

Cryptography

*My Life had stood - a Loaded Gun -
In Corners - till a Day
The Owner passed - identified -
And carried Me away -*

*And now We roam in Sovereign Woods -
And now We hunt the Doe -
And every time I speak for Him
The Mountains straight reply -*

/ Dickinson

On his trip to Italy in 1689, Gottfried Wilhelm von Leibniz prepared his selected universal library—a 35-page catalogue of must-have books. This bibliography included a dozen items on steganography, cryptology, and verbal concealment.¹ Perhaps these books accompanied him as he traveled to Modena, in search of a common origin for the northern Italian House of Este and the German House of Brunswick-Lüneburg.

On my trip to Pittsburgh to see Leibniz’s cipher machine—the first of two existing reconstructions of the philosopher’s device, never once built in his lifetime—I bring with me two books: a hardbound art-edition of the Voynich Manuscript, and a copy of James Joyce’s story, “The Dead.” My copy of the Voynich has glossy, fold-out photo reproductions of the original manuscript’s pages, which are filled with a curly cipher script accompanied by strange, rude images of unspeakable plants, bathing women, and cosmological signs and devices. Housed today in Yale’s Beinecke Library, the Voynich was written on parchment from the early fifteenth century, then bound later in animal skins. Though many have tried, including American codebreakers who solved important encryptions during World War II, no one has been able to read or decipher the language in which the book is written—an alphabet of either 15 or 40 characters that scholars have called “Gallows” for the hangman-shaped style of its lettering. Nobody knows what the Voynich says, or if it says anything. Some think it was written as an elaborate con; during the Renaissance, both rare books and cryptography were much in vogue, so ripe for counterfeit.

Some believe the book was written and encoded by Roger Bacon, a medieval Franciscan scientist, and then later taken from England to Prague by John Dee, a mathematician and alchemist who spoke to angels and knew well the theories of Johannes Trithemius—this latter, who, in addition to writing the first book on cryptography in Western Europe, proposed that people might be able to communicate with each other over long distances by using spirits. In Prague, the Holy Roman Emperor, Rudolph II, a lover of all things strange and uncommon, of genetic aberrations and

¹ Rescher, Nicholas. *Leibniz and Cryptography: An Account on the Occasion of the Initial Exhibition of the Reconstruction of Leibniz’s Cipher Machine*. University Library System, 2013, pp. 7

curiosity cabinets, paid a small fortune to possess the manuscript for himself. After a long period of historical quietness, the Voynich resurfaced in 1912, when it was purchased by a book dealer named Wilfrid M. Voynich, “a man of ‘amazing bibliographical erudition’ and ‘almost omniscient knowledge,’ who was said to be fluent in twenty different languages.”² He spent much of his life trying to decode the cipher manuscript. As part of his attempt, Voynich enlisted the help of William Romaine Newbold, a prominent medievalist at the University of Pennsylvania.

Newbold eventually claimed to have discovered the key to Bacon’s cipher: each letter had to be “read” under a microscope, since each character was comprised of multiple parts or signs. Each sign on each letter was an abbreviation in Greek that could then be expanded into words, phrases, and entire paragraphs written in Latin. Even though Newbold was able to provide proof that portions of the Voynich could, in fact, be read in this way, he was ultimately proven wrong—what Newbold had seen under the microscope hidden in each letter of the manuscript, was, in reality, cracks in the aging ink. John Matthews Manley, a codebreaker and English professor at the University of Chicago, explained why Newbold was able to produce legible solutions to the Voynich’s encryptions on the basis of an impossible cipher-key, writing that “experience has shown that even a group of less than fifty letters can be rearranged in several thousand different ways all forming intelligible human speech.”³ By Manley’s logic, it wasn’t so strange, then, that ink cracking over time might randomly reveal fragments of sensible language—in this case, an elaborate combination of Greek abbreviations unfurling into Latin paragraphs.

As we make the seven-hour drive from North Carolina to Pittsburgh, K and I alternate between driving and reading out loud from scholarly editorials written about the Voynich, and from James Joyce’s “The Dead.” I return to Joyce every spring, through the crashing-in of snow and blossoming trees. This time, half-way through the scrap woods of West Virginia, I read out loud and mark Joyce’s description of the meal laid out at the Misses Morkans’ winter party, attended by all their friends and family, including the main character of the story, Gabriel Conroy. The passage reads like a still-life painting, burgeoning but balanced, inflorescent with beveled, faceted glass, glistening with sauces and lipids and fruits:

A fat brown goose lay at one end of the table and at the other end, on a bed of creased paper strewn with sprigs of parsley, lay a great ham, stripped of its outer skin and peppered over with crust crumbs, a neat paper frill round its shin and beside this was a round of spiced beef. Between these rival ends ran parallel lines of side-dishes: two little minsters of jelly, red and yellow; a shallow dish full of blocks of blancmange and red jam, a large green leaf-shaped dish with a stalk-shaped handle, on which lay bunches of purple raisins and peeled almonds, a companion dish on which lay a solid rectangle of Smyrna figs, a dish of custard topped with grated nutmeg, a small bowl full of chocolates and sweets wrapped in gold and silver papers and a glass vase in which stood some tall celery stalks. In the centre of the table there stood, as sentries to a fruit-stand which upheld a pyramid of oranges and American apples, two squat old-fashioned decanters of cut glass, one containing port and the other dark sherry. On the closed square piano a pudding in a huge yellow dish lay in waiting

² *The Voynich Manuscript*. Beinecke Rare Book & Manuscript Library, Yale University Press, 2016, pp. 11

³ *The Voynich*, 56

and behind it were three squads of bottles of stout and ale and minerals, drawn up according to the colours of their uniforms, the first two black, with brown and red labels, the third and smallest squad white, with transverse green sashes.

I can trace back to still-life painting the reason I have convinced K to come with me to Pittsburgh to see Leibniz's cipher machine in the Hillman Library. In a still-life, paper frill, decanter, and apple become compositional, harmonic, shelving off into one another, into cleaving, interpenetrating planes that carve themselves up for the onlooker just as Gabriel Conroy might carve gooseflesh for evening guests while snow falls across Ireland, over both the living and the dead. Lines and groupings scaffold the chaos of a cornucopia. I love to look at pyramids of oranges and American apples, and hunger, and be filled, not with food, but with forms: American apples assembled into the shape of an inscrutable tomb.

Perhaps this is why I was drawn in the summer to Leibniz, through Deleuze and his ideas about folds. Though he never explicitly articulated a theory of aesthetics, Leibniz understood the world in aesthetic terms. Frederick Beiser shows how Leibniz's "view of the world as a work of art or organism" emerges out of his metaphysics, where substance is "the basic unit of reality." According to Leibniz, substance is a "living force...with the power to unify a manifold, to create unity amid variety." As Beiser reminds us, "Unity amid variety is order or harmony, which is the structure of beauty itself."⁴ Substance, then, which is unity, expresses itself as beauty.

Ours, then, less a world of apples, than of pyramids.

In Pittsburgh, through intermittent, furious snow-showers that disperse as soon into late sunlight, K and I walk among the graves at Homewood Cemetery near Frick Park. As snow begins to fall again, we spot deer among the headstones, observing, too, several marble crypts with columns interspersed, and the absurd pyramid that looms through the mist on the hilltop and marks the final resting place of William Harry Brown, banker and heir to a shipping empire. It snows faster, hard and blindingly, at an angle, and we are obliged to turn and walk backwards against the white force, backwards through a graveyard. Our reversal of the right way of things, I worry, might be the start of some summoning, an incantation without intent. So I turn back to face my blindness, and K laughs that there are snowflakes on my eyelashes.

Beiser reports on Leibniz, who believed "even sensual or physical pleasure is aesthetic...because it derives from the perception of a perfection, even if we are not fully aware of the perfection itself."

In other words, as Leibniz put it in a letter to Sophia Charlotte, a queen and daughter of the house of Brunswick-Lüneburg, the sensual world is, in its essence, occult.

⁴ Beiser, Frederick C. *Diotima's Children: German Aesthetic Rationalism from Leibniz to Lessing*. Oxford University Press, 2009, pp. 32.

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Nicholas Rescher, the philosophy professor at Pittsburgh who built Leibniz's cipher machine for the first time in 2011, writes that Leibniz designed his device to be portable, "readily contained in a box sufficiently small to escape notice among the impedimenta of a travelling prince."⁵

En route to Pittsburgh, I glimpse from the freeway a cluster of shipping containers sloped on a hillside. A billboard with the words "American Homes" hovers nearby.

At first, Leibniz was interested in cryptography not because he wanted to hide his thoughts from others, but because he saw it as kin to algebra, part of the general science of human knowledge. His early writings on cryptography show that he hoped that theory, or rather a clear, methodological set of rules, could be applied to the art of decryption. In fact, Leibniz viewed the whole scientific method in cryptologic terms. To him, a hypothesis was "like the key to a cryptograph, and the simpler it [was], and the greater the number of events that [could] be explained by it, the more probable it [was]." But he also understood that, just as a complex cipher can be solved using multiple keys, with only one revealing the true message, a hypothesis can never be proven beyond doubt, since "the same effects can have several causes."⁶

Furthermore, Leibniz saw the world as an encrypted text. To obtain scientific knowledge about it is like solving a cipher. But Leibniz's skeptical ideas about science and hypotheses meant that it was entirely possible to find a bad key that still made sense.

It is possible to think you have found it, but you haven't—it retreats through the woods. You may never know, thinking you do. You may never feast, though you feel your belly full.

The Heinz Memorial Chapel aspires behind the massive, gothic highrise of the Cathedral of Learning, where the ninety-year-old Rescher keeps his offices. The Heinz Chapel has 4000 square feet of stained glass. Each of its 23 windows, some of which ascend to a height of 73 feet, depict famous authors, scientists, and theologians, representing equally both men and women. One page of an "Alphabetical List of the Figures in the Windows" reports the installment in glass of Galileo, Gamaliel, Saint Genevieve, Christopher Gist, and God. Gist is described as an "American frontiersmen." God is described as "divinity of the three great monotheistic religions."

Just as much a part.

⁵ Rescher, 40

⁶ Rescher, 5

Emily Dickinson is here, too. In an aureole of red shards, Dickinson holds a fascicle and a quill. The parchment reads: “A wounded deer leaps highest.” Above her head leaps a stag. At her feet is a snake—“a narrow fellow in the grass”—and a mourning dove—“a bird came down the walk.”

The summer before K and I met each other, both of us early-stage doctoral students studying literature at the University of North Carolina, it turns out we both attended an academic conference in Paris concentrated on Emily Dickinson. It’s possible we sat together in the same room, not knowing that one day we would stand together in the Heinz Memorial Chapel, two cognoscenti looking up at Dickinson in glass while chapel stewards indulged their visitors by playing Bach overhead on the great pipe organ. That summer, before the conference, I wandered Paris and its suburbs trying to make sense of the recent stadium bombing and the shooting at the Bataclan club. When I visited the Stade de France in Saint Denis, I didn’t know the suburb had one of the highest recruitment rates in Europe for ISIS. I didn’t know that some of the terrorists responsible for the attack had been killed in Saint Denis, in a shoot-out with the police less than two miles from the ancient basilica where all the kings of France are buried. The night I learned the truth about Saint Denis, I couldn’t sleep. My heart leapt and leapt in my chest, constricting my breath.

It was hard for me to locate the source of my panic. In retrospect, part of me thinks my response was fear, the fear of having been close to death without knowing it.

Another part of me knows I was thrilled to panic, too. Not the perverse, voyeur’s thrill of having come close to someone else’s violence, but, more perversely, the thrill of making connections, synthesizing a network of underground associations. The thrill of being included in a vast plot stretching from Syria to Saint Denis, all the way from Clovis I to Emily Dickinson to the Eagles of Death Metal.

But if the world is encrypted, who is its cryptographer? And why? What is there to hide?

I learn from Leibniz that, when it comes to cryptographic discovery, analysis is not enough: instead, in the non-methodological, “rambling hunt (*vaga venatio*)” of decryption, “a more extensive (*longior*) procedure of synthesis will prove necessary.”⁷

But accurate decryption depends on a finite text—one not too long, not too short. When the text is limited, “a meaningful decoding is its own verification.” On the other hand, when the text is nature, as Leibniz believed, and nature’s text is limitless, “our ‘decryptions’ thereof afford no more than the moral certainty of high probability.”⁸ And highest leaps the wounded deer. And I am the deer here. And I am the shooter.

⁷ Rescher 15, 3

⁸ Rescher 6

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Perhaps the lesson of the Fall is a lesson in cryptography. Taste of the fruit of knowledge and be buried. Be encrypted. Beneath a pyramid of apples.

Leibniz's cipher machine is modeled after his calculator, an ornate system of gears and screws arranged around a "stepped drum," called a *staffelwalze*. This "Leibniz-wheel" is engineered so that it can mesh variably with other, more regularly shaped and rotating gears. Each drum has six "steps" that are designed to either lock with or skip the teeth of the other gears. The result is that the rotation sequence of the machine can be programmed differently, depending on user settings. In his calculator, the *staffelwalze* permits a carrying operation and multiple mathematic functions. In his cipher machine, the *staffelwalze* allows for increasingly complex and variable cryptographic permutations.

On first seeing the stepped drum, K says it looks to her like a nautilus shell.

In the Hillman Library, we are shown the machine and how it works, and provided access to a handful of other papers by or about Leibniz, including a handwritten letter he addressed in 1711 to Michael Gottlieb Hansch, a scholar of Johannes Kepler. The letter treats the topics of the Fall, infant sin, free will, liberty, perception, and, in passing, Hansch's work on an edition of Kepler's writing.

The cipher machine is designed to be used as one might play a harpsicord. Leibniz returns to this analogue repeatedly in his letters: "While both encipherment and decipherment is [ordinarily] laborious, there is now a facility enabling one to get at the requisite ciphers or alphabetic-letters as easily as though one were playing on a clavichord or other [keyboard] instrument."⁹

The special collections librarian explains to us that, because the device was built for demonstration purposes, their version doesn't include the decode function, which would involve the installment of some extra parts. Thus, the first of only two existing versions of Leibniz's celebrated cipher machine can only be used encrypt messages. The only song you can play is a darkening song.

Around the time of the machine's construction, Nicholas Rescher donated Leibniz's letter to Hansch to the Hillman Library. In the letter, Leibniz refutes Spinoza and Descartes's claim that liberty (free will) requires "complete indetermination." To make his point, Leibniz cites Bayle, who said that if "I do not perceive it, hence it is not there." What Leibniz means to say is that if free will exists, it must be determinate in order to be perceptible. That being said, he grants that "even if we do not perceive reasons of necessity, they can certainly still be there. We do not even perceive all of

⁹ Rescher, 39

the things actually within us, for we have many confused perceptions whose constituents are not perceived by us.”

What is perceived is real, but we can't perceive everything. We can't, because we are essentially constrained, essentially confused.

But it's not just that perception is limited. Perception itself cannot be perceived, and so it remains unknowable. The very tool I use to decipher nature's texts is a mechanism that I cannot rationalize or explain to myself. Leibniz illustrates his point by comparing perception to a windmill:

One is obliged to admit that perception [i.e. mental activity] and what depends upon it is inexplicable on mechanical principles, that is, by figures and motions. In imagining that there is a machine whose construction would enable it to think, to sense, and to have perception, one could conceive it enlarged while retaining the same proportions, so that one could enter into it, just like into a windmill. Supposing this, one should, when visiting within it, find only parts pushing one another, and never anything by which to explain a perception.¹⁰

Leibniz enters the windmill of the mind and finds a complexity exceeding the sum of component parts. It cannot be analyzed to be known. Likewise, in his investigation into cryptography, Leibniz gradually realized that codebreaking “is not subject to definite rules (*certis regulis*) but is a matter of ad hoc contrivances whose complexity is ever in the increase.”¹¹

To know the mind, then—to perceive perception—is to play a complex, ad hoc song that darkens the mind and can't be undone.

I can't decrypt before I encrypt first.

“The endless movement of comprehension,” wrote Maurice Blanchot.

In their study of the mathematical architecture of Bach's “The Art of the Fugue,” Sylvestre and Costa observe that Bach probably read both Johannes Kepler's *Harmonices mundi* (1619) and Mersenne's *Harmonie universelle* (1636), “which gives clear instructions on the use of the geometrical proportion associated with the golden ratio in discussing tuning systems and instrument making.” The golden ratio was a subject of lifelong fascination for Kepler, who “in a private letter to Joachim Tanckius dated 12 May 1608, ... explained how he found the numerical expression of F from the

¹⁰ Rescher 45

¹¹ Rescher 15

Fibonacci sequence.” Kepler later published his findings publically in an essay on the geometric proportions of snowflakes.¹²

Walking snowblind among the indeterminate crypts and pyramids of Pittsburgh, I realize all at once where I am. I realize what Rilke realized, too, that “where you are, there arises a place.”

As an ocean rises. A tidal ground.

K laughs that there are nautilus shells on my eyelashes.

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According to Emerson, it is not an ocean we walk on, but “molten lava.”

His biographer Robert Richardson explains that Emerson came to feel this way after the death of his wife, Ellen, in the winter of 1831. Over a year later, no longer “sure what he really believed, who he really was, or what he should be doing,” Emerson still “felt the ‘vanishing volatile froth of the present’ turning into the fixed adamantine past.” Perhaps to return to the froth of the present, to break through the hardening crust of the adamantine past on which walked, Emerson exhumed the corpse of his dead wife with his own hands on March 29, 1832.

Calling this act “essential Emerson,” Richardson speculates that Emerson dug up Ellen because “he had a powerful craving for direct, personal, unmediated experience. That is what he meant when he insisted that one should strive for an original relation to the universe. Not a novel relation, just one's own.”

In a poem called “Woodnotes,” Emerson describes the sense of his “original relation to the universe” as an occult and “fatal song.” He invites his reader to learn the same song:

Come learn with me the fatal song
Which knits the world in music strong;
Come lift thine eyes to lofty rhymes,
Of things with things, of times with times,
Primal chimes of sun and shade,

¹² Sylvestre, Loïc, and Marco Costa. "The mathematical architecture of Bach's the Art of Fugue." *Il Saggiatore Musicale*, vol. 17, no. 2, 2010, pp. 175-195.

Of sound and echo, man and maid,
The land reflected in the flood,
Body with shadow still pursued.
For Nature beats in perfect tune,
And rounds with rhyme her every rune,
Whether she work in land or sea,
Or hide underground her alchemy.
Thou canst not wave thy staff in air,
Or dip thy paddle in the lake,
But it carves the bow of beauty there,
And the ripples in rhymes the oar forsake.

For Emerson, just living was enough to be in an endless, fated state of singing a fatal song, conjuring beauty from thin air, summoning up from underground she who works in land or sea, in “the land reflected in the flood.”

Come learn with me the fatal song.

On our way to Pittsburgh in the predawn, K and I fall to talking about people we have known, how they have changed, or haven't, and the families they've raised. She remembers a boy she knew in grade school who loved to hunt, who still loves it, who, now a grown man, posts to social media snapshots of dead deer. She tells me it disgusts her to see, and she mourns for the creatures her classmate has killed. We talk about our fathers and their guns. Talk turns to her ex, Jacob, when she remembers that after their breakup, he left behind in her apartment his grandfather's shotgun. She begins to worry out loud about it, having just remembered it, a remnant in the closet. We wonder what the procedure is like for surrendering guns to the police without license or registration. Eventually, the conversation wanders to other subjects. Once it gets light enough to see, somewhere in West Virginia, I begin to read “The Dead” out loud to K.

The poet Robert Browning lies the heart of “The Dead.” Joyce calls Browning's verse a “thought-tormented music.” Gabriel worries that the speech he gives at dinner, including a reference to Browning's poems, might go over his audiences' heads. In his speech, Browning's thought-tormented music morphs into the “thought-tormented age” that Gabriel laments as his audience's and his own.

Later, after the party, Gabriel's wife Gretta, overhears another character singing a mournful song called “The Lass of Aghrim.” The song causes her remember a boy she used to know and love in Galway. The seventeen-year-old boy, named Michael Furey, died as he and Gretta were only beginning to fall in love. To his bewilderment, Gabriel learns that his wife has harbored this young

lover in her heart for years. This new knowledge, brought to light by a song overheard by his wife behind a closed door, estranges Gabriel both from Gretta and from himself. Back at their rented room, after Gretta has told the story of Michael Furey to Gabriel and fallen to sleep, Joyce writes that a stunned, stupefied Gabriel

stretched himself cautiously along under the sheets and lay down beside his wife. One by one, they were all becoming shades. Better pass boldly into that other world, in the full glory of some passion, than fade and wither dimly with age. He thought of how she who lay beside him had locked in her heart for so many years that image of her lover's eyes when he had told her that he did not wish to live. . . . [I]n the partial darkness he imagined he saw the form of a young man standing under a dripping tree. Other forms were near. His soul had approached that region where dwell the vast hosts of the dead. He was conscious of, but could not apprehend, their wayward and flickering existence. His own identity was fading out into a grey impalpable world: the solid world itself, which these dead had one time reared and lived in, was dissolving and dwindling.

When we return home from Pittsburgh the next day, K again remembers the shotgun in her closet. She says she can't stand that it's there. At dinner, she searches her phone for some way to get rid of it. She worries out loud that she could be arrested for hiding a gun that isn't hers. She tells me she is so anxious her heart is starting to leap out of her chest. Should she throw it away? Into a dumpster? A river? She asks me to hold her. I do.

The next day, she asks me to accompany her to the police station. Sympathetic to her situation, the police send an officer to collect the gun at her apartment. They check if it's loaded in the living room.

K's therapist tells her that the reason she couldn't stand, suddenly, to have Jacob's gun in her home is because it represented a threat to her identity. A threat that had been there, with her, repressed, for nearly a year—then all at once exhumed on the road to Pittsburgh, passing the motels and motel pools of Winston-Salem, remembering, like some distant fatal song, a boy she used to know. Who she still follows. Who still follows her.

Song sings to song: the ground opens up.

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To decrypt himself (his self a sound and echo of a fatal song), Emerson decrypts his dead wife.

When he realizes his wife's insoluble encryption, the dead boy buried in her heart, Gabriel becomes encrypted to himself and to the world and the world is entombed in snow. The song she heard was fatal to them both, stirring up Furey like dust in her heart.

What I do to myself I can't do without you.

(What I do to myself I do to you.)

The song of myself, I sing it to you.

(Song of myself I can't sing without you.)

Before I go, the librarian allows me to press a single letter on the keyboard of Leibniz's cipher machine. Remembering the inscriptions on the Temple of Delphi, among them the three Delphic maxims ("know thyself," "nothing in excess," and "make a pledge and mischief is nigh") plus a large, cryptic letter E, I choose to play the letter E.