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Mind the Gap: How Metaphor and Mathematics Make (and Remake) the World

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Mind the Gap: How Metaphor and Mathematics Make (and Remake) the World

Susan J. Sechrist
November 1, 2010

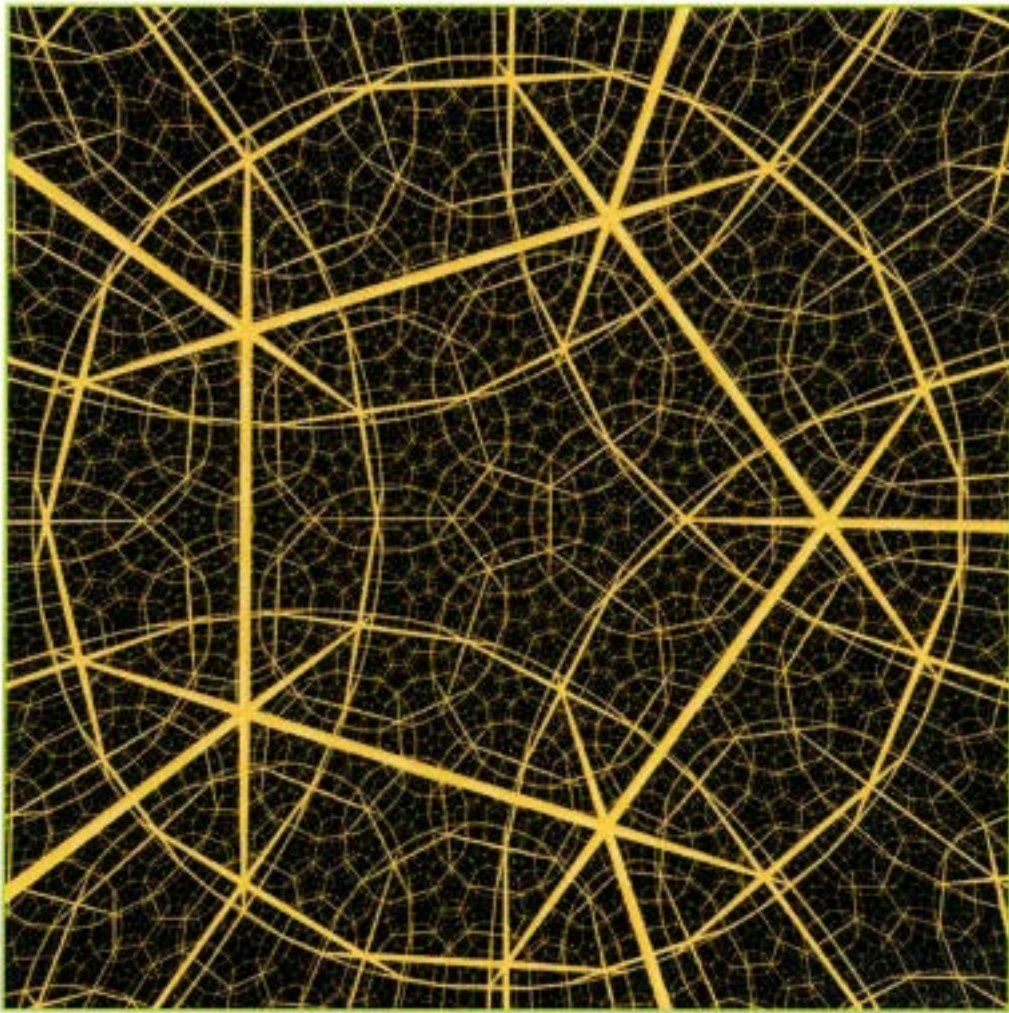


Figure 1: Artist's ¹ depiction of hyperbolic space. ²

¹ The artist being a computer software program, Curved Spaces, written by mathematician Jeffrey Weeks.

² Image from http://www.maths.bris.ac.uk/research/pure/themes/geometric_group_theory/.

Table of Contents

Part I: Introduction and Note on the Project.....	3
<i>The Bathymetrist Chapter 1: The First Day of a New Year</i>	5
Part II: Assumption – Contemplating the Void	9
<i>The Bathymetrist Chapter 2: Sprung</i>	13
<i>The Bathymetrist Chapter 3: Marginalia on an Anonymous Pamphlet</i>	34
Part III: Approximation – Arriving at the Precipice.....	48
<i>The Bathymetrist Chapter 4: Ghosts of Departed Quantities</i>	57
Part IV: Conclusion.....	80
<i>The Bathymetrist Chapter 17: Ruins</i>	80
Works Cited.....	82

Part I: Introduction and Note on the Project

I came to Skidmore as a technical and science writer interested in using figurative language, rhetoric, and literary techniques to better explicate complex scientific ideas. I hoped that if I could hinge scientific and mathematical concepts to beautiful, compelling language, people would be more inspired by and more inclined to explore the unknown and offer their unique insights into it. But, I also discovered a counterpart to this approach in authors who used elements of scientific thought, especially mathematics, to make their fiction richer, deeper, and more intuitive, and in many cases, more challenging and unsettling. It was this symbiotic relationship between mathematics and metaphor that I decided to put at the origin of my thesis project.

To challenge myself beyond writing an analytical research paper, I decided that the best way to encapsulate my interdisciplinary experience was to do an interdisciplinary project. Since my area of focus was about the relationship between fiction and non-fiction, my thesis would be as well. This project consists of several sections of analytical work with chapters from an ongoing work of fiction sandwiched (I hope, illustratively) between. The story, called The Bathymetrist³, is about Milo Finn, a teenaged girl who spends summer days in a row boat out on a pond behind her house. She begins to map the bottom of the pond by dropping a plumb bob on a length of marked twine, but discovers a spot that cannot be measured. The plumb bob drops and keeps dropping

³ A bathymetrist studies the depths and features of bodies of water; she maps the terrain providing data on underwater contours and how deep they lie.

until Milo runs out of twine. Her best friend, Flax, is frightened by this bottomless hole, but Milo is intrigued and begins to spend much more time at the pond than with her friends, creating rifts that reveal what lies beneath the surface of her relationships and her expectations of herself and others.

Where there is a gap, there is some kind of human intervention – be it through curiosity or blind faith. It’s the choice between these two assumptions that inspired me to write The Bathymetrist. To complement this idea, I began looking for authors, scientists, and mathematicians who create these gaps in their work and then fill them, bridge them, or widen them.

What I hope for the character of Milo is that she serves as a trickster who reveals one truth while concealing another. But I also see her as a guardian of the ineffable, a character who doesn’t just explore the gap but takes it upon herself to guard it, to protect it from absolutism, blind faith, and fear. She seeks and finds clarity, but also recognizes that for clarity to have meaningful destructive purpose and reconstructive power, it must also come with a remainder of incompleteness.

I wanted the authority of my thesis to come from equal parts fiction and non-fiction, metaphor and explication, since that is the very core of my overall program. I haven’t decided which one carries more weight or offers more clarity; I believe that lack of perfect knowledge is the beauty of the combined system.

The Bathymetrist

Chapter 1: The First Day of a New Year

It's New Year's Day and I am the dark pupil of the icy eye that looks only skyward. I'm the threshold. I contract, I expand, control how much light is allowed. What does this eye see? To what brain is it connected? Is it the mind of just these woods or is it the whole Earth's?

The pond is frozen over. Frozen so solid that it's bulging at its edges, curving the surface like a lens. Not a perfectly round eye, but close. An eye like this would be round enough to see out of.

The pond-eye is far back in our woods and surrounded by tall pines, reachable by a narrow, needled path. I took that path this morning, after the breakfast argument, and lay down in the middle of the frozen pond to look up through the cylinder of trees. I swung my arms and legs to make outlines of angels, but the ice is so hard my boots can't leave a scratch. I've got no substance on this surface. I'm space that has a name and a purpose but no substance. I'm the pupil of this here eye.

Through the cylinder of pines, the sky is a bright blue circle. A cloud spins through the space. I notice these things now: the motion of clouds against the color of sky, sounds in the woods, the cold at my back. Someone's got a burn barrel going down on Cynthia Lane. Evergreens don't make noise in the wind, like their leaved companions. My friendship with Flax, my oldest friendship, is over.

She thought I'd give up the pond when school started. But I kept going back. I got the idea to map the bottom one summer day, floating in the boat. The sky was brutal,

unveiled, the sun hot and yellow. In a shady, still spot I could see the bottom, with its frogs and other tiny creatures, and some shiny bits of human junk. One glint was a quarter, heads up. I thought I could reach into the water and just grab it, but it was down too deep. How water deceives, bending light into strange angles unfamiliar to the dry human eye.

The Egyptians had mapped the bottom of the Nile using barges and long poles. Like those Egyptian punters, I could take measurements. I could write them down and draw a graph of the bottom, giving form to the hidden. I could fill notebooks with these things.

When Flax asked me why I was doing it, I couldn't answer her. It just felt good to do it. To take measurements and write them down. When she asked me what I was going to do with the information, I couldn't answer that either. I wasn't going to do anything with it. I was just going to know something that I didn't know before.

The breakfast argument on New Year's Day was between my parents and my visiting grandmother. Gran Anna was recovering from a recent bout of addiction by finding a colorful brand of religion. She told my father, her son, that it didn't matter now that neither he nor his brother lived close enough to carry her body out of the house when she died. Now the church could do it. But, I suppose what's going on right now between my grandmother and my parents isn't important. I should talk about what happened this summer, about the pond and the discovery of the bottomless hole. I should talk about why Flax is no longer speaking to me. About why I'm not so frightened of that loneliness. About how I'm far more frightened of being too full rather than too

empty. And what I've learned about this brutish and shamefully un-provocative process of growing up – that it means giving back dreams, perfecting coping mechanisms.

Accepting that relief is all the living you are entitled to.

Simile, metaphor, hyperbole, lie

If we graphed these concepts like variables in a mathematical function or treated them as entities in a series, they would reveal a progression in the relationship between the known, the unknown, and the unknowable. Their characters and purposes are distinct.

A simile denotes a clear connection between real things, like in Langston Hughes' "A Dream Deferred": "What happens to a dream deferred? Does it dry up like a raisin in the sun?"⁴

A metaphor induces the dreamlike quality of uncertain power between two ideas, conferring mystery upon both, yet in a way that is recognizable if inexplicable:

"...all the world's a stage..."⁵ Hyperbole, which has meaning both linguistically and mathematically, stretches our willingness to trust it, but is spared the accusation of

fraud by its ultimately more elevating purpose: "Here once the embattled farmers stood, and fired the shot heard round the world."⁶

A lie, of course, is the truth

dismembered. A lie is also the start of a good story. And good fiction becomes more than the lie at its core. The lie becomes an engine, a difference engine, an algorithm: it

⁴ A Dream Deferred, Langston Hughes (<http://www.cswnet.com/~menamc/langston.htm>).

⁵ As You Like It, Act 2, scene 7, 139-143, William Shakespeare (<http://www.enotes.com/shakespeare-quotes/all-world-s-stage>).

⁶ The Concord Hymn, Ralph Waldo Emerson (<http://www.buzzle.com/articles/examples-of-hyperboles.html>).

transforms reality from a single, one-dimensional point into a hyperbolic, probabilistic multi-verse.

Language and the rules of language are more than representational models of consensual reality. They have the same motive power as that of variables used to describe the world mathematically, and are, therefore, malleable and symbolic. What is the power of a metaphor or hyperbole composed of variables?

Those of us who study interdisciplinarity do it because we suspect that something is amiss about reality. There's a connection undone; there's a sublimation of elements that has happened, a missing phase, a lost link. We believe that there is more to understanding the world than categories and rules; we break those rules by artfully fitting the square peg in the round hole and then justify the poor fit. In essence, we support, defend, and worship the gaps that we create, not those that we fill.

Part II: Assumption – Contemplating the Void

It's a cliché – Art imitates Life – because it's true. But the cliché, like so many self-referential artistic elements, is also incomplete. The phrase itself is a creation of our insatiable need to communicate about and to comprehend the nature of our internal and external surroundings. Art and Life are bound up together in human cognition and perception; the separation of the two for comparison is really an artifice to create a gap between them. The gap allows us room to move, to interpret, to assume meaning, and then to create functional narratives that help us develop necessary systems like self, society, and civilization.

Because humans are sentient and not just sensing creatures, we must always negotiate between a measurable physical reality and the artful models that we build to contemplate, comprehend, and manipulate that reality. Carefully codified, these models lead us to the consensual myths which shape our daily lives, our culture, our progress, and our identities as individuals and as members of societies. Models – whether artistic or scientific – are the bridge across the gap, but they too are crafted from the same source material as the gaps themselves.

Language is one of the most powerful tools with which to build models, but its malleability also challenges our ability to make useful assumptions about the meaning of narrative models. How we use narrative matters – interpretation depends on a vast

number of factors: the author/reader relationship, a cultural understanding of figurative language, and the social and political motivations that undergird the story. However, narrative and meaning, like the elements of Art and Life in the cliché, are not separate entities; they are relatives from the same family. Narrative is not a simple translation, like an algebraic equation revealed as a geometric figure through the representative structure of a coordinate grid system. Narrative is not separate from the representational or relational systems that we use as its scaffolding; narrative is also part of their construction and function. As many thinkers have shown, narrative can also change the grid. But let's step back in time a bit, to when language was first revealing itself as a good negotiator between sense and sentience.

Indigenous peoples have long used stories and myths to store data about their natural environment. This is an efficient way for people to live with their surrounding landscape; to draw boundaries where they are necessary for survival; to build common goals and a sense of community; and to create predictive systems that support agriculture, hunting, and preparation for seasonal changes. Archaeologist and linguist Elizabeth Wayland Barber studies aboriginal myths to reconstruct natural history. By studying these data, she correlates oral histories to geological events such as volcanic eruptions, earthquakes, and tsunamis. One example comes from the Klamath tribe in what is today the state of Oregon:

The Klamath tell a story about the creation of Crater Lake: a battle ensued between the people and the Chief of the Below World over the love of a woman. The Chief of the Below World, denied his love,

showered the people with fire and stone and smoke from the top of his mountain home, until appeased by a sacrifice, he descended back into his mountain, the top collapsing in on itself and forming a crater. This myth has been passed down in the tribe for almost 8000 years, and originated at the same time that geologists believe Mount Mazama, one in the Cascade chain, was demolished by an enormous volcanic eruption (Barber 6-8).

This myth is not a simple tale to frighten children or just an exercise in building a tribal literary tradition. It is a contemplation of the gap between humans and the natural environment that actually archives scientific information; it stores data that can recreate the details of an observable, physical phenomenon. This kind of narrative helps people cope and collaborate with their environment. The story of the Chief of the Below World also gives the Klamath an opportunity to contemplate and explore the unknown. Within this narrative are enticing, irresolvable clues: who was the woman the chief loved, what was the sacrifice, what could make this happen again? It is this wondering that fuels the narrative engine and gives rise to more stories.

Another famous eruption that was captured in words illustrates this ongoing motive power. Pliny the Younger, nephew to philosopher Pliny the Elder, wrote an account of the eruption of Vesuvius that buried Pompeii (and the lesser known Herculaneum). Pliny the Younger's narrative is full of beautiful metaphors that describe a natural experience no one had ever witnessed before; in fact, his account is considered in the scientific community to be the beginning of volcanology (Radice 4): "It was not clear at that distance from which mountain the cloud was rising (it was afterwards known to be Vesuvius); its general appearance can best be expressed as being like an umbrella pine,

for it rose to a great height on a sort of trunk and then split off into branches” (Radice 4).

Other ideas emerge from Pliny’s observations. As he escapes the city with his mother, he describes the scene of devastation and fear as evidence that they have all been abandoned by the gods: “Many besought the aid of the gods, but still more imagined there were no gods left, and that the universe was plunged into eternal darkness for evermore...” (Radice 7). Pliny’s description not only archives the eruption of Vesuvius – it unleashes a critique of belief that redraws the motive for and meaning of life itself. His narrative asks questions and demands proofs, much like a mathematical equation.

Philosophers, scientists, and artists would continue in Pliny’s ashy footprints to grapple with and question everything about human nature, the entire universe, and the meaning of life. Narrative was no longer about praising or elevating the gods – it could dethrone them, too.

As literacy grew, so did this ability of narrative to challenge the status quo. Cultures struggled with the nature of narrative, recognizing its ability to both glorify and cement foundational thoughts and also be the tool of their destruction. Umberto Eco’s novel The Name of the Rose explores this delicate balance beautifully: though the murderous Brother Jorge kills to keep Aristotle’s Poetics from being read by the novices, he is part of a religious order that dutifully maintains an enormous labyrinthine library full of

dangerous ideas that are antithetical to their worldview. The information itself, by nature of being written down, has a sacredness and power of its own. To Brother Jorge, destroying it is tantamount to offending God; controlling it is his burden and his test.

Controlling information begins with creating a record. Once recorded, these individual perceptions can become a dynamic narrative system that is more than the sum of its parts. It is not a mix of inert particles, but rather a volatile chemical reaction that creates many more differentiated products than it originally comprises. Imbued with metaphors and other rhetorical elements that evolve on their own, narrative develops its own algorithms and uses a kind of stored set of instructions to self-organize like a biological molecule. Narrative is not a linear assemblage of elements on a rigid, immovable scaffold; it is a form of artificial intelligence.

The Bathymetrist

Chapter 2: Sprung

It all started when school let out.

On that last day, a hundred junior high school seniors piled onto the buses for the last time, our book bags weightless, liberated from the pages that defined our 8th grade lives. Next year, we'd all be at the high school, on a different bus with different weights to carry. As the bus made its last rounds, kids spilled off in moods ecstatic and sad, into streets, stores, and woods, transforming back from drones into carefree flying things.

Flax and I went to the woods behind my house every day for weeks after school let out. At first we stayed on the trails or hung out under the trees. One day, we stumbled on an old foundation, a crumbling asymmetry of stone that looked like it had been lost generations ago. Stone and iron were the only things left: a rusting stove; blunted tools poking up in the grass, threatening tetanus; bowed and crippled stone walls coughing up dry mortar. We spent the next weeks mapping out every line and curve of the old structure, finding treasures buried in decades of seasons – a bent metal picture frame missing the photograph and the glass cover; some broken bottles and white porcelain; and a small pewter vase decorated with a calligraphic “H.” We didn’t find any lost diaries or old coins or buried jars of jewelry. Flax treated the site like a grave crossed with a shopping mall – she was superstitious about disturbing anything dead, but hopeful of finding something valuable.

Day after day we sat on the low stone walls. One day, while eating apples and bouncing our sneakers off the hard surface, Flax touched the iron stove with her foot and a flake of black iron tinged with orange rust sloughed off.

“Hey, don’t do that.” I said.

“Don’t do what?” she asked absentmindedly, now poking at the rough, dark surface left behind.

“Don’t do that,” I pointed with my apple core between my thumb and forefinger.

“You’ll break it.”

Flax laughed, “I think it’s already sufficiently broken, Milo, don’t you?”

The iron stove heaved over on one side, long ago losing the support of two of its four legs. The surface burners were open and the plates that fit over the holes missing (we looked for them). A frozen waterfall of ash spilled out of the gaping maw where the oven door used to be. All of its functional flesh was gone, its connective hinges rotten down to dull silver marrow. I wanted some respect for these bones.

“Just don’t do it. You’ll get lockjaw.” I said.

“That’s from stepping on nails,” Flax said, but she withdrew her foot, swinging around to sit sideways on the wall, riding it like a horse. “Hey, I had this cool dream last night. Danny Joliette was in it. We almost did it.” Flax took another bite from her apple and then pitched the core into the trees like she was standing on the softball mound.

“So, why didn’t you?” I asked. These conversations with Flax about boys always made me feel just a little sick, like when I found my brother’s stash of magazines in his desk (I’d jimmied the lock). Looking at the pictures was tantalizing, but after a few minutes I’d become queasy and tired. It felt like eating too much ice cream or being inside the mall for too long.

“It was just a dream, doofus. You can’t control your dreams.”

Actually, I was really good at dreaming, especially in the early morning when my conscious mind was switching roles with my unconscious. I had one dream recently where I was walking underwater in a canal that was made of different colors of mosaic glass tiles.

“You never have dream sex, do you?” Flax said. (And she did say it, not ask it. It was an accusation.)

I didn't answer. The wind was starting to pick up and it smelled like rain was coming. Flax hated to get her long, straight blonde hair wet – it frizzed. I didn't need to answer her.

"Whatever." Flax answered herself, spun back around and jumped off the wall. "You have weird dreams anyway."

"They are vivid, not weird. And you can control your dreams if you teach yourself how. You can make certain things happen. You can fantasize in a dream that you want to fly, and then start flying."

Flax chuckled, shaking her head. "You are the only person I know who fantasizes while you are dreaming. I can barely remember my dreams and they're almost always boring. Let's go, I just got hit by a massive plop." Flax hopped down from the wall and headed back to the path.

Rain began to mark dark spiky blotches on the stone foundation. Fresh water on old stone. Now-rain on then-stone. I started daydreaming, but Flax called for me from the trail and I followed her instead.

It was like this for a while. We went to the foundation every day. I brought a canvas bag to put treasures in, but we never surpassed the finds from those first few days.

Disappointed by the lack of trinkets, Flax finally stopped exploring the foundation altogether and spent most of the time perched on the kitchen wall, mining the broken corner of the iron stove with her foot. She wanted to talk and hang out.

"So, we'll be on the bus with Debbie Bartholomew in the fall." Flax said.

"Yes, I guess we will." I was on the other side of the foundation, stirring a stick around in some leaves.

"So, that doesn't bother you? Milo? You know what that bitch is like."

"I know, Flax. But I'd rather enjoy the summer than worry about the fall right now. Debbie Bartholomew can wait."

"I can't ignore it," Flax whispered. "I'm worried. She hates me."

Debbie Bartholomew dated Flax's older brother John a year ago and it ended badly. For whatever reason, Debbie took her ire out on her former boyfriend's kid sister. Probably because Flax was small and annoying; an easy target.

"It's easy for you, you're big. No offense." Flax said.

I was big – tall and a few pounds overweight. But the biggest difference between us was that I was quiet and Flax was never, ever.

"Hey, look at this!" From the pile of dried leaves, I pulled out a moldering pink silk ribbon.

"Oh, Milo, that's disgusting!"

The ribbon was filthy and pocked with fraying holes. I held it out in front of me between my finger and thumb. I wasn't inured to its decay, but I was fascinated by the two dark crumpled spots where the ribbon had obviously once been tied into a bow. It looked like something that belonged on a dress, around a young girl's waist.

"You're going to catch something from that." Flax said. "Put it back."

I turned the ribbon over a few times, still holding it at an arm's length and then dropped it back into the leaves.

“Should I bury it again?” I asked.

“Ugh, I’d leave it, don’t touch it again. It may have been used to strangle an illegitimate baby or something.”

The first Sunday in July was a rainy, windy maelstrom. A full 15 degrees colder than normal. Flax called me that morning after her family returned from church.

“I’m staying home today, too gross outside. Besides, my mom wants me to help her make a dozen batches of zucchini parmesan for my grandmother – seems the old lady has now also forgotten how to cook.”

“No problem,” I said. “I’ll see you later this week. We still going to the movies on Wednesday night?”

“Yeah, I think John can drive us.” Flax pulled the phone away from her mouth and yelled to her brother. “Yeah, we’re good. I’ll talk to you tomorrow.”

After helping my parents move junk out of the basement into the garage for the big yard sale next weekend, I sat in my room reading. A light steady rain fell against my window, and I suddenly felt compelled to visit the iron stove’s bones and the kitchen wall and the rotting pink ribbon.

Once in the woods, I followed the path to the big tree and then veered right, under the outstretched arms of a line of pines. Past them, was the east wall of the foundation. In the dim light, it looked more ominous than I remembered. I was alone. Having Flax with me had been like a song sung at a grave.

I walked around the back side of the wall to where the iron stove lay cocked to one side, its surfaces slick and shiny with rain. The cascade of ash was mottled and congealed into a mangy, matted pelt. At any moment, the stove could come alive, enraged by its abandonment. My heart actually quickened, my skin prickled with the rise of every hair. I could build such easy, breezy panic with this untethered imagination.

I thought about Flax in the kitchen with her mom making zucchini parmesan for her aged, superstitious grandmother. I pictured Flax's golden hair – hence the name – and her heart-shaped face with her deep-set brown eyes and cupid bow lips. She was a pretty girl. She had a big smile, courtesy of years' worth of braces and retainers. But when she wasn't smiling, her mouth looked a little stretched and overburdened by all those perfectly straightened teeth.

Flax's mom would give her the sloppy jobs to do. So, while Mrs. Rabbitt sliced the fat zucchini, Flax would have to dip them into a slimy egg wash and then roll them in bread crumbs. Flax hated having sticky fingers, it was practically a phobia. She said having dirty hands made her feel insecure.

I surveyed the foundation. There was a big rectangular wall that was obviously part of the living area. Off the front of that was a series of short stone pillars that might have supported a porch. Near the iron stove, behind what Flax and I called the kitchen wall, was a diminishing wedge of stones that disappeared into the forest. I didn't know what that might have been. The bedrooms must have been upstairs, and as such, they had vanished. I tried to imagine what the upstairs must have looked like, but it was very hard to picture. Only what was secured in the earth had endured. The rooms suspended,

airy above the foundation of the house, left behind no trace. And you could not reconstruct the whole of a body from just a footprint.

I wanted to see the ribbon again, so I walked the outer perimeter of the foundation to where I'd left the crumpled slither of pink. Its frayed ends offered thin threads to the breeze, but the rest of the ribbon remained unmoved. Once I saw it, laying there unchanged, I reluctantly lost interest in it. I'd hoped it would have more pull than this mediocre recognition. Then it started to rain really hard and I wondered why I was down here when I could have been curled up on the couch with a book or a movie.

I decided to head back home. But first, as an homage to my original intent, I wanted to walk over to that singular wedge of crumbling wall that disappeared into the woods. That was one area Flax and I didn't explore together. I went around the front of the house and stood next to the disintegrating shape. Crumbs of mortar lay on the ground, outlining the wall with a gray, particulate halo. I followed the diminishing wall toward the woods, running my hand along its rough surface until I stopped at a line of old lilac trees long past budding. Funny though, I imagined I could still smell the blossoms.

What I saw through the trees looked at first like the dull chrome of an old car bumper, the dark pewtery-colored stain of broken, abandoned machinery. But it was moving, shimmering, like it was chaotically struck by sunlight passing through wind-whirled leaves. But there was no sunlight today. The palette of sky and air was completely gray and dull, with no contrast. Framed by vines and lilac branches, the undulating surface looked like a living sculpture of stained glass. I watched it change,

oblivious to the rain now coming down in heavy drops, pelting the cold stiff vinyl of my dad's borrowed poncho, dripping off the hood and onto my face. Lilac leaves clung to my bare arms as the branches rasped against the poncho – I was moving through the bushes to get a closer look. Thunder sounded, again prickling my skin with imagined fear. But I wasn't afraid. What I felt just had some of the same symptoms as fear – heart straining against its moorings, peripheral vision tweaked to sense movement, muscles ready to run or swing a punch. This was not fear, but it traveled the same neural pathways. It was a very curious sensation, a sort of out of body experience but while I was still in my body. A second body experience. A dream body.

I came through the lilac trees to a muddy shoreline. I was standing at the edge of a finger of water. Past another copse of short, scrubby bushes, there was a pond.

I, Narrative

In science fiction, one of the most compelling and dangerous character archetypes is the sentient robot. Made in our image as proof of our ability to control nature and destiny both, the robot imbued with the power to reason is a tool designed to make human life better. But, the robot that can imagine and reason is a terrifying creation. This embodiment of artificial intelligence speaks to our fear of losing control not just of our technology, but also of our intent.

Narrative is a technology, but one with which we are so comfortable we forget that it can have a life of its own. We forget that it is constructed of components that are not

static but those that contribute to a complex system that exhibits dynamic and unpredictable behavior.

In the United States, the 1930s was a tumultuous pivot point – one war was over while another brewed overseas, social unrest stirred in the big cities, economic disaster had set in motion the nation’s worst depression, and the iconic American pioneering spirit had met with obstacles that threatened the narrative of manifest destiny. This narrative – that European settlers, by right of their social and technological superiority, had irrefutably conquered the savage wilderness – had met its match in the dust bowl of the Great Plains. The narratives that came out of the dust bowl are excellent examples of how observable facts and scientific measurement can create two entirely different representations of reality. These stories cause us to question the nature of the narrative itself and the value we place on character, plot, and scene as arbiters of the truth (Cronon 1373).

William Cronon, an environmental historian at Yale University, contrasts the viewpoints of several authors and historians who focus on the events that led up to the dust bowl and the affect of its aftermath on American policy and society. Cronon discovered that while two of these authors – Paul Bonnifield and Donald Worster – used basically the same information to build their narratives, their emphases were surprisingly divergent:

“For Bonnifield, the dust storms of the 1930s were mainly a natural disaster; when the rains gave out, people had to struggle for their farms, their homes, their very survival. Their success in that struggle was a

triumph of individual and community spirit: nature made a mess, and human beings cleaned it up. Worster's version differs dramatically. Although the rains did fail during the 1930s, their disappearance expressed the cyclical climate of a semiarid environment. The story of the Dust Bowl is less about the failures of nature than about the failures of human beings to accommodate themselves to nature. A long series of willful human misunderstandings and assaults led finally to a collapse whose origins were mainly cultural.

"...it is not merely their conclusions that differ. Although both narrate the same broad series of events with an essentially similar cast of characters, they tell two entirely different stories. In both texts, the story is inexplicably bound up to its conclusion" (Cronon 1348).

Narrative is never mere reporting; even nonfiction is weighted with imaginative assumptions about the role of specific characters and the affect of plot and scene. In these contrasting stories about the dust bowl, the divergent conclusions arise because of an assumption about the nature of the gap between nature and humankind. For Cronon, thresholds are crossed by human ingenuity, persistence, and belief that nature is always malleable under the hand of man. For Worster, the threshold shouldn't even necessarily be crossed – nature is a character on par with humans, with ways that should be understood and respected rather than vanquished. These narratives, as Cronon has pointed out, are tied to the assumptions of their authors (and their readers) and are destined to reveal a certain conclusion.

Obviously, there are more factors at work in the narratives of the American dust bowl than just the relationship between humankind and nature. The assumptions are tied to where the story starts, which characters are included and which are excluded, how the actions of third parties – such as the New Deal planners – are interpreted, and how each

author connects the meaning of the past to that of the future. The selection of narrative components shapes the very meaning of the story itself, to the point where it has a momentum of its own: “Placed in a particular historical or ideological context, neither group of plots [Bonnifield’s and Worster’s] is innocent: both have hidden agendas that influence what the narrative includes and excludes. So powerful are these agendas that not even the historian as author entirely controls them” (Cronon 1352).

Not only does the collective narrative gain control over plot, scene, and character within the story, it actually changes the very nature of those elements as the story unfolds. In James C. Malin’s Grassland of North America, the author describes how the evolution of the character of man during the dust bowl shapes and modifies the scene of the surrounding natural environment:

“Malin’s human agents begin as struggling immigrants who have no conception of how to live in a treeless landscape; by the end, they have become “grass men” who have brought their culture “into conformity with the requirements of maintaining rather than disrupting environmental equilibrium.” So, completely have they succeeded in adapting themselves that they can even “point the finger of scorn at the deficiencies of the forest land; grassless, wet, with an acid, leached, infertile soil.” Human inhabitants have become one with an environment that only a few decades before had almost destroyed them” (Cronon 1356).

These “ascending” narratives, to use Cronon’s term, are designed for a specific purpose and, therefore, the pecking order of character, scene, and plot is quite transparent. However, narrative in this case is not a simple organizing principle; it is an awesome force for both positive and negative change. The narrative of manifest destiny led countless people to settle in the plains where they faced a harsh environment none

bothered to predict. Furthermore, their belief in the narrative of manifest destiny and man's dominion over nature actually changed the natural landscape. The push of pioneers killed off the bison, excommunicated the native tribes, and turned a delicate grassland into an overgrazed wasteland: "The New Deal planners in effect argued that the rising plot line of our earlier storytellers not only was false but was itself the principal cause of the environmental disaster that unfolded during the 1930s. The Dust Bowl had occurred because people had been telling themselves the wrong story and had tried to inscribe that story – the frontier – on a landscape incapable of supporting it" (Cronon 1360).

Furthermore, continuing to tell the same story, in effect, sealed the fates of everyone and everything involved in the narrative:

"The problem of human settlement in the region was that people insisted on imposing their linear notions of progress on this cyclical pattern [of nature]. Their perennial optimism led them always to accept as "normal" the most favorable part of the precipitation cycle, and so they created a type and scale of agriculture that could not possibly be sustained through the dry years. In effect, bad storytelling had wreaked havoc with the balance of nature" (Cronon 1361).

However, there is another perspective on the purpose of this narrative, dependent upon which elements of narrative we make paramount. If humankind is the lead character in the story, and if character is the most important element, the unfortunate tragedies of the dust bowl are simply part of the narrative of human progress. Some will thrive and others will not; and then we tell the story of the victors in order to justify belief in the

tale. “It is a commonplace of modern literary theory that the very authority with which narrative presents its vision of reality is achieved by obscuring large portions of that reality. Narrative succeeds to the extent that it hides the discontinuities, ellipses, and contradictory experiences that would undermine the intended meaning of its story” (Cronon 1350). The tools of language and narrative have created a more complex system that confers value on certain objects, events, or people and confers valuelessness on others. Intention is tied inexplicably to assumption, for as sentient, conscious beings – not just sensing – we rarely make an assumption without some outcome in mind.

Looking at narrative as a means to a specific end forces us to more carefully analyze the elements of plot and scene and character; Cronon asks us to look at not just those elements that are present but those that are missing. The dust bowl narratives are perfect examples of this careful excising of certain elements for the elevating of others. While history does record more than just the stories of the victors, the narratives of the underrepresented or forgotten rarely compete on the same level with those that have social or political primacy. In the case of the dust bowl, the story of white settlers mostly omitted the characters of those who were already living harmoniously on the plains. The Native Americans who thrived on the plains before the arrival of the Europeans had narratives of their own built on a different kind of scaffolding. Plenty Coups, a chief of the Mountain Crow tribe who allied himself with the white settlers in hopes of saving some of his tribe’s way of life, eloquently described how the European narrative

essentially supplanted his own: "...when the buffalo went away the hearts of my people fell to the ground, and they could not lift them up again. After this nothing happened" (Cronon 1366).

The loss of Plenty Coups' narrative is more than just a silencing of one group of people.

The very shape of the landscape is altered by this end:

"Few remarks more powerfully capture the importance of narrative to history than this last of Plenty Coups: "After this nothing happened." For the Crows as for other Plains tribes, the universe revolved around the bison herds, and life made sense only so long as the hunt continued. When the scene shifted – when the bison herds "went away" – that universe collapsed and history ended. Although the Crows continued to live on their reservation and although their identity as a people has never ceased, for Plenty Coups their subsequent life is all part of a different story. The story he loved best ended with the buffalo. Everything that has happened since is part of some other plot, and there is neither sense nor joy in telling it" (Cronon 1366).

How do we recognize that any narrative contains the beginnings and ends of entire sub-narratives: plot lines peopled with unique characters? How do we reconcile that the landscape in the stories of the Crow tribe is the same scene depicted in the tale told by entitled white settlers about the future of the Great Plains? The features of these two landscapes are, of course, familiar, but narrative has split the one physical landscape of the Great Plains into many, but has chosen only one codified reality, reinforcing it by economic and political will. Languishing as memory in the minds of those disenfranchised from the mainstream of society, the other incarnations of the Great Plains pass into myth and ineffability. But that which is ineffable and irresolvable into

concrete description lends itself to other powerful narratives that are crafted from figment and cipher.

Sporting with the Hypothetical

The unwritten void in one narrative can become the incubator for the beginning of another. However, exploring the boundaries between what is codified and what is left to the unknown can prove dangerous. In the 15th century, the Catholic Church guarded most secrets of knowledge to ensure that God was given his proper due, that the populace was properly guided to gates of heaven, and that power and wealth were neatly consolidated in one place. Mathematicians at the time were struggling with constructions of Ptolemaic epicycles and eccentrics, trying to explain the movements of the planets and the Sun with Earth firmly and irrevocably placed at the center of all things. While the geocentric narrative was key to the way of life at the time, it was proving troublesome to the emerging ideas of the scientific and philosophical enlightenment.

Nicolaus Copernicus, a Polish astronomer, had a revolutionary idea, pun intended. He placed the Sun at the center of the known universe and discovered an elegant mathematics for accurately predicting movement. But, to pluck the Sun from the sky and place it in such a revered space was heresy. Copernicus crafted a careful narrative around his science to ensure that the Church felt no real threat to its absolute authority: “...though all these things are difficult, almost inconceivable, and quite contrary to the

opinion of the multitude, nevertheless in what follows we will with God's help make them clearer than day..." (Copernicus 24). But even then, he didn't publish for a long time and only under the pressure of a fellow mathematician, Georg Joachim Rheticus, a Protestant fresh from the Lutheran Reformation. Copernicus agreed to publish under Rheticus' guidance, but that's when the narrative about the narrative gets interesting. Rheticus handed off overseeing of the publication to another Lutheran, Andreas Osiander, who, fearing that the heliocentric theory would be perceived as a hostile threat to the Church, published an unauthorized letter in the preface of the book, demoting Copernicus' ideas to that of a "mathematical-astronomical text unable to attain even 'the semblance of the truth' available to philosophers; and both mathematicians and philosophers were 'incapable of stating anything certain unless it had been divinely revealed to them'" (Westman 50). Copernicus's theory then, was simply "a calculus consistent with the observations, that alone is enough" (Westman 50), rather than a revolutionary new way of thinking. Even with Osiander's obsequious assurances, the Church kept Copernicus on the Catholic Index of Prohibited Books. The caution was deserved, for Copernicus' mathematics worked so well, that the narrative took on a life of its own and many began reading past the homage to God and using the mathematics for themselves.⁷ Then, some ninety years after its publication and while still considered prohibited, the book got Galileo in a lot of trouble (Westman 46).

⁷ From a conversation with Professor Grace Burton during a meeting for an independent study, August 15, 2008.

Theologians and philosophers used hedging and hypothetical reasoning as an intellectual coping mechanism to deal with the strictures of the Church's Word. The Church itself was struggling with the idea of interpretation and representation, even of the words in the Bible. In the years that followed Copernicus' publication, factions of religious leaders, natural philosophers, scientists, and mathematicians argued and debated over how to interpret the words of the Bible and how to reconcile them to the discoveries of natural science:

"In the atmosphere of literalism prevalent in the 16th century, the Copernicans had to address the question of the Bible's true sense when it uses the words sun, earth, or moon; they had to argue that the moral and symbolic meanings of these words were detachable from any literal reference to the physical world. But there are other passages in the Scriptures that do not mention the celestial bodies and yet were singled out as containing special meaning about God's relation to nature. Romans 1:20, appealed to by Christians in a tradition reaching back to Saint Augustine, provided a text capable of wide connotation, not least as a basis for legitimating alternatives to Aristotle's philosophy of nature: "For the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made..." From this evolved an important metaphor, invoked by both Protestants and Catholics: nature is a book through which the invisible God reveals Himself sensibly to man. Now if the intention of the author of the Scriptures was also that of the author of nature, then there could be only one truth revealed – though in different forms of discourse. In what language, then, did God write the book of nature? And which disciplines would yield privileged access to its meaning?" (Westman 63).

God is omniscient and omnipotent: he can write the "book of nature" in any way he sees fit. Scientists and philosophers began prefacing their ideas with the assumption that it could be possible because God could, in his wisdom and power, make it so. This narrative approach offered some freedom for exploration of intellectual thought.

However, some creative thinkers, like Giordano Bruno, took the logic a step further: if the Bible was indeed a book of nature written by God, than narrative could not only be used to embrace new intellectual thoughts but also reveal the real purpose of the scriptures: to elevate man through personal interpretation of metaphor and parable, not to control him through simple authoritarian rule (Westman 60). Bruno subsequently got himself in a lot more trouble with a variety of heretical and blasphemous beliefs, including rumors that he supported cosmic pluralism, the possibility that life might exist elsewhere in the universe (Ferraro 735).

Scientists and mathematicians used the figurative nature of narrative to elucidate their ideas because of this malleability of language, despite the danger of being on so elastic a landscape. The Klamath tribe members and philosopher Pliny the Younger used figurative language to record their subjective observations of a decidedly objective and real physical experience: the eruption of a volcano. The use of storytelling to contextualize direct observation and to ponder its meaning underpins narrative's power to realize individual intellectual systems. Coupled with growing literacy rates, this individualistic appropriation of language begins to change how people see the world, and it is fiction – the bold, unapologetic use of the human imagination – that begins to predict the substantive changes to come in scientific and mathematical understanding.

Necessary Fictions

Until now, our examination of narrative has been historical, observational, and hypothetical. Now, we address the power of outright fantasy.

Revolutions in thought rely on planting, growing, and then sowing assumptions. A persuasive orator can present an alternative way of thinking through the traditional rhetorical pathways of logic or soundness of character or emotional affect. Or, like Copernicus, a philosopher can pose a possible viewpoint based on the elevation of different characters, plots, or scenes in an accepted narrative (for example, moving the Sun to center stage). But one scientist invested much of his time and energy in crafting a theory of reality based on the existence of something eminently unknowable.

Perhaps it was his alchemical dabbling that inspired Isaac Newton to create a universal scaffolding based on what he believed should exist – just because you couldn't sense it didn't mean it wasn't there. Unlike Rene Descartes' representational x and y axes, Newton's contrivances of absolute space and absolute time were necessary to support his understanding of the nature of the universe: "Newton can be taken as believing in the existence of a fundamental frame of reference in nature, something not consisting of material objects but having nevertheless an "objective existence" of a nonmaterial or immaterial character, this frame of reference being either unobservable in principle – a possibility to which Newton's own words lend some authority – or identified with an all-permeating ether" (Toulmin 8).

Newton's creation of this frame of reference – that space and time are backdrops, separate from physical reality, and therefore immeasurable – became one of the most contested, yet productive, fictions of its time. With this conceit to build upon, Newton developed a cohesive set of laws that accurately predicted the motion of heavenly bodies. Like other theories of the “all-permeating ether,” the idea of absolute space and absolute time gave way, ultimately, to the theory of space-time after Einstein's breakthroughs. But Newton's creation of this fiction shows what author and semiotician Umberto Eco describes as the “force of falsity” (Eco “Serendipities” 1); through confabulation we can create meaningful and provocative approximations of the truth: “...absolute space and absolute time are clearly unnecessary fictions, yet on the other hand ‘the fact that Newton was able to formulate a thoroughly adequate foundation for the mechanics of macroscopic bodies by introducing these two concepts, whose difficulties could scarcely have escaped his notice, is to be regarded as an outstanding stroke of genius...’” (Toulmin 9). Where Toulmin considers these fictions “unnecessary” because they are eventually logically dismantled, they still qualify as necessary, since without their creative construct Newton may not have successfully shared his mathematical ideas.

Do important revolutionary discoveries rely on this kind of hyperbole? Is our unfolding understanding of the universe tied to our ability to fantasize and imagine realities outside our observational senses? And, will the worlds that we fantasize about reveal themselves to us, simply because our narratives continue to reshape the idea of reality,

of what is knowable, and what remains unknowable? Can our evolving sentience eventually crash through the boundary between real and unreal, bringing the theoretical into being? Or is that Platonic separation of the theoretical – “the Ideas and the Mathematika” (Toulmin 19) – from the material a universal law forever unmoved by the force of narrative?

The Bathymetrist

Chapter 3: Marginalia on an Anonymous Pamphlet⁸

My mother used to take to her bed occasionally. She would sleep face down on the popcorn stitches of her chenille bedspread and when I would go in late afternoon to wake her up, she would be red in the face with indentations on one cheek. I knew then it was some kind of loneliness or depression that made her nap in the middle of the day, but I didn't want to understand it fully.

She was napping when Flax came over. Rather than disturb her, I wrote her a note that we were heading down to the woods and would be back before dinner. I left it on the kitchen counter under a can of mushroom soup that she had staged as a component for that night's dinner.

The woods were wet and fragrant from a couple of days of steady rain, but Flax didn't seem to notice. She babbled on and on about Danny Joliette.

⁸ From the papers of Benjamin Franklin (<http://www.bibliovault.org/BV.book.epl?BookId=10672>).

“He thinks I didn’t see, but I saw him look at Janet.” In the three weeks since they had been dating, he’d been in the doghouse for a least a third of the time. Just for being a boy, I think. This banter made me anxious and lonely, as if filling my head with Flax’s words is pushing out the more important ones.

“Have you heard a word I’ve said?” she asked. I’d been ignoring her by thinking about her instead.

“Yeah, yeah,” I lied. “Danny’s checking out Janet...”

“Well, you could be a little more supportive, Jesus.”

This started about six months ago. The expectations of being a girlfriend. I hated it almost more than anything. I would definitely fail her at this, and do so spectacularly.

“I am supportive, Flax, of course I am.” These were lies. Stealing, cheating, even smacking someone in the mouth just because you found her distasteful wasn’t as sinful as this. This felt like some kind of rot in the foundation; like you were born with it and couldn’t ever get rid of it.

“Well,” again, “okay. You just show it funny sometimes. I’m in a crisis here.”

“I’m sorry,” I wasn’t. Lying again. Corrupt. Or worse – was I jealous? “I’ll be better at it the next time.”

I liked the feeling of warm, rough wood on my bare legs. The boat was pond-worthy, but it wasn’t much else. Grey and splintered from years in the rain and snow, its surface was a galaxy of curves and lines. Wood grain popped up in concentric shapes, the membranes between the rings elevated and rough from swelling with water and drying

in the hot sun in endless cycles. There was one paddle that my dad had helped me to fix with some duct tape on the blade's end and at the throat, so my hand wouldn't get chewed up by splinters. There were two crossbeams in the boat that sufficed for seats, one in the stern and one in the bow. Flax took the bow.

"Milo, we're going to drown out here," she looked over the side of the boat, her weight tipping it slightly and her panicked overcorrection rocking it violently.

"Sit still! You'll be fine, I promise." I paddled out to the middle where the high sun poured over the tops of the pine trees. "See how beautiful this is?"

Flax opened her bag and took out a pair of sunglasses. She leaned back on the bow's point resting her elbows there and turned her face up to the sun. "If I can get a little color on my pasty cheeks, I'll be beautiful!"

We floated. I was a beautiful day. I mean, it was a beautiful day. I was paddling the boat, I was Flax's friend, I was my mother's daughter; nothing more than all that yet. Flax asked me a few questions as she sunbathed. I agreed or disagreed where appropriate, brokering the peace for the day. Out in the middle of the pond, I pulled the paddle into the boat, disturbing Flax just enough for her to lift her glasses and glare at me with one squinty eye. She quickly put her head back into the sun. I reached into my backpack for the plumb bob and the line. I had 100 feet with me, coiled neatly into a pleasing circle of white polyester twine, tied with a wooden bead at the end. I had that much line just to balance out the aesthetic of the bob – it weighed half a pound, shiny brass with a black tip. It wouldn't look right on a short, 20 foot line.

I dropped the bob over the side of the boat with a "ploop."

“What was that?” Flax-Cyclops asked.

“It’s a carpenter’s plumb bob. I’m dropping it down into the water to measure...”

“A what? You’re what?”

“A plumb bob,” I replied. “I’m measuring the bottom of the pond here.”

Flax wasn’t processing what I said, so I brought the bob back up out of the water and showed it to her. She stared at its glistening surface, yellow and black. It wobbled like a hypnotist’s watch on a chain.

“Why, I say, why are you doing that?” she asked in her best Foghorn Leghorn impression.

I laughed. “Because I’m curious how deep the pond is here. And over there.” I pointed to the shady spot under the trees. “And there. I wonder what the bottom looks like.”

Flax shook her head. “It’s summer, danger geek. Have some fun.” She went back to her reclined pose.

I dropped the bob again into the still water and watched its golden shape disappear into the dark. I was getting better at estimating depths by doing this, watching the object’s light refracted by the layers of water. At about 4 or 5 feet, the pale gold bob disappeared. I fed out the line until it went slack. On the white polyester line I had marked out each foot and its inch increments, the former with the thick nib of a Sharpie, the former with a fine ink pen. Pulling the bob back into the boat, I counted, until interrupted by Flax.

“Do you think I should marry Danny someday?”

I stopped, holding the number eight in my head and keeping my thumb on the last hash mark that I counted. "It's a little early to be making that decision, don't you think?" I reeled in another two feet and stopped, waiting for Flax's reply. Ten, I said in my head, ten, ten, ten.

"Milo, I'm going to be 14 in two months. I know I'm young, but I also think that it's never too soon to go after what you want. Look at the world out there – there's serious competition for a happy life. You need the right job, the right spouse, the right amount of money. I'll be damned if I miss that boat because I'm not prepared."

Quietly, I pulled in the line. Fourteen feet deep here.

"What do you mean, the world out there?" I looked around at the edge of the pond and its scattered round stone shore; the cylindrical surround of trees. "This is the world right here."

"Don't be stupid, Milo. You know what I mean." She sat up, rocking the boat side to side, and then braced herself until the motion ceased. "The world, the real world. People, jobs, cars, cities. Work, family. You know, the real world that sitcom writers use to make TV shows. I suppose you don't have any plans at all?"

I shrugged, wiping some grayish muck off the black end of the bob. "I wouldn't say no plans."

"Well, then, tell me. I want to know. I'm curious."

Oh, this would end badly. My personal truth was that I didn't want to share my plans with Flax anymore. They would just go into that bottomless pit of hers, that unregulated stash of nothings. That's where she kept my friendship unprotected from

her lust for Danny Joliette, her fear of Debbie Bartholomew, her vision of peroxide blonde perfection, and all other expectations and assumptions. There was no scale or measure in Flax's mind. We were all lumped in there together without any principle of organization.

"I'll go to college." I said.

"Of course, we'll both go to college. I suppose you want to go someplace far away."

"Maybe," as the boat floated, I eyed the next spot to drop the bob. "I don't know yet."

Flax sighed, "I'm going to Albany State. I'm going to study something like psychology or maybe business or maybe literature. I'm pretty good in English. Danny's awful in all of those. He'll probably have to do vocational school or work in his dad's garage."

"I thought he was pretty good at art."

"Art, Jesus. I suppose he could work as a graphic designer or something, design packages. Oh, maybe he could do covers for CDs or video games."

I watched the golden bathysphere once again disappear on its drop to the bottom of the pond. Fifteen and a half feet here. As Flax talked, I took two more measurements: 18 feet and 17-1/4 feet. We were right in the middle of the pond, probably where it was deepest. I was feeling hot from the sun, so rowed us over to where the trees cast an edge of shadow on the water. I turned the stern slightly, to keep the bow in the sun.

"My dad's threatening John with the military again." Flax had changed subjects somewhere; I hadn't been paying close enough attention.

"What does John say to that?" I was letting out line again.

"You know John; he gets mad and storms out of the house. Not exactly the best response to the threat. He's just giving them more ammunition. He's been a real jerk lately. I think he's drinking or smoking pot or something. He seems out of it."

The line continued to drop, well past the last measurement and on past the previously dry marks on the twine. We must be past 20 feet here.

"What about your brother? What does he say about John? Does he think John's behaving normally? I'm a little worried about him." Flax's worry would also be there in her unregulated brain, with my friendship, her lust and fear, and other miscellany.

"Um, Alex hasn't said anything lately. Not since they dug up that urn and accidentally chipped a corner off Mrs. Stickles' coffin." The line continued to drop.

"I'm worried about John," she repeated, to make it real. She sat up again, slowly this time. She was quiet, resting her elbows on her sunburned knees. "What are you doing?"

I couldn't respond. I just kept feeding out line. Still no slackness, no indication that the plumb bob had hit bottom. Just the gentle tug of its weight, pulling and pulling and pulling down. More line slid through my fingers. The wind blew in the curves of my ears and sloughed heat out of my hair. The boat swung a bit, bringing Flax into the shade with me.

"Milo, what are you doing?"

“Measuring...” I think I muttered.

The line continued to disappear, straight down, perpendicular to the surface of the water. The bob dropped and dropped. I’d stopped counting, I’d run out of hash marks. I didn’t mark the line past its first 30 feet.

“What are you measuring?” Flax’s voice was getting strident, nervous.

“I told you,” I said distractedly, slowly, “the bottom of the pond...” I felt the wooden bead in my hand, the bead I had tied to the end of the line. The bead that meant the end of the line. I let it sit between my index and middle fingers, palm upturned. I moved my hand out over the water and pulled the line up out of the water only to feel it pull to the center of the earth. The line was taut, the bottom still untouched. I was out of twine.

“Milo! What are you doing?!”

I watched the orthogonal line of twine cut a hole through the plane of the pond’s surface. A tiny circle of curved surface surrounded the twine, where it met the air. “I’m trying to measure the bottom of the pond.”

Flax looked at the bead nested between my fingers. “What, you need more rope?”

We sat on my bed with a bowl of popcorn and unwatched a movie as its story unfolded on the DVD player. My mother had recuperated from her fatigue and my parents had gone out to dinner. Flax chewed at her already bloodied thumbnail.

“It’s a small pond, Milo.”

"I know, Flax."

"You must have screwed something up. That pond could not, could never, be that deep." She chewed and pulled.

"Flax, stop that. It's disgusting and you're bleeding." I got up to go to the bathroom and get a bandage from the medicine cabinet. I came back with a plastic thumbnail sized patch.

"Don't you have the sheer ones?" she asked.

"No, Flax, this is all we have." I tore open the paper as she held out her gnawed thumb. I pulled the bandage out of its paper sheath and grabbed the two paper tabs on each adhesive end. "Hold still," I said, positioning the absorbent pad over the oozing cuticle. Why did she do that? I wrapped one end around her thumb while pulling away the tabs from the adhesive and securing the bandage in place. Once finished, she put it in front of her face and looked at it and then her other fingernails, which were painted fuchsia. I think now that the thumb was out of commission, she was looking for another finger to sacrifice.

"Milo. Milo," she was shaking her head while turning her hands over in front of her eyes. "I don't want to go back to that pond."

"Why not?" I said it more harshly than I intended.

"Why not?!! Milo, there's a freakin' bottomless hole in that tiny freakin' pond!"

"Don't be ridiculous..." I said in a tone that my grandmother always reserved for my father.

“Milo,” the sound of my name in her mouth was starting to bug me, “that is not normal. Ponds don’t have holes.”

“Flax, it could be a million different things,” but I didn’t really know what it could be. I thought of the hot springs in Yellowstone Park. We’d gone for a family vacation a few years ago and now I wished I’d paid more attention. I do remember looking into the deepest, bluest pool of water I’d ever seen, only to be pulled back from the edge by my worried mother. Steam rose from the water, blurring its surface, but in clear spots you could see all the way to its bottom, a textured, colorful bottom of mineral deposits. In one corner there was a hole about a foot wide where the hot water was fed into the pool from below.

“The pond could be spring fed.”

Flax seemed to think about this for a minute, but then I realized she was actually watching a scene in the movie.

“This guy, who is he? What other movie was he in?” She started chewing on the edge of her bandage, then looked at it and said absent-mindedly, “this isn’t really sticking...”

“I’m going back,” I said. “To the pond. I’m going to find out what that hole is.”

Flax immediately lost interest in the movie. “No, Milo, no. That’s not good. That’s like playing with Ouija boards or having a séance without the protective salt circle.”

“Flax, come on...”

"I mean it! This is freaky, this is... biblical freaky. This isn't right. I don't like that place, I never liked that place. I only went there because of you! We are not going back..."

"I'm going back."

"No you are not."

I laughed. "Flax, you are not my mother."

"No, I'm your best friend."

We sat there in silence for a while, as the movie played out and resolved its conflicts. The credits rolled. We had no idea what had happened.

"Huh," Flax said as white letters scrolled on a black background. "I think I already saw this movie."

Flax spent the night. My dad inflated the camping air mattress and my mom found sheets and an extra pillow. She seemed buoyed by their dinner, which I was glad for. I never liked those days when I could feel her anxiety. There were mornings I could wake up and just know that she would pick a fight and leave the house angry.

Flax didn't want to talk about the pond anymore. I honored that, but I couldn't think about anything else. Luckily, I had long ago perfected thinking one thing and saying another. We laid there in the dark, me in my bed and Flax on the air mattress on the floor. Her body was tiny, with every edge of the blanket tucked under her in a lumpy cocoon. I felt hot and restless. I cranked the window by my bed open wide to get some air in the room. Flax didn't stir in her pod. I turned toward the wind, rolling onto my side

with a pillow wedged under my head. I could smell newly mown grass and wet dirt and bitter smoky pine.

Flax snored softly. Despite her anxious nature, she always fell asleep quickly.

Artifice as Primer

There are powerful artifacts of the false assumptions in our language, which still reflect what we sense rather than what we know. We make a metaphor of nature in our every day language, despite Copernicus' hard work:

“...we know that the Ptolemaic hypothesis was scientifically false. And yet, if our knowledge is by now Copernican, our perception is still Ptolemaic: we not only see the sun rise in the east and travel through the arc of the day, but we behave as if the sun turns and we remain immobile. And we say, ‘the sun rises,’ ‘the sun is high in the sky,’ ‘it sinks,’ ‘it sets.’ Even your astronomy professors speak Ptolemaically” (Eco “Serendipities” 18).

Would it really be all that difficult to speak to the science and mathematics of real celestial motion? Could we not say, just as poetically, that the earth turns around the sun? Copernicus did, when describing the positions of the planets in orbit around the sun in De Revolutionibus:

“In the center of all rests the sun. For who would place this lamp of a very beautiful temple in another or better place than this wherefrom it can illuminate everything at the same time? As a matter of fact, not unhappily do some call it the lantern; others, the mind and still others, the pilot of the world. Trismegistus calls it a “visible god”; Sophocles’ Electra, “that which gazes upon all things.” And so the sun, as if resting on a kingly throne, governs the family of stars which wheel around. Moreover, the Earth is by no means cheated of the services of the moon;

but, as Aristotle says in the De Animalibus, the earth has the closest kinship with the moon. The Earth moreover is fertilized by the sun and conceives offspring every year” (Copernicus 25-26).

Despite the beauty of this language, we still think of the sun as rising and setting, because it appears that way to us. Our sense of sight can trump our ability to reason, even when we use tools of our own making. This is the challenge of sentience: the models we devise to codify the world are ways of extending our senses, but they are still products of our nature. While we use language to bolster our senses, challenge our senses – even refute our animal instinct, we are still working within a self-referential system that needs constant analysis and recalibration. In giving any one system perfect and absolute right of interpretation, we limit ourselves and our understanding. We must accept that every model or tool we devise provides both a kind of clarity and a kind of obfuscation.

This is the Janus-nature of narrative and metaphor. It is simultaneously revelatory and secretive. Narrative in many cases is the gatekeeper to knowledge; not only do you have to be literate (or numerate), you must also recognize the argot and be able to decipher the clues. Societies have used myth and mysticism to reveal and conceal and hence, control, the truth for eons. Some myths that appear to be morality tales are in actuality something else: an accessible way to encapsulate and share knowledge, but also a way to shape knowledge and offer ideas about the nature of reality. This capture serves two purposes: to pass down the information to succeeding generations and to safeguard the primacy of the sanctioned storytellers.

Bertrand Russell, a 20th century mathematician who was phobic about the paradoxes inherent in self-referential loops, posed a new kind of set theory in mathematics “... in which a definition of a set could never invoke that set, and moreover, in which a strict linguistic hierarchy was set up, rigidly preventing any sentence from referring to itself” (Hofstadter 61). In other words, systems we devise to describe the reality of physical objects, events, and people – like words and numbers – are only trustworthy when they are separate and distinct from that which they are describing. Russell’s set theory is akin to Newton’s absolute time and space: pristine, immovable frames of reference upon which to accurately map elements of reality. Otherwise, if the underpinnings are not absolute and there are possible multiple meanings or meanings that are contradictory, how can we rely on any system to elucidate reality?

The modernists and post-modernists – Samuel Beckett, James Joyce, Virginia Woolf, Jorge Luis Borges, to name a few – built upon the inherent limitations and recursive behavior of language, exposing the immeasurable gaps between real and representative as opportunities, rather than obstacles, to understanding. They proposed a whole new kind of understanding – incomplete, but still meaningful (and meaningful in its incompleteness).

Part III: Approximation – Arriving at the Precipice

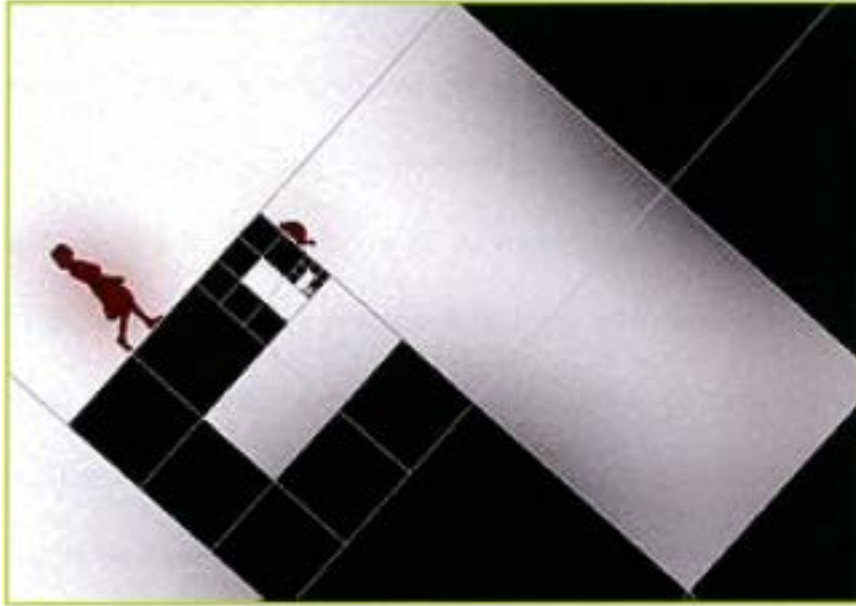


Figure 2: Zeno's Paradox.⁹

Language, like other elements of art, is often used as the sabot thrown into the loom. But, language – being self-referential, ambiguous, and complex – is a dubious negotiator with reality. For one, the phrase above implies that some actor is doing the throwing: but who intends to throw - is it the author or is it the reader? Language can be misleading, treasonous, even cannibalistic; it can destroy that which it builds.

A completely human construct (though some scientists believe other animals use forms of communication, humans are the only ones we know of so far who write it down and argue about what it means), language is used to build all kinds of truths, tales, myths, clues, probabilities, possibilities, missteps, and lies. For example, the etymology of the

⁹ Image from <http://vtropes.org/pmwiki/pmwiki.php/Main/ptitle96cc44ei>.

word “sabotage” likely has nothing to do with the actual tossing of an old shoe into machinery¹⁰, but it makes for a meaningful industrial age metaphor. Shoe and loom and textile and thrower alike are made, through language, simultaneously real and symbolic. This multiplicity gives narrative both its guiding essence as a measure of reality and its ineffable quality, like a quadratic equation with a real solution and a set of imaginary roots. Narrative can concretize our world or unsettle it. The connection between sign and signified is not always stable or equitable; rather it is a form of equilibrium continuously struck by many arbitrary assumptions. But this is what language does: it represents and interprets to the best of our cognitive ability; it relates physical, sensible, objective reality with inner, subjective perceptions, often with profoundly complex results. Whether we deign those connections are real, true, or fictitious is altogether another intellectual process.

If language is a tool of creative sabotage, who are the biggest troublemakers, and what has their trouble wrought? There are numerous writers (of literature and science both) who have used disruptive narratives to cast particular spells, both revealing and concealing their ideas in ways that force us beyond mediocre literal interpretations. Like Cronon’s historians, many of these writers don’t even recognize their full intent; the narrative takes over and builds not only the author’s world, but the worlds of countless readers who seek truth and meaning in what is in the text and what is missing from it.

¹⁰ <http://www.etymonline.com/index.php?term=sabotage>.

I have chosen troublemakers who use a kind of metaphorical and mathematical figuring in their work, because this combination produces a prodigious number of odd progeny, from the first novel to a fractured fairy tale to modern magical realism.

“Not an Atom of Meaning in It”

Helena Pycior in her essay “At the Intersection of Mathematics and Humor: Lewis Carroll’s “Alices” and Symbolical Algebra,” reveals the dual existence of the above quote. It appears in mathematician Augustus De Morgan’s Trigonometry and Double Algebra, and Lewis Carroll’s Alice’s Adventures in Wonderland. De Morgan was writing about the emergence of a new form of mathematics, symbolic algebra: “With one exception, no word nor sign of arithmetic or algebra has one atom of meaning throughout this chapter, the object of which is symbols, and their laws of combination, giving a symbolic algebra” (Pycior 149). Lewis Carroll would creatively plagiarize De Morgan’s phrase years later, when Alice responded to the White Rabbit’s nonsense verse with “‘I don’t believe,’ Alice declared, ‘there’s an atom of meaning in it’” (Pycior 149).

De Morgan and Carroll were contemporaries; both were mathematicians working in English universities. De Morgan’s admonition against seeking meaning, however, is not to belittle the study of mathematics; rather, it is intended to inspire the reader to look past the ordinary use of algebra as a manipulation of real numbers and see it as a powerful symbolic language with a grammar of its own. On the contrary, Carroll’s

comment is a direct warning that a mathematics that “stressed structure and logical certainty rather than meaning and physical applicability” (Pycior 151) would open a gaping void in the conservative, Victorian mores that offered guidance and clarity to traditional everyday life.

Lewis Carroll was more prosaically known as Charles Lutwidge Dodgson. In addition to being a mathematician and writer, he was a photographer, a rumored drug addict and possible pedophile, sufferer of migraines, stutterer, and a conservative and quite literal Anglican. While many scholars have used these and many other quirks, characteristics, or outright improvable suppositions, to reason why he wrote Alice’s Adventures in Wonderland, researcher and doctoral candidate Melanie Bayley at Oxford University has another theory: Alice was designed as pure satire meant to expose the new mathematics of symbolic algebra as a dangerous and meaningless fraud.

Dodgson was a Euclidean – a firm believer in the logical, axiomatic use of mathematics as proof of real, physical things. Euclidean geometry beautifully predicts the real world, giving its practitioners a great sense of control and confidence in how the world must work. However, that control was slipping away. New problems in mathematics, such as dealing with negative and imaginary numbers, were inspiring mathematicians to explore methods unfettered by analogues in the real world.

De Morgan argued that a mathematics allowed to be symbolic, like letters in an alphabet, could confer upon the discipline the flexibility of a grammar, and therefore, more opportunity for meaning through exploration (Bayley 39). Freed from a strict set of arithmetic rules that required a real number answer, algebra became a system in which a special kind of story could be written, one that needn't take the shape of a Platonic solid or graph-able curve. This allowed many mathematicians to abandon the first principles and absolute truths of traditional algebra for a discipline that encouraged the mathematician to make up the rules (Pycior 152). However, many of the concepts of this absurd new mathematics were difficult for more conservative mathematicians to accept. Dodgson was particularly disturbed by these changes, and he turned to his avocation – writing – and his dead mentor for help:

“...Dodgson took his mathematics to his fiction. Using a technique familiar from Euclid's proofs, *reductio ad absurdum* [A method of proof which proceeds by stating a proposition and then showing that it results in a contradiction, thus demonstrating the proposition to be false], he picked apart the “semi-logic” of the new abstract mathematics, mocking its weakness by taking these premises to their logical conclusions, with mad results. The outcome is Alice's Adventures in Wonderland” (Bayley 39).

He tackled each of his algebraic concerns through narrative, including the concept of negative numbers. Fictionally, he describes his distrust of this idea through the dialogue between several of the characters in the story:

“In Alice in Wonderland, the Mad Hatter proclaims the impossibility of subtracting something from nothing. In the tea party scene, the March Hare offers Alice ‘more tea.’ Alice replies that she has ‘had nothing yet [and] so... can't take more.’ This provides the opportunity for the Hatter's

comment: ‘You mean you can’t take less... it’s very easy to take more than nothing’” (Pycior 164).

While Dodgson picks ridiculous non-entities and impossibilities to describe his experience of the negative, symbolic algebraists did have practical applications of negative numbers in mind, such as using them to describe a very real life occurrence: financial debt (Pycior 164). This suggests that Dodgson was unable or unwilling to extrapolate meaningful ideas from the symbolic structure of the new mathematics:

“Alice’s recognition of the potential meaninglessness and arbitrariness of mathematics, in fact, comes early in Alice in Wonderland. Subjected to the vagaries of her underground experience, such as changes in her size, Alice comes to question even her identity. She wonders if she is Ada or Mabel, two of her above-ground friends. In this epistemological crisis, reminiscent of Descartes’ in the Discourse on Method, Alice imitates the French philosopher by trying to establish what she knows with certainty. It is not surprising that Alice turns first to mathematics, given its privileged position in Victorian culture. If there is any truth or certainty in the natural world, her Victorian contemporaries would have agreed, it is evidenced by mathematics” (Pycior 165).

Dodgson connected certainty with the very essence of identity. Without certainty, how could people know themselves, their culture, their place in the world? How could they be moral? Dodgson tried to literalize what he saw as the madness in symbolic algebra, but his narrative actually breaks free and gets away from him. In writing Alice’s Adventures in Wonderland, he actually found a way to make symbolic algebra expressible; he found an interdisciplinary way to represent its power and meaning. While he feared the maddeningly disoriented world that he created, others would marvel in the power of his metaphor and welcome this exciting new figurative

landscape as an opportunity to explore human potential and identity. Dodgson unknowingly provided a grammar for symbolic algebra. In the process he unwittingly freed language to create a classic of literature that is celebrated as a whole that is more than the sum of its strange, satirical parts. Perhaps what Dodgson objected to, since he was also a writer, was mathematics playing at the metaphorical games reserved for language. De Morgan describes an opportunity for symbolic algebra to function like language:

“We... ask, whether it might not be possible so to vary the meaning of the signs, as to make an entirely different algebra, which should nevertheless present exactly the same theorems in form as the one, the forms having different meanings... This may seem something like asking, whether two different languages might have all their words in common, but with different meanings, in such manner that by writing a treatise on astronomy in the first language, we write, *totidem verbis*, a treatise on music in the second” (Pycior 166).

De Morgan proposes that the language of symbolic algebra could explain things as vast as astronomy and music, a property that had been the domain of words. Much like the early theologians looked at Copernicus’ mathematics and metaphor with suspicion, being accustomed to the Word of God (as revealed and sanctioned by church leaders) as the only way to the truth. In both cases, there is a problem of interpretation: “Peacock and the period’s other algebraists characterized symbols as simultaneously “arbitrary” (standing for nothing in particular) and “universal” (standing for many different things)” (Pycior 167). Dodgson pokes sarcastic fun at this multiplicity by having his Mad Hatter draw a humorous parallel:

“The Hatter applies the latter interpretation [universal] to words (rather than algebraic symbols) in sentences (rather than mathematical formulas). ‘You can draw water out of a water-well,’ the Hatter says, ‘so I should think you could draw treacle out of a treacle-well – eh, stupid?’ (p. 102). The structure of the two sentences is the same (you can draw b out of a b-well), but the content is different. In the language of symbolic algebra, the symbol b is universal, or subject to multiple meanings such as water and ink. But b is not absolutely universal; there are some nouns, such as treacle, which, when substituted for b, leave the sentence with no empirical signification. The point of Carroll’s humor now seems clear: structure does not guarantee meaning; emphasis on structure over meaning, so basic to the symbolical approach, can lead to nonsense.

But, the period’s symbolical algebraists might very well have replied, nonsense results only when symbols are accepted as absolutely universal in interpretation. This retort, however, raises another problem, also alluded to in the *Alices*: who determines appropriate interpretations of symbols” (Pycior 167).

This brings us to another source of Dodgson’s discomfort: one of undefined authority.

What happens to certainty if authority is no longer defined by absolute truths? If mathematicians are allowed to make up rules to their own algebra, what happens to Euclid or any of the founding fathers of logic and philosophy? What happens to a civilization that comes to realize its rules are malleable and changeable? This fear is typically Victorian, but not unique to the era, and it is an anxiety seen again and again where mathematics or science and language intersect (or collide). Dodgson’s legacy, however, is less a cautionary tale about the dangers of uncertainty and more an invitation to play wholeheartedly with fantasy, an outcome that would doubtless make him incredibly uncomfortable. Fantasy is often the harbinger of change, and despite his best efforts, Dodgson’s absurd narrative takes on a collective meaning of its own that he would have been loathe to have propagated.

Dodgson would likely argue with this interpretation of his work, since he explicitly states his own perspective on the matter of human nature and the nature of reality in his Curiosa Mathematica: “It may well be doubted whether, in all the range of Science, there is any field so fascinating to the explorer – so rich in hidden treasures – so fruitful in delightful surprises – as that of Pure Mathematics. The charm lies chiefly, I think, in the absolute certainty of its results: for that is what, beyond almost all mental treasures, the human intellect craves for. Let us only be sure of something!” (Dodgson page xv). However, his comments about certainty speak volumes about uncertainty, ambiguity, and the mystery inherent in both mathematical and narrative exploration. He’s hedging: “...the charm lies chiefly, I think...” he says, and “beyond almost all...” While statistically, reality behaves in a manner in which we can predict and manipulate, we know as curious, intellectual beings, that there is always a possibility that the unpredictable and the unexpected can throw a shoe into the loom of thought and destroy the textile.

The gaps between statistical and possible, real and ideal give us intellectual and creative room to move. What Dodgson may have had anxiety about was allowing symbolic algebra to coexist with the Euclidean, making his logic (and view of the world) relative rather than absolute. Allowing for this relativity forces us to recognize that the foundations are as malleable as the structures they support. The grid system that serves as a backdrop for the translation of an algebraic equation into a geometric figure is subject to the same variability as the equation. If mathematics can be decoupled from the real, measurable world, then language – its more easily influenced counterpart –

surely can be endlessly manipulated until the real and ideal and the gap between them all become the responsibility of the fertile and fickle human psyche.

The gap itself is simultaneously a reality and a metaphor. It is the void of deep space, the uncross-able asymptote of the complex equation, the unrequited love of the novel's protagonist for the unreal model of his or her desire. It is the tiny space between the neurons in the brain, which pass chemicals back and forth, allowing us to grapple with words (and other tools) to explore and express strange and wonderful ideas. Without this expanse of nothingness and uncertainty, whether vast or miniscule, we are ultimately without movement and, therefore, meaningless.

The Bathymetrist

Chapter 4: Ghosts of Departed Quantities¹¹

Flax was superstitious about coincidences. I always dissected words to get to their truths because I trusted no thing. If faced with something new that she couldn't immediately understand, Flax went directly to the little nodule that produced addictive monkey-fear hormones in her brain.

"Coincidence. Co-incident. Get it? These are two or more things that happen at the same time or in some other measurable proximity that make them meaningful to you. They are co-incident; not magical or prophetic." I would say it, and she would hear

¹¹ From George Berkeley's *The Analyst* (http://en.wikipedia.org/wiki/Ghosts_of_departed_quantities).

it because she would squirrel up her pretty little face at me, but she still didn't buy it.

Flax was nothing if not a savvy consumer.

It was the same with consequence. She thought that consequences were meted out by gods (yes, she was Catholic and believed in one God but she was also superstitious, which created a whole other pantheon). I would say to her that without sequence, there is no consequence. You do something, then something happens. Or, someone else does something and you get in the way of that person's consequence. That's an accident. It's all Newtonian. But rather than a conversation about responsibility and intent, Flax would want to talk about destiny and fate. Fate that she wouldn't recognize her soul mate when he finally appeared to her. She was terrified of misinterpreting the signs.

Speaking of signs; lately, I'd been having lots of dreams. Little dreams, like trinkets you put on shelves. They are small but detailed, painted porcelain pieces. I'm used to strange dream epics, but lately my mind's become a homebody. It's been sifting through an attic space and cleaning it out, boxing things up, throwing others away. I miss the odyssey of weird adventures and their vast spaces, open vistas, giant machines, deep pools and wide roads, skies full of flying things. But these attic space dreams feel important, too. In the last dream, I was in a lovely house with windows that opened in. The wind caught the gauzy curtains and they flowed into the room. The walls were ochre and warm. I was waiting for someone. There was a TV or a radio on. I was in an overflowing bathtub trying to drain enough water out to keep the water flowing in the tub just level with the tub's edge, but I couldn't find the right balance. Streams of bath

water were spilling on to the tile floor. The only thing I had control over was the rubber stopper in the drain, I wasn't allowed or able to turn the faucet.

Flax was over at my house and we were up in my room when we heard the news. It was a terrible coincidence, one that would affect our whole summer and I imagine change how we moved in the world forever. We were sitting on my bed flipping through magazines, each of us sitting with one leg tucked under and the other hanging off the bed. When my mother came up and stood in the doorway I thought it must be the strange funhouse reflection that Flax and I made together – Flax's small frame incongruous next to my larger one – that made her stop and stare at us. But it was something else.

"Girls, can you come downstairs for a moment?" My mother's voice was strangely quiet.

"Sure, mom. What is it?"

"Come on down, we'll talk."

Flax hopped off the bed and we followed my mother downstairs. The living room was dark, the large stone wall that housed the fireplace sucking up the light from the sole lamp that was on. My heart started to jump around, but Flax seemed the picture of oblivious calm. My mother motioned us to sit on the couch while she perched on the edge of the mantel.

Oh god, this wasn't "the talk," was it?

"Girls, there's no easy way to talk about this," my mother began. Her face was pale and now I noticed that her eyes seemed sore and red-rimmed. My imagination was bouncing all over the place – my father? My grandmother? Had my grandmother been committed? The dog, the cat, the house? Were we losing the house?

"Flax, honey, the police were at your house this afternoon, to talk to your brother John."

Flax's face was calm for a moment as the words processed. Then, her smooth brow knit together and her bottom lip curled up under her front teeth.

"They were there because something has happened to one of John's friends." I felt guiltily relieved. It was not my father, or my house, or my cat. It was something to do with Flax's brother. Flax's hot head, depressive, soon to be alcoholic brother.

My mother shifted her pose, leaning toward us, her hands clasped together. "Girls, do you remember a girl named Debbie Bartholomew?"

Flax's eyes went wide. "Yes, she's a... she's a... she dated John last year."

"She's a senior this year," I offered, filling the blank.

My mother nodded. She looked directly at Flax. "The police wanted to talk to John because Debbie's been... Debbie's missing. She hasn't been home in 2 days."

Flax and I went down to the foundation after the long talk with my mother. We got equal parts assurance that everything would be fine and warning not to talk to strangers or go anywhere alone. It wasn't like a girl had never gone missing in our town. It

happened ten years ago at the state university. But this was very different. We knew Debbie; we knew the sound of her voice and the size of her jeans and the clubs she belonged to at school. We knew her, we knew what kind of person she was. She was a missing person.

Flax tapped her heels on the stone wall, her eyes still wide and her face still pale. She whispered, just to get it out, "I wonder if she'll be on the bus this fall."

The story was all over the local news that night. Honor student, cheerleader, and all around American girl goes missing in small town. The picture they showed of Debbie was one of those posed sittings with the fake velvet front that shows off your shoulders and collarbone. Supposed to be pretty, demure. In the picture, Debbie wore a string of tiny pearls and her lips were touched up to look pinker. She still had big blue eyes, but the freckles on her nose had been airbrushed away. My mother mistook my concentration during this measuring process for unexpressed distress.

"It'll be okay, Milo. I'm sure she's fine and they will find her."

I allowed my mother to comfort me. My father was silent but kept glancing at her with this quiet, concerned look. Later that night, my grandmother called to check in on us. She lived only 80 miles away and had heard the news.

"Milo, you never ever go anywhere alone, you hear me?" Gran Anna said in her crackly voice. "God protects, but don't be stupid. You hear me?"

"Yes, Gran, I do."

"God protects, but not the stupid..." she muttered on the other end of the phone. Stupidity was Gran Anna's number one reason for bad things. (Disobedience was second). Bad things happened to hapless, stupid people, bless them anyway, she would say. Don't be stupid, and God will take the time to clear away the obstacles and the perverts from your path.

That night I had difficulty sleeping. No surprise. I wondered what really happened to Debbie and I was feeling bad because I didn't like her. Not liking someone didn't mean I wished something bad would happen. It was just a coincidence that Flax mentioned her the other day. It was logical to talk about people you knew and things happened to people you knew, good things and bad things. The universe worked in ways that had nothing to do with what you thought or what you wished.

I got up out of bed and sat at my desk, looking out my window to the woods behind the house. I had to admit that I was frightened. What made my woods any safer than the woods Debbie might be lost or buried in? I felt panicky and sick and got up from my chair to lie down on the floor. I hugged my knees to my chest to flatten my back on the hard wood and I breathed through my nose. On the ceiling, broken constellations of glow-in-the-dark stars still shone; I had put those up there three years ago when I wanted to be an astronomer.

I woke up early the next morning curled up on my floor. I don't remember falling asleep, but I did remember a dream that had nothing to do with Debbie or Flax or vanishing or

molestation. It was a strange comfort that my unconscious mind could uncouple itself so completely from my conscience.

We ate breakfast together as a family. Pancakes and fruit. My parents were attentive and sad, so I became their daughter completely for the day. We decided to go for a drive together. First, we called my brother Alex at college and all of us spoke to him. He asked about John Rabbitt and Debbie Bartholomew, but my father fielded most of his questions. John and Alex worked together at the cemetery two years ago and had been friends for a summer. We didn't know anything more. I called Flax right before we were getting ready to head out the door.

"My brother's freaked out," Flax whispered over the phone. "My parents are hounding him for some reason. Maybe they think he really did something. I'm going to my grandmother's today. My mom said she wants me out of the house."

There was no other news on Debbie's disappearance. Her family was putting up flyers and they were planning a sweep of some of the park woods that day.

"What about our woods?" I asked while we were bouncing down a country road in my dad's truck.

"Our woods? What do you mean?" My mother asked.

"Well, there's that old foundation down there. I didn't even know it was there until this summer. Our woods have all kinds of hidden and overgrown places. Shouldn't we look there?"

"Foundation? What foundation?" My mother pulled her shoulder belt away from her body so she could turn around fully and look at me.

"There's an old stone foundation in the woods. And a pond."

"It's the old Holloway place," my dad said. "It was abandoned for 40 years and then I think the original house partially burned. Martin showed it to me when we first bought the property. I haven't been back there since. You said there's a pond, Milo?"

"Yes, a big one."

"How big?" My mother was still staring at me, her initial alarm growing.

"Big," I repeated. "I don't know, I'm not that good at measurements."

"Think about how tall I am, Milo. Six feet tall, right?" My dad was looking at me through the rear-view mirror. "Now imagine that there are dozens of me lying down around the shoreline of the pond. How many of me would go all the way around?"

I pictured it. A whole perimeter of dads lining the shore. A necklace of dads, strung together like pearls. I counted the dad-beads in my head. "I guess about, 30 of you. Maybe 35."

"Wow..." my dad said. "That's pretty big. We should take a look at that Bea. I don't remember a pond when Martin showed me the foundation."

"It's hidden," I said. "You have to go through some of the bushes to get to it. There's an old rowboat, too. Flax and I have been..."

"Milo, I don't want you going down there for a while, okay?" My mother interrupted, turning back around in her seat, readjusting her shoulder belt.

"But, but, mom... it's fine."

"Milo, please. Just for a bit."

This stung harder than a slap in the face. "It's perfectly safe, mom. I won't go alone, I'll go with Flax."

"Milo, just do this," my father peered at me in reflection again.

I sat back, crossing my arms in stereotypical teenaged fashion and looking out the window in silence. This sucked. Stupid, stupid Debbie Bartholomew.

"Sum of Destructions"

The gap can be a fruitful place. Whether it is created by a loss or an unknown, an acausal synchronicity or an unresolved coincidence, our relationship to the world at large is a constant contemplation of what is and what isn't. History is the product of what is recorded and what is left out, providing a gradient that causes information to flow. The role of language, including mathematics, to capture and explicate the truth is continually thwarted by the evolution of human perception and expression and the limitations of these self-referential systems. These wild disparities and tempestuous connections don't just result in a particular sum of positives and negatives; in the process of their wrangling, they draw an elaborate and illustrative line.

Pablo Picasso called modern art "the sum of destructions" (Gay 162). Artists and writers of the Modernist movement purposefully created gaps where before there were none. They fractured perspective and authority, creating new surfaces to explore and opening up voids where previously society's mores and expectations kept the landscape unbroken. This sundering of art and literature is much like the symbolic algebra of Lewis

Carroll's time: perceived incoherence gradually gives rise to a new grammar. Time is disrupted, space is made malleable, and alienation and fragmentation become the new arbiters of meaning.

Free from causal expectation, these artists thrived in the new chaos. Artist Marcel Duchamp tore time apart in his famous work "Nude Descending a Staircase," where geometric shapes that roughly resemble a human figure cascade down an oblique line. Called "an explosion in a shingle factory" (Gay 162) by critics, Duchamp's "Nude" was indeed an explosion – of linear continuity and representational truth of the human form. This kind of abstraction was pure self-expression, enabling artists to rend the smooth, predictable shape of Victorian standards into a more crenellated and hyperbolic form. Within the gaps that they created, they explored fearlessly, making the journey rather than the arrival the source of meaning.



Figure 3: Marcel Duchamp's "Nude Descending a Staircase."¹²

Key writers of the time – T.S. Eliot, James Joyce, and Virginia Woolf – used language in much the same way that artists used line and point and curve. They tore through staid and expected narratives and produced complex, self-referential works with disjointed timelines and untrustworthy narrators. Authors, like the painters of the time, worked on self-portraits, imbuing their literature with a subjectivity and loneliness that changed the relationship between reader and author and expanded the purpose of literature. Again, Pablo Picasso provides an important observation: “We all know that Art is not

¹² Image from <http://www.tate.org.uk/modern/exhibitions/duchampmanraypicabia/rooms/room3.shtm>.

truth. Art is a lie that makes us realize the truth, at least the truth that is given to us to understand.”¹³

“Art as lie” is akin to Eco’s “force of falsity” and Copernicus’ hypothetical reasoning: it is an opportunity to proffer another reality just for the sake of exploring. The beauty of this exploration is that it often turns minds to face the reality of another truth. Through this exploration we recognize that truth is not an absolute nor is it revealed to us from an authority outside the human experience. Truth is an approximation that continually leaves us with a gap between it and the world. While modern artists believed they could capture this approximation and the subsequent gap in their work, post-modernists fully embraced the gap as its own purpose. But artists weren’t the only ones struggling with the ineffable and immeasurable. Mathematicians and scientists were also struggling with limitation, uncertainty, relativity, and quantum behaviors that broke the rules of Newtonian understanding.

While for some the ideas of limitation and incompleteness may bring about an intellectual or emotional despair, thinkers confronting the power of the unknown and the unknowable, like the early symbolic algebraists, were discovering a new kind of purpose. Writer Samuel Beckett found irrationality and incompleteness to be revelatory of the idea that any formal system of knowledge was merely the latest, temporary attempt to keep chaos at bay (Culik 140), making him, to some scholars, the first of the

¹³ MALS Modernism Seminar notes, October 30, 2008.

post-modern writers. To the Victorian Charles Dodgson, chaos would be an unraveling of the fabric of reality, madness made manifest. But many – like Samuel Beckett and Marcel Duchamp – saw chaos merely as order of infinite complexity.

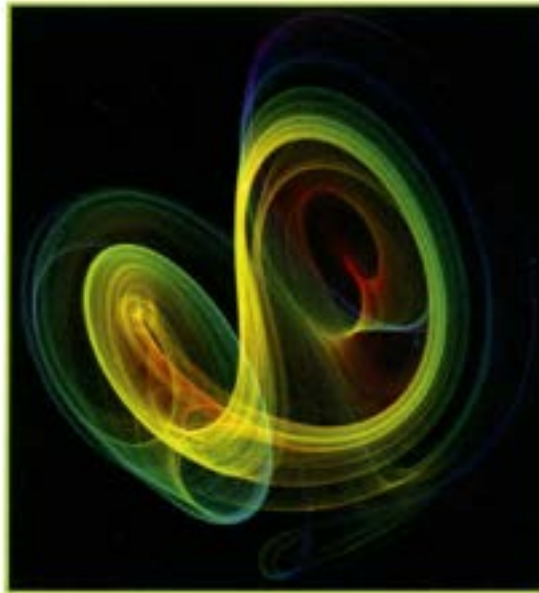


Figure 4: The Lorenz Attractor, a weather forecasting model that arose from chaos theory. ¹⁴

Mathematician Kurt Gödel “used mathematics to show that mathematics itself has limitations” (Chaitin 74). Gödel’s Incompleteness Theorem “...proved it impossible to establish the internal logical consistency of a very large class of deductive systems - elementary arithmetic, for example - unless one adopts principles of reasoning so complex that their internal consistency is as open to doubt as that of the systems themselves ...” (Nagel 6). This discovery is akin to the post-modernists’ belief that language cannot encapsulate human reality, nor can it completely mediate the

¹⁴ Image from <http://www.psychologytoday.com/blog/the-chaotic-life/200807/chaos-theory-and-batman-the-dark-knight-part-i>.

relationship between interior thought and exterior action. However, “Hofstadter, following Nagel and Newman, remarks the dangers of taking this discovery out of context, but its metaphoric power, like the metaphoric power of irrational numbers, speaks to Beckett’s concerns with language” (Culik 144). Mathematics joins language as a dubious arbiter of reality.

Metaphoric power is a heady one, yet a metaphor out of context can become a lie. But a lie, say Picasso and Eco, can have a momentum of its own that forces us to see truths we couldn’t contemplate before. A lie, and its many kin – misrepresentation, fantasy, figment, exaggeration, yarn – can reveal a deeper relationship between entities like axis and asymptote, approximation and void. Beckett argues that to fill the void with language is folly, that there are some places words cannot – and should not – go (Culik 137). That which is inexpressible and unknowable is just as meaningful as that which is expressible and known.

Nature does not really abhor a vacuum, but human nature does. We desire to fill every empty space with something that reminds us of our rightful place in the universe. We build societies shored up by faith in gods or other beliefs in prophecy, fate, and destiny; we create institutions like marriage and family to bind our individual imaginations together; we continue to contemplate the void between our consciousness and the rest of the entire world with a mix of vigilance and hope. This successful evolutionary strategy of pattern seeking has enabled our species to propagate and progress.

However, the history of human expression reveals that we also suspect this ability to be a snare.

A Convenient Geometry



Figure 5: Poincare's Hyperbolic Plane in a Circular Disc.¹⁵

"For God's sake, please give it up. Fear it no less than the sensual passions, because it, too, may take up all your time and deprive you of your health, peace of mind and happiness in life."

—Wolfgang Bolyai (1775-1856) to his son Janos Bolyai regarding the study of hyperbolic geometry

"What exactly is a hyperbolic plane?"

David Henderson: There are many ways of describing the hyperbolic plane... One way of understanding it is that it's the geometric opposite of the sphere. On a sphere, the surface curves in on itself and is closed. A hyperbolic plane is a surface in which the space curves away from itself at every point. Like a Euclidean plane it is open and infinite, but it has a more complex and counterintuitive geometry."

(Both excerpts from "Crocheting the Hyperbolic Plane: An Interview with David Henderson and Daina Taimina," Cabinet Magazine, Issue 16, The Sea, Winter 2004/05)

Hyperbole is a wonderful concept because it describes both literary and mathematical excesses. The curves and voids carved out by a hyperbolic plane or a hyperbolic phrase

¹⁵ Image from <http://mathworld.wolfram.com/PoincareHyperbolicDisk.html>.

create gaps that are like the spaces between the unique petals of some effusive blossom, like a peony. Grappling with hyperbole makes one, well, prone to hyperbole.

Excess has its limitations, however. As Gödel's theorem states, a theoretical mathematics complete enough to explain everything would be far too complex for us to contemplate. We are stuck with some measure of incompleteness, but mathematicians have a crafty solution: approximation. For example, a famous approximation – π , has allowed humankind to thrive and progress, to engineer marvelous machines, to circumnavigate the globe, and to walk on the moon. But the mathematical constant π , by nature of how we've decided to measure and name things, is an irrational number. It has an excess of digits to describe its nature: it goes on and on and on into infinity – 3.14159265358979323846... How did we calculate a trip to the moon accurately using an approximation? It's a matter of tolerances: at some point the gap between the unknown and the absolute is small enough for us to accept that it can accurately represent reality.

Hyperbole by design forces us into the embrace of the absurd to engage our critical curiosity. It induces a sense of reality by presenting us with something irrational (“the shot heard round the world”) that engages our innate instinct to come to a realistic conclusion. It forces us to approximate and come to a gap that is tolerable. However, mediating reality with the absurd can be a dangerous thing. Hyperbole, like metaphor

and other kinds of figuring, is a tool of immense power. If literalized without question into faiths or fascisms, hyperbole is extremely destructive.

There is no more hyperbolic writer, for his time, than Argentine Jorge Luis Borges.

Borges is a master of the fiction within the fiction, like the infinite reflection of a mirror within another mirror, warping the shape of that reflection into an unending illusion.

Within the bright lines and dark shadows of that illusion, Borges plumbs like an Egyptian punter, mapping the unseen. Unlike Lewis Carroll's fearful fairy tale, Borges' fiction is not a reaction to the threat of non-Euclidean nonsense. (The nonsense that Borges fears is the more pedestrian human need for simplicity and control). Borges embraces the surreal landscapes and dazzling reflectivity of fantasy-mediated reality. His excess of language, scene, and plot still retains a familiarity, however, as he connects figments of his own imagination to icons of consensual reality

Borges uses the respectable and definitive scaffolding of narrative and language to build fantasies that question the nature of narrative and language. In his famous short story, "Tlön, Uqbar, Orbis Tertius," the encyclopedia that describes the existence of these mystical lands is "a literal but delinquent reprint of the Encyclopaedia Britannica of 1902" (Borges 3). After all, it takes a real model to make a convincing avatar – the respectable tome of a well-known encyclopedia becomes the skeleton that the fictional flesh of Uqbar is built upon. This assumption is at the core of Borges' story, for without the grounding of some kind of reality, the conspiratorial approximations about the

existence of the mysterious Uqbar have no power. Reality and fantasy are necessary to and for each other; they are orthogonal, like the x and y axes on a Cartesian grid. This relationship, this grid of intersection – reality to allusion – is the reference system we use to translate our lives upon.

Borges reinforces this relationship over and over again, using allusions to a consensual reality to enhance the frightening potential of Uqbar:

“Of the fourteen names which figured in the geographical part, we only recognized three – Khorasan, Armenia, Erzerum – interpolated in the text in an ambiguous way. Of the historical names, only one: the imposter magician Smerdis, invoked more as a metaphor. The note seemed to fix the boundaries of Uqbar, but its nebulous reference points were rivers and craters and mountain ranges of that same region” (Borges 5).

Borges artfully (in both key senses of the word – skill and cunning) uses the relationship between reality and fantasy to both confound and compel us. He names recognizable elements that give Uqbar a hint of reality, including a person – the “imposter magician Smerdis,” someone who is historically real but of dubious character. The phony magician is one of many recursive elements in the story; he is by virtue of being a magician someone who mocks the limitations of reality. But, he is also a fake. He is an unreliable waypoint in the story, leaving us uncertain and yet, curious. The added “invoked more as a metaphor” makes the magician’s role all the more incomplete and ambiguous.

These unreliable, incomplete nodes of intersection between reality and fantasy in “Tlön, Uqbar, Orbis Tertius” reveal the same struggle that writer Samuel Beckett tackles in his work: language – and possibly every human endeavor – cannot capture fully what it means to be human. This discrepancy between internal thought and external expectation is what drives continual human social evolution, both toward successful adaptations and disastrous ones. Borges begins to map these points on a frame of reference, comparing his reality to that of the inhabitants of one of Uqbar’s regions - Tlön: they are “congenitally idealist. Their language and the derivations of their language – religion, letters, metaphysics – all presuppose idealism” (Borges 8). Their world is a completely subjective one, without the need for an overarching cause and effect:

“It is no exaggeration to state that the classic culture of Tlön comprises only one discipline: psychology. ...the men of this planet conceive the universe as a series of mental processes which do not develop in space but successively in time. ...they do not conceive that the spatial persists in time. The perception of a cloud of smoke on the horizon and then of the burning field and then of the half-extinguished cigarette that produced the blaze is considered an example of association of ideas” (Borges 10).

Without sequence there is no consequence, a world that might appeal to a child who wants to be free of punishment for bad choices. But dreaming the universe presents other problems: “This monism or complete idealism invalidates all science. If we explain (or judge) a fact, we connect it with another; such linking, in Tlön, is a later state of the subject which cannot affect or illuminate the previous state. Every mental state is

irreducible; the mere fact of naming it – i.e., of classifying it – implies a falsification.”
(Borges 9-10).

To an amateur, this sounds a lot like the basic and simplified rules of quantum mechanics, including Werner Heisenberg’s Uncertainty Principle. Heisenberg theorized that in quantum mechanics, “the more precisely the position [of a particle] is determined, the less precisely the momentum is known in this instant, and vice versa” (Huang 49). By measuring one characteristic of the particle, another characteristic becomes unknowable, making it impossible for us to ever have complete knowledge of the particle. The people of Tlön thrive in this kind of indeterminacy. Naming something brings about falsehood, not truth. By collapsing an object into reality, it is diminished and its potential is lost. Others have professed this philosophy: “The Tao that can be told is not the eternal Tao” (Laozi xi). However, the people of Tlön are in danger of literalizing this hyperbole. Remember the words of Picasso: “art is a lie that makes us realize the truth.” Art – be it skill or cunning – is always the cipher, the unreliable narrator, the imposter magician. Equating the gaps in human understanding to the oddities of quantum mechanics as proof that the universe proffers absolute meaning may be a worthy philosophical process, but it is another dangerous simplification of a complex idea solely to fill the gap with something palatable.

Everything in Tlön is in motion; in a state of perpetual translation. There is no arrival, no definitive. Language is a series of arbitrary rules. There is only the ephemeral process of

being noun-like or possessing some measure of noun-ness: “The noun is formed by an accumulation of adjectives. They do not say “moon,” but rather “round airy-light on dark” or “pale-orange-of-the-sky” or any other such combination” (Borges 8-9). Objects and people and events are functions constantly redrawn on a reference system that is also constantly being updated and re-oriented with an origin at zero one moment and then an infinite irrational at another. The consequences for Tlön’s literature and other cultural memes are profound: “These second-degree objects can be combined with others; through the use of certain abbreviations, the process is practically infinite. There are famous poems made up of one enormous word. This word forms a poetic object created by the author. The fact that no one believes in the reality of nouns paradoxically causes their number to be unending” (Borges 9).

Borges is warning us about accepting absurd notions of relativity, arbitrariness, and symbolism, a similar caveat of Carroll’s. However, where Carroll uses hyperbole to prove a contradiction, and therefore an impossibility, Borges uses these excesses to reveal how delicate the balance between reality and fantasy truly is, and how easily one can glance askance and will into being the ephemeral sight of something seen out of the corner of the eye.

The words of Tlön are not ideas; they are a grammar of symbols that make anything possible. Lewis Carroll tried to warn us about the dangers of symbols, and Borges does so as well. But Carroll is unaware (or unwilling to admit) that he, too, is trafficking in

symbols when he satirizes negative numbers with a talking hare and a hookah-smoking caterpillar and a tyrannical red queen. Words are not ideas; they are symbols. And the many creations of language – politics, art, religion, and numerous other disciplines – are not sufficient models to describe experience. The many modes of human expression do not a definitive reality make.

Borges follows the path made by Lewis Carroll, like an ancestor, but he asks deeper more cutting questions. What is in our nature to be so drawn to a concocted world? While we regard ourselves as technologically and socially sophisticated – and in comparison to some historical instances, we are – we are no more real now than the Klamath tribe or the survivors of Pompeii or the symbolic algebraists. Borges cynically answers the question:

“Almost immediately, reality yielded on more than one account. The truth is that it longed to yield. Ten years ago any symmetry with a semblance of order – dialectical materialism, anti-Semitism, Nazism – was sufficient to entrance the minds of men. How could one do other than submit to Tlön, to the minute and vast evidence of an orderly planet? It is useless to answer that reality is also orderly. Perhaps it is, but in accordance with divine laws – I translate: inhuman laws – which we never quite grasp. Tlön is surely a labyrinth, but it is a labyrinth devised by men, a labyrinth destined to be deciphered by men.

“...already a fictitious past occupies in our memories the place of another, a past of which we know nothing with certainty – not even that it is false. Numismatology, pharmacology, and archaeology have been reformed. I understand that biology and mathematics also await their avatars...”
(Borges 17-18).

In the grips of a desire for simplistic order and purpose, the narrator's world misuses the art of fiction and is seduced by the power of fantasy made manifest. They abdicate their individual experience of and responsibility for the world. However, a purely imagined, self-referential world without cause and effect does not free humankind from the vagaries of natural laws; it simply enslaves us to our inability to cope with uncertainty. Tlön, Uqbar, and Orbis Tertius are worlds of infinite iteration, in which we can have anything we imagine until the gaps between reality and fantasy are completely filled and nothing can pass between, destroying the engine and the prime mover of civilization itself.

Fortunately, Borges' impotent world congested with metaphor and hyperbole is not the final destination. Art imitates Life, and all human art – be it narrative, quantum mechanics, or sculpture – is a self-portrait. This self-centeredness forces us to continuously see our own reflection in everything we do. We are driven by the sight of the smallest perceived imperfection to seek more truths about who we really are. While history is full of plateaus where literal interpretations of the imagination take hold of culture and society, human nature always breaks that continuum by challenging the sanctity of language or by moving the Sun. Because we unravel as much as we knit together; fracture as much as we fuse; are inspired as much by the undifferentiated form as by the clear, concise pattern; we guard the unknown as much as the known.

Part IV: Conclusion

The Bathymetrist

Chapter 17: Ruins

The boat was ruined. It sat half in, half out of the pond. Its bow on the frozen mud, its stern entombed in ice, the wooden planks forever splintered. I neglected it while I tried to figure out a normal life. Now it was ruined – I ruined it. All for a normal lie.

I slid out onto the ice and I heard a deep cracking sound, a rent in the cornea of the pond-eye. Don't worry, I won't fall in. Even though this pond is unknowably deep, there's a thick enough layer of ice on its surface to keep me up here instead of down there. That would be a dumb end to the story.

I pulled out the plumb bob and its attached twine. I stabbed at the ice with the bob's sharp and blackened steel point, slowly chipping a periphery of tiny jeweled shards around a widening, tourmaline-colored hole. A splash of water hit me cold in the face.

I dropped the plumb bob into the hole. Wind corraled pain in my ears, I could no longer feel the fingers on my right hand, so I stuffed it in my pocket and used my left to drop the line. The bob went down, but then stopped at about 17 feet. I was in the wrong spot. I'd have to dig a new hole.

Should have gone home. It was almost dark, but I couldn't leave yet. I chopped away at the surface, making a new hole in another guessed space. Again, I looked into the tiny dark pupil and dropped the plumb bob down.

Twenty feet. More twine.

Thirty feet. More twine and the weight of the bob still tugged toward the bottom.

Fifty feet. I hit the spot; my heart came unmoored. Blood rushed into my cold ears, my bladder threatened loosening. I let more and more line go down just like before on that summer day of terrible possibility. I fed the line out, now a hundred feet and past the knot where I added more marked twine, a hundred and ten, a hundred and twenty, a hundred and thirty two, because now there's no need to speak in even numbers, a hundred and forty five, a hundred and fifty one...

Sobbing over this hole pierced in the ice, I could barely see by the light of a just gone sun that I still held the taut line and the plumb bob still yearned for the bottom. One hundred and fifty eight feet and out of twine. I'd made a small loop with an adjustable knot at the very end. I tightened it hard around my thumb, drawing a line of white stressed flesh. The weight of the bob pulled at my thumb, pulled at me. I pulled the end of the twine, releasing the knot on the loop. The frayed end jerked from my fingers and disappeared forever into the water below.

The crying stopped. I rolled onto my back and met the dark surround of treetops presenting the first stars of night. First because they were closest or because they were brightest?

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