issue from the mouths of actors, they instruct camera people and animators, they define the sets and the costumes. The broad dissemination of writing is now to some extent displaced by audiovisual presentation of recorded actions and words.

The evolution of video to displace writing echoes in some ways the evolution of programming away from the machine. The writer increasingly finds roles in places where her writing may never be read by more than the few people who produce the video stream – a situation much like that of the programmer who writes for the microprocessor.

The Ash Grove

The song, in its entirety in English.

*Down yonder green valley where streamlets meander,
When twilight is fading, I pensively rove,
Or at the bright noontide in solitude wander
Amid the dark shades of the lonely Ash grove.*

*'Twas there while the blackbird was joyfully singing,
I first met my dear one, the joy of my heart;
Around us for gladness the bluebells were ringing,
Ah! then little thought I how soon we should part.*

*Still grows the bright sunshine o'er valley and mountain,
Still warbles the blackbird his note from the tree;
Still trembles the moonbeam on streamlet and fountain,
But what are the beauties of nature to me.*

*With sorrow, deep sorrow, my bosom is laden,
All day I go mourning in search of my love.
Ye echoes, O tell me, where is the sweet maiden?
She sleeps 'neath the green turf down by the Ash grove.⁵³⁷*

⁵³⁷ The Thomas Oliphant version, published in 1862, in Volume I of *Welsh Melodies*, with Welsh and English Poetry, compiled by the harpist John Thomas, with Welsh words by John Jones (Talhaiarn) and English words by Thomas Oliphant.

THE AUTHOR

Dana Paxson brings multiple fields of study, work, play, and experience to this undertaking. As a software inventor, he has generated electronic authoring and publishing software innovations and patents, and virtual-world habitats and scripting. As a patent clerk, he drafts patent applications for law firms. As a professional nonfiction writer, he creates essays on a broad range of topics, including clean energy, water supply, education, technology, social change, physics, astronomy, and religion. As a professional author, he writes poetry, general fiction, and science fiction. As an artist, he has produced a small body of abstract constructionist art, along with a profusion of minor digital illustrations, diagrams, and transformed images. As a mentor, he has provided facilitation and course mini-lectures for online classes.

His own e-publishing patents embrace a single, portable, easy-to-use, Web-friendly presentation of literature and knowledge. He explores mathematics, medieval and modern poetry, astronomy, molecular neurobiology, linguistics, cognitive science, artificial intelligence, and a few languages, and he has a B.S. in Design in art, and a B.A. and M.A. in mathematics. Now and then he dances and sings. In all this, caffeine is his close friend.

Draft

ACKNOWLEDGEMENTS

None of this essay would have been written at all had it not been for the nurture, encouragement, critique, wisdom, and patience of many people both close in my life and available through their works alone.

My wife Frances blesses me with the perfection of a haven for rest, peace, and the illuminating, abiding light of her deeply-human, very-wise, most-tender connection. From our beginnings she has healed and advanced my life. This essay's deep currents of feeling owe their best features to her wise, loving, supportive, creative, presence all along.

My dear friend Douglas-Val Ziegler, linguist of globe-spanning vision, longtime companion in exploration of the worlds of mind and spirit, has drawn from me the best I can generate, patiently exploring the essay during its development and offering insights many of which have found their way in various forms into the weavings here. The entire section [THE ROLE OF LANGUAGE](#), and the Excursions essay [The Projection of Meaning](#) both came into being to address pivotal language issues of special interest to him in connecting religion and science. He has also contributed many suggestions and references which I have gladly incorporated here. He lives now in the greater world beyond this one, and I can feel his warmth and joy.

My fine mentor, teacher, and astrophysicist friend Brian Koberlein drew me along the path of science to where I could engage both more broadly and more accurately with the scientific dimensions of the essay. His knowledge, discipline, and insights have informed and sharpened my thinking in more ways than I can explain here. The Excursions essay [Space Drawings](#) arose as one of the outgrowths of our many conversations and explorations.

My fellow author, language inventor, graphic artist, virtual-world builder, and respected scholar Sarah Higley grants me a wondrous, synaesthetic infusion of idea flow that characterizes so much the way disparate genes entwine themselves in the organisms of thought.

My beloved aunt Joan Sweany set me firmly on my adolescent beginnings of a path through whole sweeps of literature, and her constant, critical, loving attention through the years gave me the equivalent of an advanced college degree in English literature and language. She opened for me the doors to the study of Zen Buddhism. She gave me her college organic chemistry text when I was in junior high, getting me jump-started in science. She introduced me to the incomparable works of J. R. R. Tolkien. She can be credited with my development to such a level in my early years that one of my college English professors told me at the conclusion of his challenging course on short stories and poetry, *"If I'd known that this course would be so easy for you, I would have made it harder."*

Her picture stands on my bookcase. I miss her, even though I feel she's still here.

A tender remembrance. When I began to write science fiction, the very first story I sent out was quickly accepted for national magazine publication. That was a happy surprise for me, but it led to something more. Ellen Key Harris, an editor at Del Rey, wrote me an e-mail, telling me that she had been reading my story on the subway in New York City on her way to work, and she got so absorbed that she missed her stop. She said that if I could write a novel as good as the story, she would buy it and publish it. Her note changed my entire path of writing from then on. Although she passed away all too early at 50 years of age from a bout with cancer, I feel her supportive presence to this day.

Invaluable reflections, comments, and critique have come to me from a fine source through an excellent happenstance. My wife is a friend of Suzanne Bell, an amazing woman who shared the stage with us in various Gilbert and Sullivan productions. An offhand remark to Suzanne about this book-in-progress led to her suggesting her husband as a possible interested reader. He is Christopher Brown, a retired professor of computer science at the University of Rochester, and he was more than interested – he gladly undertook reading and review of many early drafts of the book's sections. His suggestions and reactions have significantly helped elevate the quality of this work, and I am indebted to him.

The distinguished scholar John S. Hatcher, in his profound, stimulating, insightful, disciplined, and richly-connected book "Close Connections: The Bridge between Spiritual and Physical Reality", gave me considerable benefit in undertaking the present essay. For anyone wishing to delve more deeply into the Bahá'í Writings, views of their meanings, and the abundant connections between these Writings and our human realities, I strongly recommend Hatcher's book.

The Excursion story "THE BUDDHA LECTURES ON COSMOLOGY" appeared in an earlier form in 2004 in Aeon Two, the second issue of the electronic magazine Aeon Speculative Fiction published by Bridget McKenna and Marti McKenna. The author is most grateful to the McKennas for all the support, guidance, and assistance they have afforded him over the years.

In the course of developing, revising, editing, and rewriting parts of this work, some fine people have given me very-useful suggestions and ideas which have led to what I feel are improvements in the essay. Among these are Michael Moum and Iain Palin, whose online reflections and comments on review drafts have helped me clarify, focus, and enrich the narrative.

There will be many more names mentioned here as I go on.

READING AND READINGS

Readers

Here are a few observations for different groups of readers.

Literary Reading

The literate general reader expects an author to follow certain commonly-accepted practices in a work of this scope. The author has done his best to make the work accessible, but the familiar practices of written presentation reflect their traditional origins in ways that the work attempts to transcend both in its content and in its form.

There are both advantages and disadvantages in emulating the traditions one is attempting to transcend in one's examples. On the one hand, readers are more comfortable with and accepting of the familiar written forms. On the other hand, the use of those familiar forms can obstruct or undermine the points on such forms the author is attempting to make⁵³⁸.

The reader is free to read as she or he will, in any pattern or order, without some constrained process in mind. The structure of this work sets things out in an order, enumerates them in some form, references them back and forth; but no 'control' over readers is intended. The collection of Excursions following the main body of this work offers side tours the reader can traverse at any point in this flight. One Excursions essay, **Fractal Reading and Writing**, offers some reflections on what "fractal reading" means.

The structure and style of the work can appear demanding. Here is an echo chamber of repetitions of quotes, phrases, ideas, and patterns that evoke the fractal character of their resonances in different contexts. Footnotes and cross-references are everywhere. The apparent chaos mirrors the unfamiliar complexity in which the divine outpouring of our time has plunged us.

To the author, unfamiliar patterns are friends, not adversaries; he has tried to embrace such patterns in his efforts to connect them, in the hopes of drawing readers with him toward improved understanding. In reflecting on his aerial wanderings through a life infused with literature, art, science, and mathematics, he recalls the words first gifted to him by his Buddhist aunt, words in various forms attributed to the Zen master Ch'ing-yüan Wei-hsin, (Seigen Ishin) and quoted by scholar Alan Watts.⁵³⁹ First, a mountain looks like a mountain. As we begin to learn better, the mountain no longer seems to be a mountain. Finally, when we have learned enough, the mountain is the mountain.

⁵³⁸ For example, in this work the author debated inwardly the use of specific enumerations of points to be made. Enumeration itself is a long-respected device in expository writing, taken completely for granted by authors and readers alike, but it "chops up" the flow of narrative, making it generally unsuitable in fiction and other settings where smooth movement through a scene or a process conveys information more usefully to the reader. Given the mass of diverse ideas, the author conceded to the structural value of enumeration in certain areas, and turned to narrative flow where specifics allowed greater freedom and clarity. The idea of flow is itself a topic of this work, especially in this new world of "fractal reading".

⁵³⁹ Alan Watts, *The Way of Zen*, p. 126, quoted at <https://terebess.hu/zen/qingyuan.html>.

Grappling with the unfamiliar is fine. It just means that one is on the essential journey we all share in this life.

We'll take leaps here and there, explore some side streets and alleyways, return to themes again and again, repeat statements and passages in separate settings, propose unexpected ideas, and more. This is no linear progression through a disciplined, fully-fleshed outline. It's a wandering, fractal path through a savory journey from one human marvel to another in the vast garden of possibility. Some parts will no doubt fascinate some readers and not others. Some parts will no doubt seem alien and forbidding to some while deeply familiar to the rest. Every reader here is free to choose what to read, what to postpone, and what to let pass by.

Reading Scientifically

For scientists, mathematicians, and those of similar mind, the whole idea here is exploration of what lies at and beyond the boundaries. This work is not an attempt at proof of any kind.

Some of these skilled and expert people may bridle at what might seem a light-hearted treatment of the true complexities of the difficult work in which they are immersed – work to which they are deeply committed. After all, even one single specialty in these swiftly-advancing fields consumes all of the attention and energy of its practitioners, if only to stay abreast of the advances flooding their field as they study its ever-developing convolutions and unresolved questions. Anything short of detailed, correct characterization of such a field may well seem to them an utterly-inadequate oversimplification.

Such a judgment can be generally justified within the discipline of science and mathematics regarding any attempt to characterize what cannot be simplified. In a lecture in 1933, Albert Einstein spoke of the irreducible elements that constitute the axioms and postulates of a theory, elements such that they contain the whole theory but need no further augmentation.⁵⁴⁰

This is perhaps one of the sources of the briefer statement attributed to Einstein, *“Everything should be made as simple as possible, but not simpler.”* In either form it warns against oversimplification of the ways we represent ideas, theories, or other realities. At the same time it urges the greatest possible simplification of those representations. Consequently anyone attempting to summarize, sketch, or characterize an already-compact representation of a theory will find oneself *“in a state of sin”*⁵⁴¹.

⁵⁴⁰ Albert Einstein, from *On the Method of Theoretical Physics*, the Herbert Spencer Lecture delivered at Oxford, June 10, 1933.

⁵⁴¹ This phrase references a statement by famed polymath John von Neumann concerning computerized generation of randomly-distributed numerical values: *“Anyone who considers arithmetical methods of producing random digits is, of course, in a state of sin.”* The reason is that arithmetical methods are always patterned, however haphazard the patterns may appear at first. Patterned sets of values are not random; their patterns can be discovered and exploited. This why such methods are properly termed *“pseudorandom number generators”*. (One can see from this footnote

To address problems of broader communication, the present author joins the throngs of others who work to bridge the gulfs that separate different readerships. Such bridges to be built are not intended as the disciplined fusion or integration of the terrains they join; metaphorically speaking, these pathways connecting one realm to another can range from the grandest, heavily-bastioned stone arches over a city's rivers all the way to long and rickety rope suspensions over wind-swept mountain chasms of uncertain sky. The bridge metaphor here suggests that one cannot avoid the oversimplifications of the journey if one wishes to delve more deeply and rigorously into the realms at the journey's extremities – and in so doing find harmony and orchestration in the ensemble of them all.

Here the author has offered only tastes of what can be explored, many bridges to many realms, and the reader may freely pass one by to follow another at any stage of exploration. But the true purpose here is to situate the reader in some central setting of all these bridges in order to discover, on further exploration, that they all lead to parts of the same vast, universal metropolis.

Reading Spiritually

For readers who arrive here from spiritual perspectives, the whole idea here is harmony, unity, vitalization, and enrichment of spirit. This work draws frequently upon the Writings of the great faiths of our world for meaning, illustration, and illumination.

The Bahá'í Writings constitute a primary source of meaning here. Why? Bahá'u'lláh, the Author, Founder, and Revealer of Bahá'í Teachings poured the flood of His Revelation over the entire universe, entraining every human soul in the effects of that deluge. His words appear in the writings of innumerable others of our time, whether they knew of Him or not, emerging as if erupting by magic everywhere.

The Bahá'í Writings themselves make both our shortcomings and our opportunities for ways forward perfectly clear. Bahá'u'lláh gently reproved a seeker's followup queries concerning questions asked earlier:

*'Now, as to his questions, it was not deemed advisable to refer and reply to each one individually, for the response would have run counter to wisdom and been incompatible with that which is current amongst men. Even so, in that which was revealed in his honor from the heaven of divine favor, answers were provided in a language of marvelous concision and clarity. But it appeareth that he hath failed to consider the matter closely, for otherwise he would have readily admitted that not a single point was omitted, and would have exclaimed, "This is naught but a clear and conclusive utterance!"'*⁵⁴²

how the "rabbit hole" of an innocent-looking phrase can go deep – one of the virtues of letting simplification loose now and then to avoid endless burrowing in, among other things, footnotes.)

⁵⁴² Bahá'u'lláh, *The Pen of Glory* (Bahá'í Publishing 2008), p. 105, from "Responses to questions of Maníkchí Sáhíb from a Tablet to Mirza Abu'l-Fadl".

Our shortcomings consist in part in our inherited and received limitations of language and thought as we read the transformative Words streaming from an otherworldly Pen. From the great passage offered in full in the concluding section of this work:

“The conceptions of the devoutest of mystics, the attainments of the most accomplished amongst men, the highest praise which human tongue or pen can render are all the product of man’s finite mind and are conditioned by its limitations.”⁵⁴³

We can see that in seeking understanding of the both the familiar world and the greater world, we – all of us – will always have lifetimes of work to do. Many Bahá’í scholars, researchers, and authors have pursued the exploration of Bahá’u’lláh’s science-and-religion principle very diligently, and this work will continue for a long time. The present essay offers perspectives that leaves many openings for others, not attempting any definitive, directed unified view; we are all voyagers in an infinite, eternal space.

Regarding the writings of others, the astute reader can find in innumerable contemporary works the evidences of the universal informing force that inspired, animated, and birthed these same works, irrespective of any distinction of connection, evident or claimed, with the world community of Bahá’ís or the Bahá’í Writings. Occasionally one sees direct statements reflecting this point, one of the least among them the observation transmitted by Samuel F. B. Morse on his first telegraph communication in 1844 from Washington, DC to Baltimore, *“What hath God wrought?”* This took place one day after the Báb revealed His station and message to Mullá Husayn in Shiraz.

This book presents numerous examples of the effects of this “universal informing force” loosed in the flood of the Writings of the Báb and Bahá’u’lláh. By offering such examples, the author has sought here to underscore the universality of both the power and the appeal of the bestowals flowing to us from the greater world, bestowals both revelatory and scientific, in the hope that a broader range of readers will find this work both attractive and challenging.

Further Reading

The seas of knowledge are infinitely broad and deep, and the process of searching them is endless. In the course of developing this essay, many additional works offered insight, motivation, challenge, and delight. The Bibliography can give some idea of the bewildering, clashing, effervescent, joyful voyage in which the present essay is only a small part.

The Excursions essay [The Dance](#), is a lighthearted but fairly-detailed illustration of the ways we are bringing together our ideas of faith and reason, of religion and science. This dance is for all of us, together.

⁵⁴³ Bahá’u’lláh, from *Gleanings from the Writings of Bahá’u’lláh*, XXVI.

WARNING

I sit alone, scribbling through my keyboard. The glare of this screen before me is not an oncoming locomotive light. It is the future approaching. We, the entire family of our human species, are racing out of the vast enduring darkness of our human past toward blazing light.

We drag with us every terror, every hate, every cancerous practice of survival, every toxic comfort food, every distraction. We are still barely awake to the simple truth that we need none of our burdens. Of seeming necessity we clutched all our baggage, had it thrust upon us, sack by heap, or had it burned into our very beings. We don't yet understand the freedom ahead of us. It can feel as if nothing has changed in the past half century, as if we have merely circled the drain one more time.

If those who do not learn from history are condemned to repeat it, those who do learn from history are tasked with transforming it. Just fifty years have seen change so great that we still sit here stunned, staring into these glowing, dancing, fleeting walls of swift-writing, watching the world at lightspeed, mesmerized, horrified, bemused, transfixed.

We live and breathe the Internet and the World Wide Web: the living Library of Everything We Know, and more. It draws us in as a family of seekers surfing all of human knowledge. So quickly does it expand and mutate that the markers and links we trail behind us are obliterated in the flood of newness erupting continually from the minds of all. The doors of knowledge and understanding have been flung open, so much so that everything has been brought to light, no matter how insignificant it might appear to be.

This blaze of knowledge penetrates the veils of mystery that have kept past generations from knowing what we know. The veils have been lifted, drawn aside, so that we can see all the way to the edges and fates and origins of the universe itself. This has happened in the brief century just past. A single word in Greek identifies this event: *αποκάλυψις*, or 'apocalypsis' – apocalypse, "the lifting of the veil".

Yet in our daily lives we still think that nothing much has changed. That is wrong. Everything has changed, everything is changing, everything will change. We ourselves are in continual change – and we ourselves, reluctant or eager, are agents of the world's ongoing change.

This book is a loving search, full of far more questions than answers. As I write, I record error after error, backtracking, turning, correcting, searching within each search until the press of life insists that I abandon one idea to embrace the next – and not vanish down some endless recursion of rabbit-holes... or rat-holes.

Every book we read is a snapshot, an author self-portrait, of a moment in eternity. We look into old books, and sense the depths of time and the currents of great change, reading the skeletons of meanings long forgotten or decayed. Meaning is dynamic, alive, transient;

where do we anchor our comprehension? Some day – maybe even as I write – this book will decay in its meaning as the world around me flies onward.

How did this book come to be? Framed passages offer glimpses of my own coming to be. As I came to be, the book's beginnings and connections formed, and the stages, incidents, accidents, and openings of my life gathered those beginnings into a living organism: a creature of thought with symmetries, harmonies, contrasts, colors, and a rich, developing realm of being.

We face a blazing new existence together. Its light is as blinding as the sun, its challenges staggering, its future incomprehensible, our places in it unknown. No wonder we fear for ourselves, our children, our friends and families. How will we begin the search for our future?

We are restless, long-winged birds, fated and fledged to wander in the appalling distances of a Creation beyond imagination and dreams, beyond dimension and sense and meaning. Together we scry a few fallen feathers, trace great arcs of flight, hear the penetrant cries of fliers here and there, glide through ranges of greater meaning, and tease out from all these texts of spirit some faint taste of universal wonder.

We love our own significance as much as we love breathing. To stare down and discover dark nothingness supporting us, to scan light-years outward to infinity, to blink upward to blindness in star-borne light: these visions uproot us from our comforts and assurances, our sense of meaning of ourselves. This adventure lures us out of the selves we know and onward to selves we have yet to discover.

There are easier or more-tender journeys to understanding. But great flight is joyous, glorious, dreamlike, lyrical, fulfilling, drunken: to be loved and cherished in utter freedom. We aren't looking for "right answers". There is no such thing.

Reality is not fixed or stable. It breathes; it morphs; it flows endlessly from the cocoon of itself; it bursts its shells, its banks, its chains of the past; it transcends all ideas of itself. We struggle to embrace it and to flee from it. None of us owns reality. Reality owns us.

We search restlessly through reality's treasure-trove seeking living jewels, like J. R. R. Tolkien's hobbit Bilbo Baggins stumbling through the glistening hoard of Smaug's amassed gold, until we stand, bemused; and then, triggering our shock, horror, and wonder, the dragon Reality opens its eye to look upon us, so near that we cannot escape it.

Reality emerges in discovery, in the eye of a newborn, a lover, a mentor, a friend, a searcher, a ruler, any consciousness not our own that says to us, "I see you."

In terror, delight, and astonishment, we have always yearned to dwell in that moment, that instant where the light in the eye seeing us embraces, affirms, devours, destroys, transforms us from the less we have been to the greater of our joining with it: the annihilation in love.

BIBLIOGRAPHY

- 'Abdu'l-Bahá. 2010. *'Abdu'l-Bahá on Divine Philosophy*. facsimile reprint of the 1918 original. Edited by Elizabeth Fraser Chamberlain (Soraya Chamberlain). Kessenger.
- . 1976 (first published 1921). "Tablet to Dr. Auguste Forel." *Bahá'í World*, 37-43.
- . 1971. *Memorials of the Faithful*. Bahá'í Publishing Trust.
- . 1999. *Paris Talks*. reprint. Wilmette: Bahá'í Publishing Trust.
- . 2011. *Paris Talks: Addresses Given by 'Abdu'l-Bahá in 1911*. Bahá'í Publishing.
- . 1997. *Selections from the Writings of 'Abdu'l-Bahá*. Wilmette: Bahá'í Publishing Trust.
- . 2014. *Some Answered Questions*. revised. Translated by Bahá'í World Centre. Haifa: Bahá'í World Centre.
- . 1984. *Some Answered Questions*. Wilmette: Bahá'í Publishing Trust.
- . 1912. "Interview between a Prominent Rabbi and 'Abdu'l-Bahá'." *Star of the West, Book II*, June 24.
- . 1997 (original publication in Persian/Farsi). *Tablet of the Universe (provisional translation by Anonymous)*. Accessed May 12, 2016. http://bahai-library.com/abdulbaha_lawh_aflakiyyih.
- . 1991. *Tablets of the Divine Plan*. Bahá'í Publishing Trust.
- . 2000. *The Secret of Divine Civilization*. Bahá'í Publishing Trust.
- 'Ali, Maulana Muhammad. 1990. *The Religion of Islám: A Comprehensive Discussion of the Sources, Principles, and Practices of Islám*. Lahore: The Ahmadiyya Anjuman Ishá'at Islám.
- 'Omar, 'Abdul Mannan. 2010. *Dictionary of The Holy Qur'an*. Noor Foundation International.
- Abbott, Edwin A. 1992. *Flatland: A Romance of Many DIMensions*. Reprint. Dover.
- Abu'l-Fadl, Mirza. 1981. *Miracles and Metaphors*. Translated by Juan Cole. Kalimát Press.
- Adams, Douglas. 1990. *The Long Dark Tea-Time of the Soul*. Simon & Schuster.
- Akegarasu, Haya. 1977. *Shout of Buddha*. Translated by Gyoko, and Sweany, Joan Saito. Chicago, IL: Orchid Press.
- Alighieri, Dante. 2005. *Dante: De Vulgari Eloquentia*. Translated by Steven Botterill. Cambridge University Press.
- Andrews, Munya. 2019. *Journey Into Dreamtime*. Diamond Creek, Victoria, Australia: Ultimate World Publishing.
- Arberry, Arthur. 1996. *The Koran Interpreted: A Translation*. Touchstone.

- Armstrong, Karen. 2007. *Muhammad: A Prophet for Our Time*. reprint. HarperOne.
- Asad, Muhammad. 2008. *The Message of the Qur'an: The full account of the revealed Arabic text accompanied by parallel transliteration (English and Arabic Edition)*. The Book Foundation.
- Asimov, Isaac. 2011. *The Foundation Trilogy*. reprint. Barnes & Noble.
- Attar, Farid ud-Din. 1984. *The Conference of the Birds*. Penguin.
- Bahá'u'lláh. 1971. *Epistle to the Son of the Wolf*. Bahá'í Publishing Trust.
- . 2005. *Gleanings from the Writings of Bahá'u'lláh*. Translated by Shoghi Effendi. Wilmette: Bahá'í Publishing Trust.
- Bahá'u'lláh. 1928. "God and the Universe." In *Bahá'í Scriptures*, by Bahá'u'lláh & 'Abdu'l-Bahá, edited by Horace Holley, 555. Bahá'í Publishing Committee.
- . 1978. *Tablets of Bahá'u'lláh, revealed after the Kitáb-i-Aqdas*. Bahá'í World Centre.
- . 2003. *The Book of Certitude (Kitáb-i-Íqán)*. Bahá'í Publishing.
- . 2003. *The Book of Certitude (Kitáb-i-Íqán)*. Translated by Shoghi Effendi. Bahá'í Publishing Trust.
- . 2002. *The Hidden Words of Bahá'u'lláh*. Translated by Shoghi Effendi. Bahá'í Publishing.
- . 1993. *The Most Holy Book (Kitáb-i-Aqdas)*. Bahá'í Publishing Trust.
- . 2008. *The Pen of Glory*. Wilmette, IL: Bahá'í Publishing.
- . 1945. *The Seven Valleys and the Four Valleys*. Wilmette: Bahá'í Publishing Trust.
- . 2006. *The Summons of the Lord of Hosts*. Bahai Publishing.
- Bahá'u'lláh, 'Abdu'l-Bahá, Shoghi Effendi, and Universal House of Justice. n.d. "Lights of Guidance: A Bahá'í Reference File." <http://bahai-library.com/>. Edited by Helen Hornby. Accessed August 2016. http://bahai-library.com/hornby_lights_guidance.
- Balyuzi, H. M. 1976. *Muhammad and the Course of Islam*. George Ronald Publisher.
- Bauer, Friedrich L. 1991. *Decrypted Secrets: Methods and Maxims of Cryptology*. Springer-Verlag.
- Bede. 1990. *Ecclesiastical History of the English People*. London: Penguin Books.
- Black, Edwin. 2012. *War Against the Weak: Eugenics and America's Campaign to Create a Master Race*. Expanded edition. Dialog Press.
- Bloch, William Goldbloom. 2008. *The Unimaginable Mathematics of Borges' Library of Babel*. Oxford University Press.
- Blomfield, Lady Sara. 2007. *The Chosen Highway*. reprint. London: George Ronald.

- Bohm, David. 1968. "On Creativity." *Leonardo*, April: pp. 37-149.
- Borges, Jorge Luis. 1998. *Collected Fictions*. Penguin.
- Brown, Kevin. 2013. *Penicillin Man: Alexander Fleming and the Antibiotic Revolution*. The History Press.
- Bushrui, Suheil. 1994. *The Style of the Kitáb-i-Aqdas: Aspects of the Sublime*. Capital Decisions.
- Callender, Craig & Huggett, Nick. 2001. *Physics Meets Philosophy at the Planck Scale: Contemporary Theories in Quantum Gravity*. Edited by Craig & Huggett, Nick Callender. Cambridge University Press.
- Cantor, Georg. 1955. *Contributions to the Founding of the Theory of Transfinite Numbers*. reprint. Dover.
- Carey, Nessa. 2015. *Junk DNA: A Journey Through the Dark Matter of the Genome*. Columbia University Press.
- Center, U. S. National Bahá'í. 2016. *What Bahá'ís Believe*. Accessed May 11, 2016. <http://www.bahai.org/beliefs/>.
- Cheney, Margaret. 2001. *Tesla: Man Out of Time*. Touchstone.
- Chomsky, Noam. 1957. *Syntactic Structures*. 2015 reprint. Martino Fine Books.
- Clark, David P. 2010. *Molecular Biology made simple and fun*. Fourth edition. Cache River Pr.
- Clarke, Arthur C. 1962. *Profiles of the Future*. 1985 reprint. Warner Books.
- Clayton, Donald. 1984. *Principles of Stellar Evolution and Nucleosynthesis*. reprint. Chicago: University Of Chicago Press.
- Consortium, Unicode. 2016. *The Unicode Standard, Version 8.0*. The Unicode Consortium. <http://www.unicode.org/>.
- Contemporary Physics Education Project. n.d. "A Guide to the Nuclear Science Wall Chart." *Berkeley Lab*. <http://www2.lbl.gov/abc/wallchart/teachersguide/pdf/Chap00.pdf>.
- Dauben, Joseph Warren. 1990. *Georg Cantor: His Mathematics and Philosophy of the Infinite*. reprint. Princeton: Princeton University Press.
- DeGruy, Joy. 2017. *Post Traumatic Slave Syndrome: America's Legact of Enduring Injury and Healing*. Uptone Press.
- Deutsch, David. 2011. *The Beginning of Infinity: Explanations the Transform the World*. Penguin.
- Diamond, Jared M. 2011. *Collapse: How Societies Choose to Fail or Succeed: Revised Edition*. Penguin Books.
- . 1999. *Guns, Germs, and Steel: The Fates of Human Societies*. W. W. Norton & Company.

- Drucker, Ernest. 2013. *A Plague of Prisons: The Epidemiology of Mass Incarceration in America*. reprint. The New Press.
- Dubuc, Serge. 1991. "Models of Irregular Curves." In *Fractals: Non-integral Dimensions and Applications*, by ed. G. Cherbit. Wiley.
- Dunne, J. W. 2001. *An Experiment with Time (Studies in Consciousness)*. Hampton Roads Publishing.
- Eco, Umberto. 1997. *The Search for the Perfect Language*. Blackwell .
- Effendi, Shoghi and Universal House of Justice. n.d. "Science and Technology." *Bahá'í Library Online*. Accessed April 11, 2017. https://bahai-library.com/compilation_science_technology.html.
- Effendi, Shoghi. 1974. *God Passes By*. Wilmette: Bahá'í Publishing Trust.
- . 1934. *The World Order of Bahá'u'lláh*. Bahá'í Publishing Trust.
- Eglash, Ron. 1999. *African Fractals: Modern Computing and Indigenous Design*. Rutgers University Press.
- Einstein, Albert. 1949. "On the Method of Theoretical Physics." In *The World As I See It (Mein Weltbild)*, by Albert Einstein, 270-276. Philosophical Library. Accessed May 20, 2017. http://www.pitt.edu/~jdnorton/teaching/2590_Einstein_2015/pdfs/Einstein_Method_Physics.pdf.
- . 2015. *The Theory of Relativity: and Other Essays*. reprint. Philosophical Library/Open Road.
- Esslemont, J. E. 1980. *Bahá'u'lláh and the New Era*. Bahá'í Publishing Trust.
- Euclid. 2006. *The Elements: Books I-XIII*. Sterling.
- Falconer, Kenneth. 2003. *Fractal Geometry: Mathematical Foundations and Applications*. John Wiley & Sons.
- Fauconnier, Gilles & Turner, Mark. 2002. *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. Basic Books.
- Fenton, William N. 2010. *The Great Law and the Longhouse: A Political History of the Iroquois Confederacy*. University of Oklahoma Press.
- Feynman, Richard. 1985. *QED: The Strange Theory of Light and Matter*. Princeton University Press.
- Feynman, Richard. 1965. *The Development of the Space-Time View of Quantum Electrodynamics*. Prod. The Nobel Foundation. Oslo, December 11. http://www.nobelprize.org/nobel_prizes/physics/laureates/1965/feynman-lecture.html.
- Fitzgerald, Stephanie. 2011. *Children of the Holocaust*. Compass Point Books.

- Flanagan, Mary. 2013. *Critical Play: Radical Game Design*. MIT Press.
- Forbes, Nancy & Mahon, Basil. 2014. *Faraday, Maxwell, and the Electromagnetic Field: How Two Men Revolutionized Physics*. Prometheus Books.
- Ford, Kenneth & Wheeler, John. 2000. *Geons, Black Holes, and Quantum Foam*. W. W. Norton.
- Frank, Adam. 2018. *Light of the Stars: Alien Worlds and the Fate of the Earth*. W. W. Norton.
- Friere, Olival Jr. n.d. "Science and exile: David Bohm, the cold war, and a new interpretation of quantum mechanics." *Princeton University Department of Physics*. Accessed September 12, 2017.
http://www.physics.princeton.edu/~mcdonald/examples/EP/freire_hspbs_36_1_05.pdf.
- Gamow, George. 1988. *One, Two, Three... Infinity: Facts and Speculations of Science*. Revised reprint of Mentor Books 1953 edition. Dover Publications.
- Ganz, Nicholas. 2009. *Graffiti World: Street Art from Five Continents*. 2nd edition. Harry N. Abrams.
- Gilmore, Robert. 1993. *Catastrophe Theory for Scientists and Engineers*. reprint. Dover.
- . 2005. *Lie Groups, Lie Algebras, and Some of Their Applications*. reprint. Dover.
- Gilmore, Robert, and Christophe Letellier. 2007. *The Symmetry of Chaos*. Oxford University Press.
- Giunti, Carlo & Kim, Chung W. 2011. *Fundamentals of Neutrino Physics and Astrophysics*. reprint. Oxford University Press.
- Gleick, James. 2011. *Chaos: Making a New Science*. electronic edition of the 1987 book. Open Road Integrated Media.
- . 2011. *The Information: A History, A Theory, A Flood*. Random House.
- Gollub, G. L. Baker & J. P. 1990. *Chaotic Dynamics: an Introduction*. Cambridge University.
- Gould, Stephen Jay. 1999. *Rocks of Ages: Science and Religion in the Fullness of Life*. Ballantine Books.
- Graeber, David. 2014. *Debt: The First 5000 Years*. Melville House.
- Gray, Jeremy. 2012. *Henri Poincare: A Scientific Biography*. Princeton University Press.
- Greene, Brian. 2010. *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory*. 2nd. New York, NY: W. W. Norton.
- . 2005. *The Fabric of the Cosmos: Space, Time, and the Texture of Reality*. New York: Vintage Books.
- Gusfield, Dan. 1997. *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology*. Cambridge University.

- Hadlock, Charles R. 2012. *Six Sources of Collapse: A Mathematician's Perspective on How Things Can Fall Apart in the Blink of an Eye*. Mathematics Association of America.
- Hannas, William C. 1997. *Asia's Othographic Dilemma*. University of Hawaii Press.
- Hatcher, John S. 2005. *Close Connections: The Bridge between Spiritual and Physical Reality*. Bahá'í Publishing.
- Hatcher, John S. 2005. "Unveiling the Húrí of Love." *Journal of Bahá'í Studies* 15 (1/4). <https://bahai-studies.ca/wp-content/uploads/2014/05/15.1-4.Hatcher.pdf>.
- Hatcher, W. S. 2004. *Minimalism: A Bridge between Classical Philosophy and the Bahá'í Revelation*. Juxta Publishing. Accessed August 2016.
- Hawking, Stephen. 2001. *The Universe in a Nutshell*. Bantam.
- Hofstadter, Douglas R. 1999. *Gödel, Escher, Bach: An Eternal Golden Braid*. Basic Books.
- Ioannesyan, Y. A. 2010. "Reflections on Some Messianic Prophecies in Shaykhi Works." <http://irfancoquua.org/>. Accessed August 2016. http://irfancoquua.org/u/ioannesyan_messianic.
- Isaacs, Rufus. 1999. *Differential Games: A Mathematical Theory with Applications to Warfare and Pursuit, Control, and Organization*. Reprint of John Wiley & Sons 1965 book. Dover Publications.
- Jablonka, Eva, and Marion Lamb. 2014. *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life*. MIT Press.
- Jaynes, Julian. 2000. *The Origin of Consciousness in the Breakdown of the Bicameral Mind*. Mariner Books.
- Joyce, James. 1999. *Finnegans Wake*. reprint. Penguin Classics.
- Jung, Carl. 1983. *Alchemical Studies (Collected Works of C.G. Jung Vol.13)*. Princeton University Press.
- . 1980. *Psychology and Alchemy (Collected Works of C.G. Jung Vol.12)*. Princeton University Press.
- Kaku, Michio. 1995. *Hyperspace: A Scientific Odyssey Through Parallel Universes, Time Warps, and the 10th Dimension*. Anchor Books.
- . 1999. *Introduction to Superstrings and M-Theory*. Springer.
- Kathi'r, Ibn. n.d. *The Miracles of the Prophet Muhammad*. IslamKotob.
- Khalili, Nader. 2006. "Cal-Earth." In *Design Like You Give a Damn: Architectural Responses to Humanitarian Crises*, 106-112. Metropolis Books.
- Khanum, Ruhyyih. 1969. *The Priceless Pearl*. Baha'i Publishing Trust.

- Kolb, Edward & Turner, Michael. 1994. *The Early Universe*. Westview Press.
- Kramer, Heinrich & Sprenger, James. 1971. *Malleus Maleficarum*. reprint. Translated by Montague Summers. Dover.
- Kuhn, Thomas. 1970. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Kurt Gödel. 2011. "On Formally Undecidable Propositions of Principia Mathematica and Related Systems." Vers. English translation by B. Meltzer, January 1962, University of Edinburgh. *JAcq Krol* (<http://jacqkrol.x10.mx/>). July. Accessed April 18, 2017. <http://jacqkrol.x10.mx/assets/articles/godel-1931.pdf>.
- Lakatos, Imre. 2015. *Proofs and Refutations: The Logic of Mathematical Discovery*. reprint. Cambridge University.
- Lakoff, George & Núñez, Rafael. 2000. *Where Mathematics Comes From: How the Embodied Mind Creates Mathematics*. Basic Books.
- Lakoff, George. 1990. *Women, Fire, and Dangerous Things: What Categories Reveal About the Mind*. University of Chicago Press.
- Lakoff, George, and Mark Johnson. 2008. *Metaphors We Live By*. Chicago: University of Chicago Press.
- Lample, Paul. 2017. "In Pursuit of Harmony between Science and Religion." *Association for Bahá'í Studies*. April. Accessed July 22, 2017. <http://bahai-studies.ca/wp-content/uploads/2017/04/26.4-Lample.pdf>.
- Lang, Kenneth R. 2013. *The Life and Death of Stars*. Cambridge University Press.
- Langland, William. 2006. *Piers Plowman*. Edited by Elizabeth Robertson and Stephen h. A. Shepherd. Translated by E. Talbot Donaldson. Norton Critical Editions.
- Latour, Bruno. 1986. *Laboratory Life: The Construction of Scientific Facts, 2nd Edition*. Princeton University Press.
- Lawson, Todd & Ghaemmaghani, Omid, eds. 2012. *A Most Noble Pattern: Collected Essays on the Writings of the Báb, 'Alí Muhammad Shírází (1819-1850)*. George Ronald.
- Lawson, Todd. 1997. "The Dangers of Reading: Inlibration, Communion and Transference in the Qur'án Commentary of the Báb." In *Bahá'í Studies Volume III: Scripture & Revelation*, edited by Moojan Momen. George Ronald.
- Lessing, Doris. 1979. *Shikasta*. Knopf.
- Levin, Janna. 2016. *Black Hole Blues and Other Songs from Outer Space*. New York: Knopf.
- . 2003. *How The Universe Got Its Spots : Diary of a Finite Time in a Finite Space*. reprint. Anchor.

- Lewis, C. S. 1963. *Out of the Silent Planet*. paperback reprint. Macmillan.
- Lieber, Lillian. 2008. *The Einstein Theory of Relativity: A Trip to the Fourth Dimension*. Paul Dry Books.
- Lorentz, H. A., Albert Einstein, Hermann Minkowski, and Hermann Weyl. 1952. *The Principle of Relativity: A Collection of Original Memoirs*. reprint. Dover Publications.
- . 1952. *The Principle of Relativity: A Collection of Original Memoirs*. Dover Publications.
- Lovelock, David, and Hanno Rund. 1989. *Tensors, Differential Forms, and Variational Principles*. revised. Dover Publications.
- Ludwig, Charles. 1985. *The Wright Brothers: They Gave Us Wings*. Mott Media.
- Mandelbrot, Benoit. 1982. *The Fractal Geometry of Nature*. W. H. Freeman.
- Manin, Yuri. 2007. "Mathematics as Metaphor: Selected Essays of Yuri I. Manin." In *Mathematics as Metaphor*, by Yuri Manin, 27-32. American Mathematical Society.
- many. 2006. *Design Like You Give a Damn: Architectural Responses to Humanitarian Crises*. Edited by Architecture for Humanity. Metropolis Books.
- . 2010. *King James Bible*. Zondervan.
- . 2015. *One Thousand and One Nights – Complete Arabian Nights Collection*. Delphi Classics.
- . 2002. *Short Protocols in Molecular Biology (2 volume set)*. 5th edition. Edited by Roger Brent, Robert E. Kingston, David D. Moore, J. G. Seidman, John A. Smith, Kevin Struhl Frederick M. Ausubel. Current Protocols.
- Matt, Daniel C. 2009. *The Essential Kabbalah: The Heart of Jewish Mysticism*. HarperOne.
- McCants, William. 2012. "A Grammar of the Divine: Solecisms in the Arabic Writings of the Báb and His Thoughts on Arabic Grammar." In *A Most Noble Pattern: Collected Essays on the Writings of the Báb, 'Alí Muhammad Shírází (1819-1850)*, 52-87. George Ronald.
- McGonigal, Jane. 2011. *Reality is Broken: Why Games Make Us Better and How They Can Change the World*. Penguin.
- Michael M. Cox, Jennifer Doudna, and Michael O'Donnell. 2011. *Molecular Biology: Principles and Practice*. First Edition. W. H. Freeman.
- Minsky, Marvin. 1988. *The Society of Mind*. Simon & Schuster.
- Mohammed, Khaleel. 2005. "Assessing English Translations of the Qur'an." *The Middle East Quarterly*, Spring: 58-71. <http://www.meforum.org/717/assessing-english-translations-of-the-quran>.

- Muhammad Ali, Maulana. 2002. *The Holy Qur'an with English Translation and Commentary (English and Arabic Edition)*. Ahmadiyya Anjuman Ishaat Islam.
- Muhammad. 2004. *The Koran*. reprint. Translated by John Medows Rodwell. Bantam.
- Murchie, Guy. 1999. *The Seven Mysteries of Life: An Exploration of Science and Philosophy*. Mariner Books.
- Nabil-i-Zarandi. 1932. *The Dawn-Breakers: Nabil's Narrative of the Early Days of the Bahá'í Revelation*. Translated by Shoghi Effendi. Bahá'í Publishing Trust.
- Nagel, Ernest, and James Newman. 2008. *Gödel's Proof, Revised Edition*. revised. Edited by Douglas Hofstadter. New York: NYU Press.
- Nahin, Paul J. 2010. *An Imaginary Tale: The Story of [the Square Root of Minus One]*. Princeton University Press.
- . 2006. *Dr. Euler's Fabulous Formula Cures Many Mathematical Ills*. Princeton University Press.
- Nasr, Seyyed Hossein, Caner Karacay Dagli, Maria Massi Dakake, Joseph E.B. Lumbard, and Mohammed & Rustom. 2015. *The Study Quran: A New Translation and Commentary*. HarperOne.
- Needham, Tristan. 1997. *Visual Complex Analysis*. Oxford University Press .
- Neuenschwander, Dwight E. 2011. *Emmy Noether's Wonderful Theorem*. John Hopkins Press.
- Nolte, David D. 2010. "The Tangled Tale of Phase Space." *Physics Today*, April: 33-38.
- Nottale, Laurent. 1993. *Fractal Space-Time and Microphysics: Towards a Theory of Scale Relativity*. World Scientific .
- . 2011. *Scale Relativity and Fractal Spacetime*. Imperial College Press.
- O'Shea, Donal. 2007. *The Poincare Conjecture: In Search of the Shape of the Universe*. Walker Books.
- Parrinder, Geoffrey. 2013. *Jesus in the Qur'an*. reprint. Oneworld Publications.
- Peebles, Phillip James Edwin. 1993. *Principles of Physical Cosmology*. Princeton University Press.
- Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*. Vintage.
- Phelps, Myron. n.d. *'Abbas Effendi, His Life and Teachings*.
- Piketty, Thomas. 2014. *Capital in the 21st Century*. Harvard University Press.
- Plato. ca. 380 BCE. *The Republic*.

- Poincaré, Henri. 2011. *Science and Hypothesis*. reprint. Dover Publications.
- Poston, Tim, and Ian Stewart. 1996. *Catastrophe Theory and Its Applications*. republication. Dover.
- Pound, Ezra. 1960. *ABC of Reading*. New Directions.
- . 1968. *Literary Essays of Ezra Pound*. Edited by T. S. Eliot. New Directions.
- Prescod-Weinstein, Chanda. 2021. *The Disordered Cosmos: A Journey into Dark Matter, Spacetime, and Dreams Deferred*. Bold Type Books.
- Pynchon, Thomas. 1974. *Gravity's Rainbow*.
- Randall, Lisa. 2006. *Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions*. New York: Harper Perennial.
- Read, John. 1957. *From Alchemy to Chemistry*. Courier.
- Richard, Feynman. 2010. *Quantum Mechanics and Path Integrals*. Emended edition. Dover.
- Robinson, Abraham. 1996. *Nonstandard Analysis*. Princeton University Press.
- Rodney Douglas, Henry Markram, and Kevan Martin. 2004. "Neocortex." In *The Synaptic Organization of the Brain*, by Gordon M. Shepherd, edited by Gordaon M. Shepherd. Oxford University Press.
- Rodwell, John Medows. 2004. *The Koran*. reprint. Bantam Classics.
- Rosen, Robert. 2012. *Anticipatory Systems: Philosophical, Mathematical, and Methodological Foundations*. Springer.
- . 1991. *Life Itself*. New York: Columbia University Press.
- Ryding, Karin C. 2005. *A Reference Grammar of Modern Standard Arabic*. Cambridge University.
- Sagan, Carl. 1997. *Contact*. Pocket Books.
- Sakura, Masaharu Takemura and. 2009. *The Manga Guide to Molecular Biology*. 1st edition. No Starch Press.
- Schneier, Bruce. 2015. *Applied Cryptography: Protocols, Algorithms and Source Code in C*. Wiley.
- Schroeder, Manfred. 1991. *Fractals, Chaos, Power Laws: Minutes from an Infinite Paradise*. reprint W. H. Freeman. Dover.
- Schumm, Bruce A. 2004. *Deep Down Things: The Breathtaking Beauty of Particle Physics*. John Hopkins Press.
- Scorpan, Alexandru. 2005. *The Wild World of 4-Manifolds*. American Mathematical Society.

- Searle, John R. 1972. "Chomsky's Revolution in Linguistics." *New York Review of Books*, June 29.
- Seife, Charles. 2007. *Decoding the Universe: How the New Science of Information Is Explaining Everything in the Cosmos, from Our Brains to Black Holes*. reprint. Penguin Books.
- Selvam, A. M. & Fadnavis, Suvarna. 1998. "Cantorian Fractal Spacetime, Quantum-like Chaos and Scale Relativity in Atmospheric Flows,." *arXiv.org*. August 13. Accessed 2007. arXiv:chao-dyn/9808015 v1 13 Aug 1998.
- Shannon, Claude & Weaver, Warren. 1963. *The Mathematical Theory of Communication*. reprint. University of Illinois Press.
- Sheldon, Lee. 2012. *The Multiplayer Classroom: Designing Coursework as a Game*. Course Technology.
- Shepherd, Gordon M. 2004. "Introduction to Synaptic Circuits." In *The Synaptic Organization of the Brain, 5th edition*, by Gordon M. Shepherd et al., edited by Gordon M. Shepherd. Oxford University Press.
- Shírází, Alí Muhammad (The Báb). 1976. *Selections from the Writings of The Báb*. Wilmette: Bahá'í Publishing Trust.
- Singh, Simon. 2000. *The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography*. Anchor.
- Smolin, Lee. 2002. *Three Roads to Quantum Gravity*. Perseus.
- Smullyan, Raymond M. 1992. *Satan, Cantor & Infinity: Mind-Boggling Puzzles*. reprint. Dover Publications.
- Snow, C. P. 2012. *The Two Cultures*. reissue of 1959 lecture. Cambridge University Press.
- Soleri, Paolo. 2012. *Conversations with Paolo Soleri*. Edited by Lissa McCullough. Princeton Architectural Press.
- Solzhenitsyn, Aleksandr. 2007. *The Gulag Archipelago Abridged: An Experiment in Literary Investigation*. Harper Prenal Modern Classics.
- Sommerville, D. M. Y. 2005. *The Elements of Non-Euclidean Geometry*. reprint. Dover Publications.
- Staff, Hayden Planetarium. n.d. "Hayden Planetarium / Digital Universe ." *American Museum of Natural History*. Accessed May 6, 2017. <http://www.amnh.org/our-research/hayden-planetarium/digital-universe/>.
- Stephen F. Kennedy, Donald J. Albers, Gerald L. Alexanderson), Della Dumbaugh, Frank A. Farris, Deanna B. Haunsperger, Paul Zorn. 2015. *A Century of Advancing Mathematics*. Mathematical Association of America.

- Sternberg, Shlomo. 2013. *Dynamical Systems*. reprint. Dover.
- Stewart, Georgina Tuari. 2020. *Maori Philosophy: Indigenous Thinking from Aotearoa*. Auckland: Bloomsbury.
- Strogatz, Steven H. 1994. *Nonlinear Dynamics and Chaos*. Perseus Books.
- Svozil, K. 1987. "Quantum field theory on fractal spacetime: a new regularisation method." *J. Phys. A: Math. Gen.* 20 3861-3875.
- Taherzadeh, Adib. 1975 and later. *The Revelation of Bahá'u'lláh, 4 vols.* 4 vols. George Ronald.
- Talbot, Michael. 2011. *The Holographic Universe: The Revolutionary Theory of Reality*. reprint. Harper Perennial.
- Taleb, Nassim Nicholas. 2005. *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets*. Random House.
- . 2007. *The Black Swan: The Impact of the Highly Improbable*. Random House.
- Taylor, A. R. & Jagannathan, P. 2016. "Alignments of radio galaxies in deep radio imaging of ELAIS N1." *Monthly Notices of the Royal Astronomical Society: Letters*, March 10: 36-40.
- Taylor, Edwin F. & Wheeler, John A. 1971. *Spacetime Physics*. W. H. Freeman & Co.
- Tedlock, Dennis. 2010. *2000 Years of Mayan Literature*. University of California.
- Tegmark, Max. 2015. *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality*. Vintage.
- Tent, M. B. W. 2008. *Emmy Noether: The Mother of Modern Algebra*. A K Peters/CRC Press.
- Thom, René. 1972. *Stabilité Structurelle et Morphogénèse*. Benjamin.
- Thomas, Dylan. 2010. *The Collected Poems of Dylan Thomas*. New Directions.
- Thorne, Kip S. 2014. *The Science of Interstellar*. W. W. Norton.
- Tolkien, J. R. R. 1995. *The Return of the King*. Reprint. Houghton Mifflin.
- Vico, Giambattista. 1984. *The New Science of Giambattista Vico: Unabridged Translation of the Third Edition (1744)*. Translated by Bergin and Fisch. Cornell University.
- Vonnegut, Kurt. 1969. *Slaughterhouse-Five: A Novel*.
- Wallace, David Foster. 2010. *Everything and More: A Compact History of Infinity*. W. W. Norton & Company.
- Watts, Alan. 1951. *The Way of Zen*. New York: Pantheon Books.
- Weeks, Jeffrey R. 2002. *The Shape of Space, second edition*. CRC Press.

- Weinberg, Steven. 1994. *Dreams of a Final Theory*. Vintage Books.
- Weintraub, Pam. n.d. "Haunted by history." *Aeon*. Accessed December 2, 2019.
<https://aeon.co/essays/how-the-sufferings-of-one-generation-are-passed-on-to-the-next>.
- West, Bruce, Mauro Bologna, and Paolo Grigolini. 2003. *Physics of Fractal Operators*. Springer.
- West, Geoffrey. 2017. *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies*. New York: Penguin Press.
- . 2015. *This Idea Must Die*. Edited by John Brockman. New York, NY: Harper Perennial.
- Weyl, Hermann. 1939. *The Classical Groups*. Princeton.
- Weyl, Hermann. 2012. "Why is the World Four-Dimensional?" In *Levels of Infinity: Selected Writings on Mathematics and Philosophy*, by Hermann Weyl, edited by Peter Pesic. Dover Publications.
- Wheeler, John Archibald. 1990. *A Journey into Gravity and Spacetime*. Scientific American Library.
- Whitehead, Alfred North. 1979. *Process and Reality*. Free Press.
- Wigner, Eugene. 1960. "The Unreasonable Effectiveness of Mathematics in the Natural Sciences." *Communications in Pure and Applied Mathematics*, February.
- Wittbecker, Alan, and Michael W., et. al. Fox. 2014. *Redesigning the Planet: Global Ecological Designs*. CreateSpace Independent Publishing Platform.
- Wittbecker, Alan, Paolo Soleri, and Michael W., et. al. Fox. 2014. *Redesigning the Planet: Local Systems: Reshaping the Constructs of Civilizations through the Use of Ecological Design & Other Conceptual & Practical ... Experiments, & Eutopian Strategies*. CreateSpace Independent Publishing Platform.
- Witten, Edward. 2007. "From Superconductors and 4-Manifolds to Weak Interactions." *Bulletin of the American Mathematical Society* (American Mathematical Society) 44 (3).
- Wolfson, Richard. 2003. *Simply Einstein: Relativity Demystified*. reprint. W. W. Norton.
- Yourgrau, Palle. 2006. *A World Without Time: The Forgotten Legacy of Gödel and Einstein*. Basic Books.
- . 1999. *Gödel Meets Einstein: Time Travel in the Gödel Universe*. Open Court.
- Yusuf Ali, Abdullah. 2001. *The Holy Qur'an*. Wordsworth Editions.
- Zee, Anthony. 2003. *Quantum Field Theory*. Princeton University Press .

Zukav, Gary. 2009. *The Dancing Wu Li Masters: An Overview of the New Physics*. reprint. HarperOne.

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