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Toward a genealogy of a cold war communication sciences: the strange loops of Leo and Norbert Wiener

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Toward a genealogy of a cold war communication sciences: the strange loops of Leo and Norbert Wiener

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A modest footnote in the mid-century annals of digital communication sciences, this article observes several strange loops in the dual biographies of Norbert Wiener, a primary founder of cybernetics – an American-born computer-compatible communication science that later took root in the Soviet Union – and his father, Leo Wiener, a Byelostock émigré who began Slavic studies in America. It proceeds in two parts: first, a biographical reflection on Norbert Wiener's method by analogy, which he first developed under his father as a youth, and second, a reflection on how Wiener's mature cybernetics combine analogy, feedback, and their contradictions ripe in biographical mind–body tensions. Among other notes, this article contends that the origins of a leading theory of digital communication may best be understood not as a disembodied abstraction of information, but rather in the messy world of biographical influences that helped usher in a cold war era of calculating communication.

Keywords: cybernetics; digital communication; cold war; biography; history; Wiener

> Neither the life of an individual nor the history of a society can be understood without understanding both. (Mills, 1959, p. 3)
>
> To my father, Leo, my closest mentor and greatest antagonist. (Wiener, dedication to *Cybernetics*, 1948)

It is commonplace to organize intellectual history around individuals, especially founders and fathers of various academic trends. Thus, history teaches that Plato founded the modern academy; Copernicus, heliocentric astronomy; and Einstein, space-time relativity. This essay offers no exception, except that its protagonists – the father Leo Wiener and the son Norbert Wiener – appear here for a different reason. The goal is not to attribute the movement of cybernetics to Norbert Wiener or Slavic studies in America to Leo Wiener. On the contrary, it is to explore how their life stories contain a wider world of competing forces and influences: it is not to praise the Wieners as influences on the cold war communication science and culture, so much as to view the Wieners as a refracting prism for focusing analysis on the same.

Given that Slavic studies in America need little introduction to the readers of this journal, suffice it to say that cybernetics, however neglected today, may be one of the most significant cold war theories of computer-compatible communication and control; although it failed to cohere institutionally into a successful field, mid-century cybernetics shaped the digital age's vocabulary of encoding, decoding, signal, feedback, entropy, equilibrium, information, communication, and control. It popularized the prefix "cyber" (from the Greek root for *govern*) and the phrase "in the loop". It kindled the literary imagination for human–machine cyborgs (Hayles, 1999; Kline, 2009). In the Anglophone

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academy, it bolstered advances in game theory, operations research, information theory, as well as in the Shannon–Weaver transmission model of communication, in Gregory Bateson's anthropology, and in Roman Jakobson's linguistics. In the post-Stalinist Soviet academy, where the once-American field reinvented itself, cybernetics too enjoyed a broad intellectual impact by infusing Soviet scientific discourse with a computer driven sort of informational materialism (Gerovitch, 2002; Peters, 2008, 2012). Cybernetics on both sides of the Atlantic animated perennial puzzles about digital communication: how we think and verify truths, how we mechanize control, where we situate the body in a digital world, among others – that were just as alive to our cold war forebears as they remain today (Medina, 2011; Pickering, 2010; Segal, 2003).

Norbert Wiener (1894–1964) was one of those forebears. He spent his life in search of a harmony of tensions between mind and body, symbol and substance, and ally and enemy, which riddle both his life work and his life story. Judging by several biographies written on him and, in two cases, *by* him, a brief description of the man follows: He was the son of an overbearing genius father from the Pale of Settlement and an anti-Semitic German-Jewish mother, a potent theological ambiguity rehearsed in his final lectures on the information age, *God and Golem, Inc*. At home, Wiener grew up a child prodigy whose world-class education from his father, like that of John Stuart Mill's, cost him his childhood. At work, a likely cyclothymic manic-depressive, he oscillated between intellectual highs of self-promotion and debilitating lows of self-doubt. In adult life, a colleague described him as "in reactions, a child and in judgments, a philosopher" (Masani, 1990). In times of war, he calculated military strategies against the Germans, and, in times of peace, he leaned left as a pacifist public intellectual. A penetrating wit and a dreadful bore, a legendary and absent-minded professor, a globally misunderstood polyglot and a mathematician, he was all this and more. In life and work, Wiener sought, methods including the strange loop of analogic and feedback methods noted below, for balancing the unstable worlds within and without (Conway & Siegelman, 2005; Heims, 1982; Masani, 1990; Wiener, 1953, 1966).

For the purposes of this article, I call this series of biographical tensions "analogic", meaning they hold separate ideas in parallel: mind and body, symbol and substance, ally and enemy, and west and east. These pairs, among others, resolve themselves in Wiener's cold war theory of cybernetics. In cybernetics, the Cartesian dualism between mind and body resolves itself into a single neurophysiologic system that analogizes the neurological signals of a mind with that of a processor's circuits. In the executable codes of cybernetics, symbols too take on fresh substance of information embodied; in the strategic deployment of its universal theories of information control and communication, cybernetics serves ally and enemy, the West and the Soviet Union equally well. Cybernetics – or at least Wiener's version of it – may be understood as a metascience for working with analogies in feedback.

This article proceeds in two parts. The first, a biographical sketch of Norbert Wiener and his father Leo Wiener, is followed by the second, some notes on their father–son relationship as a type and shadow for Wiener's ideas about analogies and feedback in cybernetics. In this method, two systems in analogy seek to resolve their tensions, but cannot, without the method of feedback, which internalizes the discipline of an outside observer into an observer within the system (cf. the somewhat analogous term "second-order cybernetics"). In life too, after struggling long for intellectual autonomy, Wiener finds his mature method by internalizing the corrective methods his father imposed upon him.

Thus, the father–son duo of Leo and Norbert Wiener become locked in what we might call with Douglas Hofstadter a "strange loop" (Hofstadter, 2007, pp. 101–102). Hofstadter explores "strange loops" in *I am a Strange Loop*, defining it at one point as the following:

> Not a physical circuit but an abstract loop in which, in the series of stages that constitute the cycling-around, there is a shift from one level of abstraction (or structure) to another, which feels like an

> upwards movement in a hierarchy, and yet somehow the successive "upward" shifts turn out to give rise to a closed cycle. That is, despite one's sense of departing even further from one's origin, one winds up, to one's shock, exactly where one had started out. In short, a strange loop is a paradoxical level-crossing feedback loop. (pp. 101–102)

A "strange loop" then is a sort of self-referential system in which, after proceeding through a series of steps that leaves one off where one began. A first strange loop is identified here in the scientific methods – proceeding from analogy to feedback loops – used by Leo and Norbert Wiener. A second strange loop is also identified in the two fields in America that these men dedicated to the universalizing study of cold war communication: Slavic studies and cold war cybernetics, two rare fields fluent in both cold war enemy scripts, Cyrillic and cryptographic. In short, both laid the groundwork, through a fundamental humanistic-mathematical unity in the method of analogy, for their own enterprising studies in what we might call communication science (in Leo's broad sense of the German *Wissenschaft*) for the short twentieth century.

Like father, like son: the humanist and universalist Leo Wiener

> Man lives for science as well as bread. (James, 1875/1987)

On 22 November 1894, Norbert Wiener was born in Columbus, Missouri to Margaret (Bertha) Kahn Wiener and Leo Wiener. Bertha was the daughter of a department store owner in St. Joseph, Missouri and a part Jewish Southern belle. Married to Leo in 1893, she was committed to domesticating her recently emigrated "beau" – a brilliant, fiery, small lion of a man – into the dignified middleclass Midwestern life she knew so well.

Leo Wiener (1862–1939), Norbert's father, would have been something to tame. Leo was born in Byelostock, White Russia (Belarus) to Salomon Wiener and Frieda Rabinowicz. Salomon, a devotee of Moses Mendelssohn and of German-Jewish reform, ruled his home with "a frenzied fury", to the point that he forbade Frieda from speaking her native Yiddish in her own home. Leo inherited his father's prodigious gift for languages, beginning a lifelong search for a universal knowledge of languages that his firstborn would later inherit as mathematics.

At nine, with native German, Hebrew, and Yiddish, and French well underway, Leo began teaching a friend Russian, which he had begun studying at eight. The rate was a one-hour lesson in exchange for "a quart of gooseberries". His parents ferried him among specialized schools, prefiguring what Leo and Bertha would do for Norbert a generation later. After a year in a classical gymnasium in Minsk, Belarus, where he added Latin, Greek, and German dialects, he was relocated to Warsaw at 12, where he learned Polish and Italian and Dutch from tutors and relatives. Conservative estimates of the total number of languages Leo learned well start at over 20 (Conway & Siegelman, 2005, p. 354; Wiener, 1966, p. 48).

A precocious, bold young man in late 1870s Berlin, Leo joined the Tolstoy Society, upholding the post-conversion Tolstoyian ideals of ascetic renunciation, naturalism, and a strict vegetarian and teetotaler's diet. In this company, he stirred dreams of founding a "vegetarian humanitarian socialist commune" in "the Newlands beyond the sea" (Conway & Siegelman, 2005, p. 9).

Broke, long haired, and 19, Leo set sail for Belize in 1882. He had hopes, like his near namesake "Levin" in Tolstoy's *Anna Karenina* and the *narodniks* of Russian intelligentsia, of founding abroad a commune to care for the natural land. On the transatlantic trip, he inhaled a dozen English grammars and soaked in Spanish from passengers. When his funds ran out in New Orleans, he abandoned the ship and moved up the Mississippi River, working as a locomotive laborer until he located a rumored vegetarian commune in Kansas, which lay deserted when he arrived.

After a year working in the fields alone, Leo returned to the civilized life of Kansas City, where he quickly rose from a janitor to a high school teacher to a noted figure in the local

Philosophical Society. At a related high society function, he met Bertha Kahn. In 1892, Leo was appointed a professor of modern languages at the University of Missouri in Columbia – and in 1893, Bertha and Leo were married. On 24 November 1894, Bertha gave birth to the first of their four children, whom they named Norbert after the hero of Robert Browning's romantic poem *In a Balcony.* In it, the noble protagonist, Norbert, endures dramatic intrigue before managing a true public expression of his love for his sweetheart Constance, a somewhat compromised character – after whom Norbert's sister would be named less than four years later.

In 1896, a faculty reorganization at Missouri denied Leo a chair in German languages. In response, he moved Bertha and his two-year-old son to Boston, where Leo made contacts as a freelance translator. He was soon appointed, without the conventional credentials, as the first Jewish professor at Harvard and the founder of the first Slavic language and literature program in America (Dyson, 2005). He began with a course offering Russian, Polish, and Old Church Slavonic languages, Slavic philology, and a literature course on Tolstoy. After a prolific 35-year career, Leo would retire in 1930 from the chair in Slavic language and literature that the structural linguist Roman Jakobson, who was incidentally also a participant in the Macy conferences on cybernetics, would fill in the heyday of Slavic studies at Harvard nearly two decades later (Department of Slavic Languages & Literature, 2010).

A colleague at Harvard once caricatured Leo, whose name means *lion*, as "an iconoclast spreading light and havoc" (Department of Slavic Languages & Literature, website, "about us" "history", 2010). Part Tolstoyan, part agnostic, all humanist, Leo socialized with a wide range of top European scholars, including the Polish philologist and inventor of Esperanto (1887) L.L. Zamenhof, the Czechoslovakian philosopher and statesman Thomas Masaryk, and the Russian geographer and anarchist Prince Peter Kropotkin. Many of these men shared with their American-based colleague something of the belief in a spontaneous symbolic order, underlying nature – a belief common among digital age anarchists and innovators as well. Leo, at least, seemed to believe that all things could be understood with study. His oeuvre is immense, ranging from key works in early Slavic studies such as the translation of the complete works of Leo Tolstoy, anthologies of Russian literature and drama, an *Interpretation of the Russian People*, a nineteenth century history of Yiddish literature, to areas well outside his field, including *Commentary on Germanic Laws and Medieval Documents*, *Africa and the discovery of America, Mayan and Mexican Origins*, and works on Arabic-Gothic culture and Christianity, among others.

His knowledge of natural sciences and mathematics was autodidactic, sure, and broad; the mathematician among Norbert Wiener's biographers suggests that only after earning a college degree in mathematics did Norbert surpass his father in mathematics (Masani, 1990, p. 32). Norbert called his father;

> A small, vigorous man, of emotions both deep and quick … ready to approve and to condemn, a scholar rather by nature than by any specific training … In him were joined the best traditions of German thought, Jewish intellect, and American spirit. He was given to overriding the wills of those about him by the sheer intensity of his emotion rather than by any particular desire to master other people. (Wiener, 1966, p. 18)

Despite his successes in America, Leo considered himself essentially a German liberal and expressed a somewhat naïve wish to win praise among German academics. "In this expectation, father had never been completely realistic" (Wiener, 1966, p. 46).

A childhood, thrice divided

Three resonant themes in Norbert Wiener's life and work were set into motion during his unusual and prodigious childhood: one, the painful integration of mind and body, mathematics and

biology; two, an unresolved religious identity from both his mother and father; and, as explored later, three, a tortured search for disciplined self-mastery from his father.

Leo and Bertha poured their energy into their precocious children, sometimes to overflowing. Norbert reportedly learned the alphabets at eighteen months, began reading Kipling back to his mother at three, and marveled on nature walks with his father at the "modest inconvenience" suffered by an earthworm cut in two (Wiener, 1953, p. 41).

Norbert excelled at the local public school until his father found him computing his multiplication tables on his fingers. As a result, between 1901 and 1903, Leo subjected Norbert to an intense experiment in prodigy home schooling; the experiment was conducted in the same family room and 24-month period in which Leo translated into English Leo Tolstoy's complete works, at a clip of one volume a month. At the end of two years, Leo had overseen his seven-year old's passage through the eighth grade, earning praise from the local Cambridge community for his methods, and simultaneously easing his family's financial pressures with his translation work. For his feat of translation, Leo earned $10,000, well over $200,000 in 2012 dollars.

But not all was well with Leo's methods. What Leo saw then as "tactful compulsion", Norbert recalled as "systematic belittling" four decades later. Norbert recounts Leo "verbally pummel [ing]" him with "half an ear" open for mistakes (Wiener, 1953, p. 67). Wiener recalled an algebra misstep would spark sarcasm and verbal abuse from Leo calculated to effect "a knout with many lashes", leaving Norbert feeling "morally raw all over" (p. 67).

As reflected in his autobiographies and the dedication to his book *Cybernetics*, Wiener would carry a dual image of his father as at once "gentle and loving" and "an avenger of blood" (Wiener, 1953, p. 67; see also epigraph to this article).

A future translator of books on the education of prodigies, Leo penned in the July 1911 edition of *The American Magazine* an article on new ideas in child training;

> It is nonsense to say, as some people do, that Norbert and Constance and Bertha are unusually gifted children. They are nothing of the sort. If they know more than other children of their age, it is because they have been trained differently. (*American Magazine*, vol. 72, 1911, p. 291)

Norbert recalls the turmoil he felt from these backhanded compliments. "My failures were my own", he admitted, "but my successes were my father's" (Wiener, 1953, p. 159).

Young Norbert strove to excel until, after an intense year under Leo's gaze, he was ordered by the (perhaps mercifully observant) family doctor to rest his eyes from all reading for six months. The medical leave of absence, as it were, threatened to ease Leo's disciplined regiment over his son, so he quickly shifted the curriculum from written to oral lessons. As a result, Bertha read him his lessons, while tutors reviewed his chemistry, Latin, and German (German poetry, especially Goethe and Heinrich Heine, still triggered emotion for the mature Wiener). And for half of a year, Norbert did all his mathematics in his head, eyes closed.

The results, Wiener reports, were transformative. "I relearned the world. My mind completely opened up. I could see things I never saw before" (Wiener, 1953, p. 75). Instead of counting on his fingers, he mastered the mental manipulation of symbols – a skill he considered "most valuable, for it forced me to be able to do my mathematics in my head and to think of languages as they are spoken rather than as mere exercises in writing" (Wiener, 1953, p. 76).

By mastering and manipulating his body by tuning out all visual inputs, he liberated his mind to see mathematics as a symbolic art and an aesthetic economy. The point here is not that Wiener mastered mathematics but he used his body to master his mind in new ways. It began with a boy with his eyes closed and his ears open. In maturity, Wiener argued that mathematics, which many see as the most factual of all sciences, is actually the most colossal metaphor imaginable. It thus must be judged aesthetically as well as intellectually in terms of the success of this metaphor.

He called mathematics a colossal metaphor in that it relates not facts but the elegance and the economy of symbols, anticipating French mathematician Louis Couffignal's phrase for cybernetics as "the art of securing the efficacy of action". After this six-month hiatus, Norbert returned to his voracious reading patterns, simultaneously pursuing projects in biology, zoology, electricity, and literatures – themes that would converge repeatedly in his lifetime work to animate "quasi-living automata" (Wiener, 1953, p. 65).

In 1904, Norbert began high school at the age of eight with a new challenge. His body, fed a strict vegetarian diet from birth, lagged perpetually as far behind his peers as his mind put him intellectually ahead. His physical motor skills, handwriting, note taking, and eyesight were poor throughout his life. A mentally quick, physically slow adolescent, "unaware", as he put it, "of the consequences of my actions", Wiener's (1953, p. 65) fascination with natural science stumbled up against his clumsiness in the laboratory. Such body–mind tensions only mounted, as Wiener had to choose between studying zoology and philosophy in college.

Two years later, in the fall of 1906, Leo enrolled Norbert, then 10 years old, in Tufts college, where the preteen prodigy enjoyed a breath of premature manly self-confidence. And understandably so: *The New York World Magazine* (1906) had recently called him, not without some exaggeration, the youngest "college man" in history. These body–mind tensions sprouted their commensurate disciplines as Norbert balanced his own interests in zoology against his father's insistence that he study philosophy. In the laboratory, his body fell ever clumsily behind his brain, running up what he later called "probably the greatest cost in apparatus per experiment … by a Tufts undergraduate" (Wiener, 1953, p. 105).

After enrolling in a zoology doctoral program against Leo's wishes, Norbert flopped after a semester of inadequate lab work, transferring from zoology, under Leo's guidance, to the Sage School of Philosophy at Cornell. He left zoology, his own field of choice, a lifelong enemy of vivisection and painfully sensitive to the tension between working with the sluggish matter of biology and the lightning quick immateriality of mathematics. This tension would later reconcile itself in Wiener's cybernetic merger of organic and mechanical systems.

In philosophy, his father's preferred field, Norbert experienced more success. He attended lectures by William James, regularly visiting the James' home with many others in the company of his father. He also personally interacted with and absorbed much of the American pragmatism of James, Josiah Royce, and C. S. Peirce, then little known except through Royce and James. He read deeply on the scientific method, imbibing, among others, Roger and Francis Bacon, Aquinas and Kant, Spinoza and Leibniz, the patron saint of cybernetics.

During his first year of graduate school, the mounting tension in Wiener's thoughts between the natural and the theoretical sciences, between zoology and mathematics, between the real and the symbolic came to a head in a personal issue that led Wiener to later call it "the black year of my life" (Wiener, 1953, pp. 108–109).

One day, 15-year-old Norbert overheard Professor Thilly of Cornell tell his father the great twelfth century rabbi, Moses Maimonides, was distantly related to the Wieners. He realized his parents had concealed their Jewish heritage from him. Upon reflection, it occurred to him that during his *Grossmutter* Freida's visit to her son Leo, the one foreign language newspaper that Norbert, then five, could not read had been in Yiddish. More stunning still, Wiener realized not only was his father Jewish but his mother Bertha – a repeater of then popular anti-Semitic sentiments in her home – bore the maiden name of Kahn, a variant of Cohen.

With an intellectual antagonist for a father, a Jewish anti-Semite for a mother, Wiener's teenage identity crisis was complete; a vicious cycle of body–mind and biological–intellectual tensions. He alternated between "a period of cowardly self-abasement and a phase of cowardly assertion, in which I was even more anti-Semitic than my mother" (Wiener, 1953,

pp. 148–149). As he saw it, his parents' "injudicious attempt to conceal from me my factual Jewish origin, combined with the wounds which I suffered from Jewish anti-Semitism within the family, contributed to make the Jewish issue more rather than less important in my life" (Wiener, 1953, p. 153).

After bouts of internal turmoil, he rediscovered hidden affinities in his attraction to Spinoza, Heinrich Heine, and Henri Bergson. Through this, Wiener continued to struggle in his studies at Cornell. Again, Leo intervened and Norbert was transferred back to Harvard in the fall of 1911. Capitulating to his father's wishes, Wiener reentered Harvard in philosophy, where he fell under the influence of several great philosophers and logicians of the early twentieth century including Josiah Royce, George Santayana, G.H. Palmer, R.B. Perry, and E.V. Huntington. In this environment, Wiener began to emulate his parents in pulling close those to whom he owed much with one hand, while pushing them away with the other.

His close collaborators included neurologist Warren McCulloch, polymath Walter Pitts, Julian Bigelow, information theorist Claude Shannon, Oliver Selfridge, psychiatrist Jerry Lettvin, and presidential science adviser Jerome Wiesner. Among these and others, only Arturo Rosenblueth, a Mexican doctor of Hungarian Jewish descent, was never isolated at some point by Wiener.

Among these colleagues, Wiener's one-time dissertation adviser, Josiah Royce, a philosopher of absolute idealism turned to pragmatism and mathematical logic, stands out. Wiener studied under Royce between 1910 and 1913, when Royce had a stroke. Wiener completed his dissertation, per his father's advice, under the direction of the logician Karl Schmidt at Tufts University.

Royce made a lasting impact on young Norbert. Nearly four decades later on page one of *Cybernetics*, Wiener mentioned Royce's summer workshops on the scientific method as a model for Wiener's subsequent interdisciplinary collaborations and, then, in his first autobiography (Wiener, 1948, p. 1, 1953, p. 166). He noted with an uncharacteristic lack of equivocation that Royce provided some of "the most valuable training" he ever had. Wiener did not specify the value of that training. Recently uncovered archival evidence from his papers has clarified that, in coursework and two interdisciplinary summer schools on the scientific method, Royce formally trained Wiener in thinking by systematic analogy.

After completing a post-doctorate at Cambridge under Bertrand Russell, Wiener returned to the USA with World War I brewing on the European continent and on his mind. His physical fitness repeatedly hampered his efforts to enter the US Army. At last, he succeeded near the war's end in joining only to serve a short, dull stint before being honorably discharged from the army in January 1919.

While in the army, Wiener grew close to Harvard's Professor W.F. Osgood, who shared Wiener's love of classics, mathematics, and physics; after the war's end, Wiener took Osgood's suggestion that he apply for the open position in mathematics at the Massachusetts Institute of Technology (MIT). In the fall of 1919, Wiener secured a temporary position as a lecturer at MIT, where he eventually rose to Institute Professor in 1960, a full interdepartmental omnibus position that he held until his death in 1964.

His varied and subsequent career has been adequately treated elsewhere (Conway & Siegelman 2005; Heims, 1982; Masani, 1990; Wiener, 1953, 1966); suffice it to note that Wiener returned in 1926 to Europe as a Guggenheim scholar to work with G.H. Hardy, an unofficial postdoctoral mentor at Cambridge and then with David Hilbert in Göttingen, Germany, the early twentieth century world capital of mathematical talent. Unmarried and needing to escape the creeping politics of interwar Göttingen, 31-year-old Wiener consented to his parent's arrangements by marrying Margaret Engemann, a non-Jewish German émigré that happened to share his mother's first name (Wiener, 1966).

Analogy, feedback, and the strange loops of cold war cybernetics

This second section stresses Norbert Wiener's vision of cybernetics as a union of grand-scale analogy making and closed-system feedback loops. These two concepts emerged in parallel to tensions in his own biography.

Analogy came first. "Objecting that cybernetics is merely an analogy", literary critic N. Katherine Hayles has argued, "was for [Wiener] akin to saying that cybernetics is 'merely about how we know the world'" (Hayles, 1999, pp. 91–99). Analogies and their contradictions are central to Wiener's extraordinary childhood education, his lifelong interest in the philosophy and method of science, as well as his articulation of cybernetics:

> Across the range of Wiener's writing, the rhetorical trope that figures most importantly is analogy. Understanding communication as relation suggests a deeper reading of this figure. Analogy is not merely an ornament of language but is a powerful conceptual mode that constitutes meaning through relation. When analogy is used to constitute agents in cybernetic discourse, it makes an end run around questions of essence, for objects are constructed through their relations to other objects. (Hayles, 1999, p. 99)

As trained under his father and Josiah Royce, Wiener was fond of finding a structural comparison and generalizing their unity. In cybernetics, he described the behavior of men and machines through a grand analogy of a control and communication system that unified neurological and circuit information signals.

Critics have long seen cybernetics as an over-reaching mathematical attempt to minimize the ontologically distinct systems in sloppy analogy, whether mind and body, machine and mediated society, model and modeled (Pierce, 1973). Whatever the value of the criticism of the shaken foundation upon which rests the core cybernetic analogy between "communication and control in the animal and the machine", it is at least clear that this weakness was not a loss on Wiener (Wiener, 1948).

In fact, his work brims with thought about imperfect analogies. Wiener was acutely aware that when two variables becom[e] equal or near equal, computationally exact comparison and analysis becomes increasingly difficult. He was fond of joking that "the best model of a cat is a cat – preferably the same cat", and his writings are littered with references to self-contradictory, unstable sets, and their problems – including Russell's paradox, his post-doctorate mentor at Cambridge with whom he had an almost immediate falling out. Even Wiener's first publications in 1914 and 1915 favor a "higher good" over any highest good and an ethic of relative relativism, in which even relativism has necessary limits (Wiener, 1914a, 1914b).

Throughout his work, Wiener captures these self-contradictory moments with frequent references to creator-creature analogies in which the creature becomes more powerful than the creator. In his 1948 masterwork *Cybernetics*, he catalogs a number of such stories. In Goethe's *The Sorcerer's Apprentice,* the master returns to stop the magic of the apprentice from destroying him. In the tale of the Arabian Nights, a fisherman talks a vengeful Genie back into his bottle. In the English story of the *Monkey's Paw*, the paw grants wishes to its owner with terrible, literal consequences, which Wiener applied to a cold war military that asked for victory by the magic of technology, but like the owner of the monkey's paw, does not know what terrible victory it will bring (Wiener, 1948, pp. 176–177). In the caste of Joseph in Egypt, Wiener favored the tale of the "totally efficient slave" wherein a Greek philosopher–slave becomes the master of the Roman household he serves. In this telling, the servant becomes the master by understanding the workings of the household well enough that his knowledge makes it impossible for him to remain both perfectly efficient and subordinate to the less-than-perfect orders of the Roman master. Perhaps no other anecdote expresses

as well Wiener's own lifelong search to balance his dual role as servant and master at home, at work, and in a world at war.

This same search for balance led Wiener, among others, to grapple with the second proto-cybernetic concept mentioned here: feedback, an engineering concept fit for bringing stability to uneven and chaotic environments. In his proto-feedback work in the 1920s and 1930s, Wiener observed feedback in the practices of control engineers while researching widely on Brownian motion, Fourier integrals, harmonic analysis, and analog computing. In 1935 and 1936, Wiener visited Beijing, claiming to have learned Mandarin on the transoceanic flight, thereby rehearsing his father's claim to having done so with English on the boat ride from Europe to New Orleans.

As an engineering practice, feedback is ancient but as a cybernetic concept, Wiener imported it from his work with control engineers in the 1920s and 1930s (Mayr, 1970; Mindell, 2004). Feedback is a process wherein the output of a given system is turned into an input of that system with the effect of influencing future output. Instead of checking itself against another system, as the method of analogy demands, a system in feedback turns inward, checking itself against its own past behavior. Thus, an automated thermostat works by a feedback loop, in which it checks the interior temperature of a room against the set target temperature and adjusts accordingly.

The technical term *feedback* comes in two basic types: positive and negative. The terms *positive* and *negative* refer to an arithmetic multiplier and carry none of the normative sense of when, say, a businessman speaks of receiving positive feedback from a client. The less desirable of the two types is a positive feedback loop. This is because it amplifies, through a positive multiplier, the effect of the next round of output without correction (Rosenblueth, Bigelow, & Wiener, 1943). Examples of positive feedback systems include avalanches, snow melting on black mountain soil, malignant cancer, viruses, cold war nuclear arms escalation, the consumer custom of keeping up with the Joneses, or even a star's progression into a supernova. All these behave according to positive feedback loops; their behavioral paths build in intensity until they burn out.

Systems in negative feedback do the opposite; they check their own growth and they self-regulate. Negative feedback corrects the effect of a signal by reversing it with a negative multiplier, thus avoiding burnouts and seeking sustainable dynamic balance. Examples include body temperature in warm-blooded animals, the proprioceptive balance of the inner ear, steam engine boilers with release valves, automated thermostats, ecosystems, and Madisonian checks and balances of democracy. For Wiener and his wartime research colleagues, negative feedback meant an enemy pilot flying his aircraft toward a target in the heat of battle (Mayr, 1989). In each example, an agent pursues a given goal by behaving predictably. All goal seeking agents, living beings or heat seeking missiles, share negative feedback mechanisms in common (Rosenblueth et al., 1943).

The concepts of analogy and feedback sped toward a convergence in the turbulent decade leading to the World War II. Between 1940 and 1941, as the German Luftwaffe blitzed London, Wiener signed on to a minor Defense Department contract to develop a predictive algorithm that could potentially help an anti-aircraft gun and gunner ensemble predict the path of an approaching enemy plane. Although his team failed to roll out an improved anti-aircraft gun before the war's end, Wiener's team found new significance in an airplane pilot's statistically predictable flight path toward a target on a bomb run. Namely, the anti-aircraft gun and gunner could exploit that predictability and serve as model for Wiener's first cybernetic human–machine assemblage.

In a seminal 1943 article "Behavior, Purpose and Teleology" Wiener and his coauthors found in their fire control work for the US military new philosophical heights for the concept of feedback, a mechanism common to all actors that behave purposefully. Three years later in 1946, the

field of metascience of cybernetics began to coalesce in the collaborative discussions of the Macy Conferences (Heims, 1991). By 1948, Wiener published his seminal piece, *Cybernetics: Control and communication in the animal and the machine*.

Wiener's book-length articulation of cybernetics in 1948 rested on a shared uniformity of nature between not just gunner and gun, but human and machine behavior. Cybernetics helped midwife into being what historian of science Peter Galison calls a vision of the "Enemy Other" as a rational, calculating, and predictable actor (Galison, 1994). Both enemy and ally, human and machine actors that sought goals strategically and thus predictably were merged into cybernetics' unified human-machine analogy.

Rational, calculating, and mechanical, human–machine agents constituted a new cold war military mode of thought. Although the neologism of "cyborg" for cybernetic organism took root only in the 1970s, the image of a new cybernetic man came with the war. A new "man hunting" model whose masculine physical prowess had been replaced by a ferociously strategic, rational mind formed a spitting image of Wiener's own mind–body tensions, fully mobilized against the German oppressors, now located across the ocean, and no longer his childhood living room (Haraway, 1989, pp. 216–217).

At the same time, Wiener was launching this well-known, war-fueled science of cybernetics, his life entered a new chapter: in 1939, Leo Wiener died; and with the passing of his original German oppressor, Wiener lost his lifelong external check, the outside observer who had long held his prodigy analogist son in check. His father's took place at roughly the same time as a full, painful interiorizing of his father's methods. "It was because of this, because my taskmaster was at the same time my hero, that I was not bent down into mere sullen ineffectiveness by the arduous course of discipline through which I went" (Wiener, 1953, p. 74).

In the years that followed, Wiener excelled by enforcing his father's strict methods upon himself, although he also continued to suffer from psychological patterns of work that exhibited signs of internal feedback tensions, both positive and negative. For decades, even while philosophizing about the virtues of negative, self-correcting feedback, his psychological states passed through periods of the oscillating highs and lows of positive feedback (self-exacerbating spirals). During these periods, he repeatedly fell into depression for weeks until his internal intellectual pressure built to the point of forcing some new mathematical breakthrough. Self-exacerbating, but unstable highs alternated with stable, but depressed lows.

Once suffering from a particular spell of delirium, he expressed his mature embodied relationship with mathematics; "I cannot say merely that the pain revealed itself as a mathematical tension, or that the mathematical tension symbolized itself as a pain: for the two were united too closely to make such a separation significant" (Hayles, 1999, p. 92).

Bound up in searing psycho-physiological emotion, Wiener saw in mathematics a balm to "reduce [his internal] discord to semi-permanent and recognizable terms" (Hayles, 1999, p. 92). The solution of this mathematical problem would "release it and pass on to something else" (p. 92). His embodied relationship with mathematics oscillated between self-exacerbating and self-correcting feedback loops. In the technical concept of feedback, we find a technical articulation of the correcting methods once imposed by Wiener's father but now practiced by himself on himself. In short, we may speculate that the mature Wiener internalized the external observer and found in his wartime work, a way to continue living and working without his greatest antagonist.

Of course, this type of psychoanalysis can also mislead, sliding into unhelpful reflections. I do not mean to argue Wiener's upbringing led him to embrace the concept of feedback in his work or that his father's death somehow compelled any specific breakthroughs in philosophizing feedback. Rather, I only mean to observe a plausible affinity between tensions in his domestic education and the conceptual forces at work in his career. Without putting too oedipal a point on

it, by internalizing his father's moody swings of discipline, Wiener's own mental swings rehearse the story of the slave that becomes a ruler in his master's house by means of self-mastery, only without the stability. In his writing, if not in his work, Wiener sought this stability in critical, frequent reference to stories such as the Sorcerer's apprentice overcome by his own magic, the genie fooled by his own powers, and the cold war faith in forestalling nuclear apocalypse through deadlock. In each, the imperfect command of the creator over its own creature stands out. Cantorian "paradoxes of the superlative" animated the mind of Norbert as a child who could never be good enough. This happened through paternal pressure to manipulate mathematics in his mind as a child, through driving him in maturity to new mathematical heights through periods of depression and inactivity, or through vaulting observations about aircraft pilots to general theories of human–machine relations.

In conclusion, we may observe how tensions raised in Wiener's biography resonate with larger enduring questions of the information age: What are the proper methods for identifying and verifying truths? How can one bring stability and control to a dynamic, unstable world? How can one situate, however uneasily, the material body in virtual-symbolic space?

Three subsequent notes follow. First, in life and work, Wiener long sought ways to independently and objectively verify the truth of a proposition – whether information received in the form of a message, or the larger structural analogy between systems of neural communication, circuitry, and social information flows. His search boils down to a basic observation. In a digital age and cognitivism, the method of thinking by analogy remains very much alive (Hofstadter, 1995; Hofstadter & Sander, 2013; Lakoff & Johnson, 1980). Work by analogy – as Russell, Royce, Wiener, and other early logicians were acutely aware – has a sort of troubling pre-postmodern character to it. It is no sure solution, for the analogies need to be inexact in order to help bridge difference. Yet in a Baudrillardian age, difference can be the last thing to be fixed; any digital message may be mechanically altered and the resulting hall of mirrors for modern representations of reality can bewilder even the most sober minded. So it is not surprising that the earlier founders of the information age, a philosophical age of limited relativism, proposed that structural analogy may serve as a way to press forward through the postmodern muddle.

Secondly, the instabilities built into Wiener's biography deserve some comment beyond the self-evident Freudian reading. Particular instabilities include his intellectual life arc from youthful analogic balancing of body and mind, religious identity, and his father's discipline. Another instability includes developing a whole metascience structured around systematic analogies between the behavior of man, machine, and other entities and that sustains at once, after his father's death, a mature philosophy of self-regulating feedback.

As only suggested here, a much larger intellectual backdrop on the cold war theater of ideas backlights this curious father–son portrait. The two fields the Wieners helped found in America in particular spoke the language of Galison's "Enemy Other" during the short twentieth century (Leo retired in 1930, well before Soviet-American relations turned publicly hostile). Both American Slavic studies and cybernetics enjoyed rapid growth periods in the postwar and early cold war periods. At the center, the story of Roman Jakobson, the structural linguist and the mid-century's leading cybernetic Slavicist, has only begun to be told (Geoghegan, 2011; Gerovitch, 2008).

Finally, a closer glance at the biographic sources of Wiener's cybernetics helps rethink a standard critique of cybernetics and the digital age. It is a common complaint since McLuhan and French theory that digital communication somehow virtualizes, disembodies, and mathematically reduces the material and messy reality of bodies, media, and symbolic exchange into a sterile immaterial world of the engineer's processors, storage, and transmission. And yet, the strange loops of Norbert and Leo Wiener suggest our concern about digital disembodiment is misguided, or at least incomplete. The origins of cybernetics and the digital communication tradition that follows it anchor themselves in the lived experience of oversized minds and awkward bodies,

psychological pain and war. This is not to reject the idea that digital communication does not virtualize and abstract the material-symbolic making of meaning, as indeed it can; rather, it is to suggest that, at least for Wiener, the promise of the mathematical universality of digital communication emerged not in order to avoid the material, embodied reality of life, but that he sought such a promise in part *because* of the material, embodied tensions that drove his life and work. Cybernetics is not so much an early attempt to virtualize our troubled reality, as it is the product of it.

Perhaps a fair antidote to the belief that digital communication disembodies life may yet be found in a fuller, future genealogical retelling of the very real lives of those that helped give such belief wings.

References

Conway, F., & Siegelman, J. (2005). *Dark hero of the information age: In search of Norbert Wiener, the father of cybernetics*. New York: Basic Books.

Department of Slavic Languages & Literature. (2008). *History of slavic languages and literatures at Harvard University*. Retrieved March 9, 2013, from http://slavic.fas.harvard.edu/icb/icb.do?keyword=k86637&pageid=icb.page497101

Dyson, F. (2005). The tragic tale of a genius. *The New York Review of Books*, *52*(12), 10–13.

Galison, P. (1994). The ontology of the enemy: Norbert Wiener and the cybernetic vision. *Critical Inquiry*, *21*(1), 228–266.

Geoghegan, B. (2011). From information theory to French theory: Jakobson, Levi-Strauss, and the cybernetic apparatus. *Critical Inquiry*, *38*, 96–126.

Gerovitch, S. (2002). *From newspeak to cyberspeak: A history of soviet cybernetics*. Cambridge, MA: MIT Press.

Gerovitch, S. (2008). *Roman Jakobson und die Kybernetisierung der Linguistik in der Sowjetunion* [Roman Jakobson and the Cybernetization of Linguistics in the Soviet Union]. In E. Horl & M. Hagner (Eds.), *Die Transformation des Humanen: Beitrage zur Kulturgeschichte der Kybernetik* [The Transformation of the Human: Contributions to the Cultural History of Cybernetics] (pp. 229–274). Frankfurt am Main: Suhrkamp Verlag

Haraway, D. (1989). *Primate visions: Gender, race, and nature in the world of modern science*. New York: Routledge.

Hayles, N. K. (1999). *How we became posthuman: Virtual bodies in cybernetics, literature, informatics*. Chicago: University of Chicago Press.

Heims, S. (1982). *John von Neumann and Norbert Wiener: From mathematics to technologies of life and death*. Cambridge, MA: MIT Press.

Heims, S. (1991). *The cybernetics group*. Cambridge, MA: MIT Press.

Hofstadter, D. (1995). *Fluid concepts and creative analogies: Computer models of the fundamental mechanisms of thought*. New York: Basic Books.

Hofstadter, D. (2007). *I am a strange loop*. New York: Basic Books.

Hofstadter, D., & Sander, E. (2013). *Surfaces and essences: Analogy as the fuel and fire of thinking*. New York: Basic Books.

James, W. (1875). *Vivesection*. (Reprinted in The works of William James: Essays, comments, and reviews, p. 11, 1987, Cambridge: Harvard University Press).

Kline, R. R. (2009). Where are the cyborgs in cybernetics? *Social Studies of Science*, *39*(3), 331–362.

Lakoff, G. & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

Masani, P. R. (1990). *Norbert Wiener, 1894–1964*. Berlin: Birkhaueser.

Mayr, O. (1970). *The origins of feedback control*. Cambridge, MA: MIT Press.

Mayr, O. (1989). *Authority, liberty, & automated machinery in early modern Europe*. Baltimore, MD: John Hopkins University Press.

Medina, E. (2011). *Cybernetic revolutionaries: Technology and politics in Allende's Chile*. Cambridge, MA: MIT Press.

Mills, C. W. (1959). *The sociological imagination*. New York: Oxford University Press.

Mindell, D. (2004). *Between human and machine: Feedback, control, and computing before cybernetics*. Baltimore, MD: John Hopkins University Press.

New York World Magazine. (1906, October 7). Hey, mother…isn't it time to go to college?

Peters, B. (2008). Betrothal and betrayal: The soviet translation of Norbert Wiener's early cybernetics. *International Journal of Communications*, *2*(11), 66–80.

Peters, B. (2012). Normalizing soviet cybernetics. *Information & Culture*, *47*(2), 145–175.
Pickering, A. (2010). *The cybernetic brain: Sketches of another future*. Chicago: University of Chicago Press.
Pierce, J. R. (1973). The early days of information theory. *IEEE Transactions on Information Theory*, *1*(19), 3–8.
Rosenblueth, A., Julian, B., & Wiener, N. (1943). Behavior, purpose and teleology. *Philosophy of Science*, *10*, 18–24.
Segal, J. (2003). *Le zéro et le un: Histoire de la notion scientifique d'information au 20e siécle* [The zero and the one; the story of information science in the 20th century]. France: Editions Syllepse.
Wiener, N. (1914a). The highest good. *Journal of Philosophy, Psychology, and Scientific Methods*, *9*, 512–520.
Wiener, N. (1914b). Relativism. *Journal of Philosophy, Psychology, and Scientific Methods*, *9*, 561–577.
Wiener, N. (1948). *Cybernetics, or communication and control in the animal and the machine*. Cambridge, MA: MIT Press.
Wiener, N. (1953). *Ex-prodigy: My youth and childhood*. Cambridge, MA: MIT Press.
Wiener, N. (1966). *I am a mathematician: The later years of a prodigy.* Cambridge, MA: MIT Press.