3 Sense and Nonsense in the Psychic Machine

> These paper wounds, four in type, were gradually and correctly understood to mean stop, please stop, do please stop, and O do please stop respectively, and following up their one true clue, the circumflexous wall of a singleminded men's asylum, accentuated by bi tso fb rok engl a ssan dspl itch ina, –Yard inquiries pointed out –> that they ad bîn "provoked" ay Λ fork, of à grave Brofèsor; àth é's Brèak–fast– table; ;acùtely profèšsionally *piquéd*, to=introdùce a notion of time [ùpon à plane (?) sù '' fàçe'e'] by pùnct! ingh oles (sic) in iSpace?!
>
> James Joyce, *Finnegans Wake*

It can be shown that information theory and Printed English are the logical outcomes of the earlier crossbreeding of ideas in the literary, psychoanalytic, and scientific experiments. As demonstrated in the preceding chapter, the statistical dimension of the 850-word Basic was Ogden's foremost concern from the start. This no doubt justifies Shannon's treatment of Basic and *Finnegans Wake* as the extreme opposites of redundancy and entropy in the English language. What I explore next is the way in which Shannon established the conceptual linkages among Basic, *Finnegans Wake*, the psychic machine, and the mathematical constructs which he developed for information theory.

In *The Mathematical Theory of Communication,* Shannon demonstrates that the extreme opposites of redundancy and entropy are each "represented by Basic English and by James Joyce's book *Finnegans Wake*."[1] Without mentioning C. K. Ogden or I. A. Richards by name, he explains that the Basic English vocabulary "is limited to 850 words and the redundancy is very high. This is reflected in the expansion that occurs when a passage is translated into Basic English. Joyce on the other hand enlarges the vocabulary and is alleged to achieve a compression of semantic content" (56). The expansion of which Shannon speaks was, indeed, regularly and systematically carried out by Ogden and Richards in the 1930s. Those texts were wide ranging and included the Bible (Genesis 1; I Samuel 15; Job 1, 2; Matthew 2; Mark 2) and ranged from high modernist literature to popular texts, such as Louisa May Alcott's *Little Women*, George Bernard Shaw's *Arms and the Man*, Robert Louis Stevenson's *Treasure Island*, and so on. In the appendixes to *Basic English*, Ogden makes a point of highlighting some of the noteworthy samples, literary as well as scientific, that have been converted or expanded from the original English texts to the 850-word Basic.

C. K. Ogden shows a strong interest in the statistics of acquired vocabularies from different classes and ethnolinguistic groups around the world. The samples, randomly chosen, are given in the following estimate: "The 'normal vocabulary of the average man' hovers between the alleged 300 words of the Somersetshire farmer, the 4,000 of President Wilson's State Papers, the 7,000 of the Japanese diplomat, the 12,000 of the Eskimo fisherman or the average undergraduate, the 30,000 of Sir Vade Mecum, C.V.O. at Geneva, and the 250,000 of a James Joyce."[2] This last number is the most impressive. It indicates that his grasp of the implications of Joyce's literary experiments already anticipated the way in which the electric engineer Shannon would make use of the same statistics from Joyce and Ogden's own Basic in postwar years.

Shannon's mention of Joyce, on the other hand, may strike literary scholars as a bit unusual. The first reaction would be skepticism: How substantial is the connection here? Although we are not told which specific passages from *Finnegans Wake* were actually assigned to the human subjects who participated in Shannon's guessing games or whether they were assigned at all, Joyce's work has been singled out by Shannon as an extreme case to illustrate the lower threshold of redundancy within the range of stochastic possibilities allowed by English prose. There is no reason why

1. Shannon and Weaver, *The Mathematical Theory of Communication,* 56.
2. C. K. Ogden, *Basic English: International Second Language*, 9.

literary scholars should be alarmed by the manner in which Shannon approached Joyce or be put off by his lack of interest in the semantic content of Joyce's text. For all intents and purposes, the mathematician's attention was focused on the stochastic structure of the prose he discovered in *Finnegans Wake*. This had direct implications for the limits of Printed English, which he was analyzing, and raised interesting questions about the nature of alphabetical writing that would have interested Joyce himself. We should ask, for example, Is the stochastic approach a legitimate one with respect to a high modernist text? Does Shannon's mathematical interest throw unexpected light on some aspects of Joyce's literary experiment that have heretofore been suppressed in our readings? Following the discussion of the statistical recasting of English writing from Basic and information theory in chapter 2, we now reflect on the problem of sense and nonsense between the communication machine and the psychic machine and offer an interpretation of Joyce's approach to alphabetical writing in *Finnegans Wake*.

Finnegans Wake: A Hypermnesiac Machine?

To literary critics and ordinary readers, James Joyce's *Finnegans Wake* borders on the illegible. Numerous commentaries and compendia have been published to help the reader plod along if they are curious enough to persist through the reading. But writers, literary critics, and college students are not the only ones who read James Joyce. Many others like Ogden, Shannon, and Pierce have also been fascinated and challenged by the bold experiments they discover in *Finnegans Wake*. These experiments range from multilingual verbal puns to exuberant nonsense or barely legible words such as "alaphbedic," "televisible," "iSpace," "verbivocovisual," and so on. It seems that literary theory is still trying to catch up with this modernist engineer *avant la lettre* of a cyberspace of outrageous signs and letter sequences.[3] The strange incongruence between the eminence of this English writer and the poorly understood projects he and his fellow writers and scientists mounted at the height of modernism has been striking and should concern us in this study.

3. Donald F. Theall, for instance, discusses in great detail how Joyce anticipated the age of the microcomputer and the micro's relationship with telecommunication in *Beyond the Word: Reconstructing Sense in the Joyce Era of Technology, Culture, and Communication*. See also Louis Armand, *Technē: James Joyce, Hypertext & Technology*; Darren Tofts and Murray McKeich, *Memory Trade: A Prehistory of Cyberculture*; and Thomas Jackson Rice, *Joyce, Chaos, and Complexity*.

Derrida, for example, confessed in 1982 that he had been grappling with Joyce for nearly twenty-five to thirty years and that his "Plato's Pharmacy" was a reading of *Finnegans Wake*. Conversely, the same essay was also anticipated and read "in advance by *Finnegans Wake*, in its wake, or its lineage, at the very moment that 'La Pharmacie de Platon' was itself presenting itself as a reading-head or principle of decipherment (in short another software) for a possible understanding of *Finnegans Wake*."[4] Inasmuch as Derrida wrote in the wake of Mallarmé, Stein, Pound, and Joyce, the "wake" cannot but introduce a measure of indebtedness and all that is to come in the post-Joycean modernist lineage. It is interesting that the figure of the "reading-head" and "software" translates a textual indebtedness into a definitive technological procedure. It encourages us to reflect on the act of reading as decoding a form of technologized inscription on the magnetic tape of Joyce's word machine. The machine becomes the *material condition* of Derrida's arche-writing and its modernist ethos. To be condemned to late arrival on the scene of writing is to be haunted by Joyce.

In "Two Words for Joyce," Derrida offers some interesting speculations upon the implications of *Finnegans Wake* in anticipation of the future of computer technology. He writes:

> He [Joyce] talks about it often enough for there to be no simple confusion between him and a sadistic demiurge, setting up a hypermnesiac machine, there in advance, decades in advance, to compute you, control you, forbid you the slightest inaugural syllable because you can say nothing that is not programmed on this 1000th generation computer—*Ulysses*, *Finnegans Wake*—beside which the current technology of our computers and our microcomputerified archives and our translating machines remains a bricolage of a prehistoric child's toys. And above all its mechanisms are of a slowness incommensurable with the quasi-infinite speed of the movements on Joyce's cables. How could you calculate the speed with which a mark, a marked piece of information, is placed in contact with another in the same word or from one end of the book to the other? For example, at what speed is the Babelian theme or the word "Babel", in each of their components (but how could you count them?), co-ordinated with *all* the phonemes, semes, mythemes, etc. of *Finnegans Wake*? Counting these connections, calculating the speed of these communications, would be impossible, at least *de facto*, so long as we have not constructed the machine capable of integrating all the variables,

4. Jacques Derrida, "Two Words for Joyce," 150. In a footnote to "Plato's Pharmacy," Derrida already points to this connection with *Finnegans Wake*. See Derrida, *Dissemination*, 88n20.

> all the quantitative or qualitative factors. This won't happen tomorrow, and in any case this machine would only be the double or the simulation of the event 'Joyce', the name of Joyce, the signed work, the Joyce software today, joyceware.[5]

The thought of a "hypermnesiac machine" designed to anticipate all one can possibly say in a language and exhaust every conceivable combination of verbal elements is a terrifying one. Derrida's admiring resentment toward Joyce is rooted in his modernist ambivalences about the increasing dominance of prosthetic machines in human affairs. What is "joyceware" if it is not the ultimate homage Derrida or anyone could pay to Joyce? And what would Joyce have said to the author in response?

For one thing, Joyce would certainly have concurred with the idea that *Finnegans Wake* was a feat of engineering that was intended to surpass the most advanced computer that has ever existed or will ever exist. Donald F. Theall argues, for instance, that Joyce approached language (writing) as a mathematical structure and an engineering problem. In the course of writing *Finnegans Wake*, then known as the *Work in Progress*, the ambitious novelist wrote to his patron Harriet Shaw Weaver that this book would prove him to be "the greatest engineer," an interesting claim put forth by someone who was prepared to devote seventeen years of his life (1922–39) to this single work.[6] Theall outlines three aspects of Joyce's claim that go beyond mere metaphor. First, Joyce literally conceived his work as a kind of a machine. Second, "the *Wake* encompasses several aspects of engineering: chemistry, mechanics, mathematics, geography, and strategic planning." Third, Joyce came to realize the extent to which the activities of arts and communication in his period "involved new modes of social organization and of technological production, reproduction, and distribution."[7] Here, we can add a fourth dimension to Theall's perceptive reading, namely, Joyce's anticipatory contribution to communication engineering itself. This consists of his effort to bring the statistical properties

5. Jacques Derrida, "Two Words for Joyce," 147–48.

6. See Donald Theall, "The Hieroglyphs of Engined Egypsians: Machines, Media and Modes of Communication," 132. Theall excerpts the following from Joyce's correspondence: "In the meantime, I am preparing for it . . . by pulling down more earthwork. The gangs are now hammering on all sides. It is a bewildering business. I want to do as much as I can before the execution. Complications to right of me, complications to left of me, complex on the page before me, perplex in the pen beside me, duplex in the meandering eyes of me. And from time to time I lie back and listen to my hair growing white" (134–35).

7. Theall, "The Hieroglyphs of Engined Egypsians: Machines, Media and Modes of Communication," 134.

of letter sequences and spaces among words and nonwords to light. His act of engineering involved subjecting the statistical mechanism of alphabetical writing to an elaborate literary experiment two decades in advance of Shannon's experiment with the statistical models of Printed English. In fact, the founder of information theory himself has mentioned using the statistical properties of the *Wake* in the course of conceptualizing his mathematical theory of communication. Moreover, it was precisely during the time interval between Joyce and Shannon that communication engineering became a statistical science and a branch of statistical mechanics.[8] This aspect of cybernetic developments is discussed in a later section.

No doubt, the idea of a "hypermnesiac machine" is a brilliant one and works extremely well with the *Wake*.[9] But where Joyce would disagree with Derrida is that his machine is programmed with a coding system that is "nat language in any sinse of the world."[10] To expect a computer to think in terms of "syllables" or recognize things like phonemes, semes, mythemes, etc. is not so much to make a demand on its speed and hardware as it is to ask the machine to be a linguist like Roman Jakobson. Derrida's slip of the tongue is intriguing. Could it have been an unconscious reaffirmation of the structural theory of language that he had deconstructed elsewhere? Whatever assumptions he may have held about telecommunication when proposing the trope of "joyceware," there will not be phonemes and verbal utterances in either the hardware or software of a computer. The computer obeys symbolic logic alone and works with numbers and letters that do not stand for syllables or phonemes in natural languages. It is unlikely, therefore, that joyceware—Derrida's smart parody in the spirit of the "wake"—can ever be made to operate in linguistic terms, pace Jakobson. By the same token, if a reader claims that he or she can identify phonemes, semes, mythemes in the *Wake*, it could only mean that he or she has construed these "linguistic facts" on the basis of the printed text in the reading process.

Garrett Stewart brings this cognitive process of reception to our attention in his reading of the pressures of "pronunciation upon script" in Joyce's text.[11] Stewart's reading, however, forgets to take the figure of the hypermnesiac machine into account as he ponders the unexpected erup-

8. See Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine*, 2nd ed., 8–10.

9. Elsewhere, Derrida gives an analysis of the figure of the machine in *Ulysses*. See his "Ulysses Gramophone: Hear Say Yes in Joyce," 253–309.

10. Joyce, *Finnegans Wake*, 83.

11. See Garrett Stewart, *Reading Voices: Literature and the Phonotext*, 245.

tion of "phoneme" in Derrida's interpretation of the *Wake*. For he takes this slip of the tongue to be the philosopher's unguarded reaffirmation of the priority of the phonic in the *Wake* when it could have been understood as a misguided phonocentric figuring of the computer. Stewart argues that "though no one, even to oneself, can of course say two sounds at once, even though prompted by a single letter, any of us *is* able to register, by phonic rather than graphic deferral, what amounts to an aural rather than scriptive palimpsest, an overlapping of phonemes" (246). The point is not whether the reader can register polyphony in his or her mind's ear but how the written letter is able to sustain the illusion of human voice or polyphony in silent reading at all, much less orchestrate the play of meanings across different semiotic systems.

Intuitive reflections on the phonetic alphabet appear to support the impression that letters stand for the sounds of speech. But which sounds? C. K. Ogden once complained about the excessive irregularities of English sounds with respect to the letters that were supposed to represent them. He said, "The vowels represent not 7 sounds but 54, the 26 letters of the alphabet giving a total of 107 values, or with the vowel digraphs ('each', 'ou', etc.) and multigraphs ('eau', etc.) 280"; then he added, "To distinguish all these in a vocabulary of 20,000 words, or even 2,000, necessitates an amount of drudgery which has given phoneticians and advocates of synthetic languages their opportunity."[12] Ogden's statistical view of alphabetical writing and English phonetics was an obvious impetus for launching his Basic English. The same view could very well be the starting point of the *Wake*, except that the irregularities of the sound and letter correspondence in English offered Joyce an excellent opportunity to exploit the rich ambiguities of verbal elements and tease out the surprising convergences of the boundaries of languages on his hypermnesiac machine.

As for how these elements are brought together in the *Wake*, Theall has suggested three communicating systems of particular relevance to consider. These are "traditional sign systems (hieroglyphs, alphabets, icons, drawings), technologically mediated modes of reproduction (print, telephone, film, television), and crafted modes of popular expression dependent either on the traditional or the technologically mediated modes (riddles, comics)." These systems coexist in one "integrated semiotic machine" that is grounded not so much in the logos as in gesture.[13] "The grounding of communication in gesture is underlined" by a quote that Joyce lifted

12. C. K. Ogden, *Basic English: A General Introduction with Rules and Grammar,* 21.
13. See Theall, "The Hieroglyphs of Engined Egypsians," 151.

and modified "from [Marcel] Jousse on the opening of the Gospel of St. John: 'In the beginning was the Word . . .' " : "In the beginning was the gest he jousstly says, . . ."[14] Theall explains "the gesture (gest, F. geste) as an act that is linked to the mechanics of humor (i.e., jest) and to telling a tale (gest as a feat and a tale or romance)."[15] Chapter 2 touched briefly on Leroi-Gourhan's work on graphism and its centrality in Derrida's proposition of arche-writing (*archi-écriture*). It is clear that their theoretical insights also resonate with the earlier modernist discussions of writing in Joyce's own time. In his comments on Joyce's *Work in Progress*, Samuel Beckett shows a lucid grasp of the ideographic implications of gesture in alphabetical writing. "This writing that you find so obscure is a quintessential extraction of language and painting and gesture, with all the inevitable clarity of the old inarticulation," writes Beckett, "here is the savage economy of hieroglyphs. Here words are not the polite contortions of 20th century printer's ink. They are alive. They elbow their way on to the page, and glow and blaze and face and disappear."[16] Not unlike elementary mechanical systems of communications such as signals and flashing lights, the dancing of printed "words of silent power" on the page of the *Wake* embodies what I have termed the ideographic movement of the phonetic alphabet.[17]

In *The Post Card*, Derrida relates his fascination with what Joyce has achieved in *Finnegans Wake* and writes: "For that seminar on translation I followed all the Babelian indications in *Finnegans Wake* and yesterday I wanted to take the plane to Zurich and read out loud sitting on his knees, from the beginning (Babel, the fall, and the Finno-Phoenician motif, *'the fall (bababadalgh[. . .]. The great fall of the offwall entailed at such short notice the pftjschute of Finnegan [. . .].*" The italicized Joycean quote and Derrida's mimicking continue and take up more than half a page.[18] Derrida speaks furthermore about a desire to imitate Joyce: "Never have I imitated anyone so irresistibly" and confesses that he has been "haunted by Joyce, whose funerary statue stands at the centre of the *Envois* (the visit to the cemetery in Zurich). This haunting invades the book, a shadow on every page, whence the resentment, sincere and acted, always mined, of the signatory."[19] The opening of *Glas* literally echoes the opening of the *Wake* by ruminating

14. Joyce, *Finnegans Wake*, 468.

15. Theall, "The Hieroglyphs of Engined Egypsians," 137–38.

16. Samuel Beckett, "Dante . . . Bruno. Vico.. Joyce," 16–17.

17. Joyce, *Finnegans Wake*, 345.

18. Jacques Derrida, *The Post Card: From Socrates to Freud and Beyond*, 240–41.

19. Derrida, *The Post Card*, 142, and "Two Words for Joyce," 150. The visit refers to his trip to Joyce's tomb on June 20, 1978. See *The Post Card*, 148.

on the word "fall." It is the opening brought up earlier in connection with Shannon's stochastic experiment:

> The fall (bababadalgharaghtakamminarronnkonnbronntonnerronntuonnthunntrovarrhounawnskawntoohoohoordenenthurnuk!) of a once wallstrait oldparr is retaled early in bed and later on life down through all christian minstrelsy.

Compare the quote with the opening of *Glas*: "Of the remain(s), after all, there are, always, overlapping each other, two functions. The first assures, guards, assimilates, interiorizes, idealizes, relieves the fall [*chute*] into the monument. There the fall maintains, embalms, mummifies itself, monumemorizes and names itself—falls (to the tomb(stone)) [*tomb*]. Therefore, but as a fall, it erects itself there" and so on.[20] Derrida continues in this vein through the next page as if writing is a manner of coping with the ghost of Joyce, settling a score, and discharging an old debt. However, Derrida's indulgence in etymological and semantic contortions of the word *chute* (the "fall") is a reading that Joyce set out to frustrate deliberately by inserting a nonsense 100-character string after the "fall" on which Derrida makes absolutely no comment, although he was the first theorist to intuit the *Wake* as a hypermnesiac machine and to call Joyce's language game joyceware. It behooves us to ask what Derrida's insights can teach us about Joyces's typographic experiments in the *Wake* that the blind imitation in *Glas* has nonetheless elided.

Let us take a cue from Beckett and analyze joyceware or Joyce's language game as the effect of an elaborate graphic choreography that mobilizes printed words on a two-dimensional stage, or what Joyce terms "paperspace."[21] The nonsense letter sequence within the parentheses after the "fall" precipitates a horizontal ideographic tumbling of the letters to simulate the fiction of an action. What Lacan has called "the precipitation of an unexpected meaning" in "The Instance of the Letter" couldn't have better described the "fall" of the 100-letter sequence in Joyce's stochastic experiment with chance. Philippe Lacoue-Labarthe and Jean-Luc Nancy, who remain the most astute interpreters of Lacan to this day, might have been commenting on the opening of the *Wake* when they tried to explain Lacan's notion of the signifier in *The Title of the Letter*:

20. Derrida, *Glas*, 1–2.
21. Joyce, *Finnegans Wake*, 115.

> The passage of the signifier into that symbolization (the equivalent, therefore, of the process in which signification is engendered) is presented as a "precipitation of meaning." This is a remarkable formulation, since it lends itself to at least three interpretations, which are, moreover, amusing: for this can just as well mean that meaning falls head first (and one does not say where . . .), or that meaning goes too fast, that it short-circuits the signified (man and woman, as concepts, are hardly audible any longer but through the door), or finally, that meaning precipitates in the chemical sense of the word, that is to say that it settles as such amidst the solution of the signifier.[22]

It is interesting that the signifier's movement, speed, chemistry, and even an implied circuit rather than its sound image ("hardly audible") are considered relevant to Lacan's notion of the "signifier," which had been Saussure's own term. Lacan's relationship with structural linguistics will be explored in the next chapter, but for the moment, let us try one possibility in the face of Garrett Stewart's critique. That is, even if a reader, while visually and mentally scanning the precipitation of the 100-letter sequence, is tempted to pronounce the impossible syllable sequence or tries to reintroduce the materiality of the sound image into Joyce's text, she or he is bound to discover that there are phonic elements but no phonemes to mark in the text. Marking the phoneme means closing off the boundaries of a single linguistic system (English, German, French, or other) relative to which a phoneme is strictly taken to function, and this is precisely the kind of linguistic sanctuary Joyce has refused to grant the reader.

When Joyce first began his work on *Finnegans Wake* in 1922, Harry and Caresse Crosby proposed that someone should write an introduction to his *Tales Told of Shem and Shaun*, which consists of some fragments from the *Work in Progress*. Joyce mentioned Julian Huxley and J. W. N. Sullivan. But when the scientist and the musicologist each made excuses, Joyce proposed C. K. Ogden, rightly surmising that "the co-author of *The Meaning of Meaning* and the inventor of Basic English would not resist an invitation to discuss this linguistic experiment."[23] Richard Ellmann, Joyce's biographer, also mentions that "he wished also for Ogden to comment, as a mathematician, upon the structure of *Finnegans Wake*, which he insisted was mathematical. If Ogden had refused, Ford Madox Ford was to have been asked, but Ogden accepted, and later was to translate *Anna Livia Plurabelle* into Basic, and to arrange for Joyce to record that fragment for the Ortho-

22. Philippe Lacoue-Labarthe and Jean-Luc Nancy, *The Title of the Letter: A Reading of Lacan*, 42.
23. See Richard Ellmann, *James Joyce*, 614.

logical Institute" (614). The Basic translation of this fragment appeared in Ogden's journal *Psyche* in 1931 and was then reprinted in *transitions*. As an admirer of Joyce's work, Ogden contributed a foreword to the Black Sun edition of *Tales Told of Shem and Shaun* in 1929.

Working closely with Joyce at the time, Ogden appeared to agree that *Finnegans Wake* was mathematical and even estimated the novelist's vocabulary at a colossal number of 250,000. Does the number represent the entire repertoire of the Joycean lingo, both words and nonwords included? We have no way of knowing. But as we follow Joyce's experimental forays into exotic letter sequences, one thing becomes clear, that is to say, Joyce would not abandon his play with "meaning" and would always strive to create the illusion of polyphony even at his most outrageous moment of playfulness with polyseme. With Shannon, it was a different matter. The mathematician tried to push his experiment with Printed English into the realm of pure ideographic symbols. In so doing, he assumes a radical rupture between the written alphabet and the spoken language that it supposedly represents. In fact, the letter sequences in Printed English are almost devoid of linguistic "meaning" inasmuch as what is left of meaning is made to migrate from language to the ideographic utopia of mathematical symbols. It is not as if mathematical symbols have no meaning. They do, of course, and all ideographic systems are meaningful, but these meanings need not be mapped onto any particular spoken language. The complex interplay of sense and nonsense between ideographic writing and language merits some discussion as we further tease out the mathematical implications of Joyce's writing.

At the tenth meeting of the Macy Conference of the cyberneticians, for example, the linguist Y. R. Chao was invited to speak on these questions, and he raised the issue of "sense" at the intersecting point of visual word recognition and the production of phoneme. He argues that what makes "sense" in writing may well be nonsense in speech, and vice versa, and demonstrates it by pushing the Joycean experiment to another extreme in Chinese writing. The test uses 106 written characters (with frequent repetition) in classical Chinese to write a story titled "The Story of Mr. Shi Who Eats Lions," which makes perfect sense in a silent perusal of classical Chinese characters. Of course, this improbable tongue-in-cheek story about a man trying to eat ten lions was made up by Chao to make a point. When the story is read aloud in Mandarin, the prose turns into a string of nonsense syllables and incomprehensible babbling even with proper phonemic markers such as the four tones (phonemes in Mandarin). This is because the characters repeat the same syllable *shi* in the pinyin romanization

(*shih* in the Wade-Giles). Here are Chao's 106 written characters along with a pinyin transcription that includes the four tones of Mandarin:

石 室 詩 士 施 氏 嗜 獅 誓 食 十 獅 氏 時 時 適 市 視 獅 十 時 氏
適 市 適 十 碩 獅 適 市 是 時 氏 視 是 十 獅 恃 十 石 矢 勢 使 是
十 獅 逝 世 氏 拾 是 十 獅 屍 適 石 室 石 室 濕 氏 使 侍 試 拭 石
室 石 室 拭 氏 始 試 食 是 十 獅 屍 食 時 始 識 是 十 碩 獅 屍 實
十 碩 石 獅 屍 是 時 氏 始 識 是 實 事 實 試 釋 是 事

shí shì shī shì shī shì shì shī shì shí shí shī shì shí shí shì shì shí shí shì shì shī shí shí shì
shì shì shì shí shí shī shì shì shì shí shì shì shì shí shī shì shí shí shì shì shǐ shì
shí shī shì shì shì shí shì shí shī shī shì shí shì shí shì shī shì shǐ shì shì shì shí
shì shí shì shì shì shǐ shì shí shì shí shī shī shí shí shǐ shí shì shí shí shī shī shí
shí shí shí shī shī shì shí shì shǐ shí shì shí shì shí shì shì shì shì

Stone house poet Mr. Shih was fond of lions and resolved to eat ten lions. The gentleman from time to time went to the market to look for lions. When, at ten o'clock, he went to the market, it happened that ten big lions went to the market. Thereupon, the gentleman looked at the ten lions and, relying on the *momenta* of ten stone arrows, he caused the ten lions to depart from this world. The gentleman picked up the lions' bodies and went to the stone house. The stone house was wet and he made the servant try and wipe the stone house. The stone house having been wiped, the gentleman began to try to eat the ten lions' bodies. When he ate them, he began to realize that those ten big lions' bodies were actually ten big stone lions' bodies. Now he began to understand that this was really the fact of the case. Try and explain this matter.[24]

Unlike Joyce's nonsense sequence of 100 letters, Chao's 106 syllables can be pronounced yet make no sense to the native ear. But the written characters carry enough information to make sense regardless of how or whether the characters are pronounced. Chao's demonstration of the passage at the Macy Conference has nothing to do with the monosyllabic nature of the Chinese language, which has been a popular but mistaken view, one that projects the alphabetical transcription of the written character, such as /shi/ in the pinyin, onto the spoken language.[25] What Chao is really doing with

24. The English translation used here was done by Chao himself. He also appends a footnote explaining that the character 碩 is pronounced *shì*, although this character also has an alternative pronunciation shuò. See Y. R. Chao, "Meaning in Language and How It Is Acquired," 65–66.

25. For a historical critique of this misunderstanding in comparative philology, see my *The Clash of Empires*, especially the chapter "The Sovereign Subject of Grammar," 181–209.

this improbable passage is emphasizing that the written character plays an important role in constraining the stochastic occurrences of spoken syllables in Mandarin or any other language in China. Moving in the direction of Shannon's stochastic analysis of Printed English, Chao's passage suggests an extremely high level of redundancy in transcribing spoken Mandarin, hence, very little information; but at the same time his 106-written-character sequence exhibits a high level of entropy in classical Chinese. This seeming anomaly—opposing tendencies of redundancy and entropy rates between writing and speech embodied by the same characters in Chao's passage—has fascinating ramifications for our understanding of writing as technology in general.

It is indisputable that reproducing alphabetical letters by hand or machine is much easier than reproducing the square-character script (Chinese script). With the invention of the typewriter, the cause of alphabetical writing was so vastly advanced that many, including McLuhan, began to attribute so-called Western rationality and modern progress to the phonetic alphabet itself. To be consistent in his argument, McLuhan went out of his way to argue that the printing technology and movable type were also invented in Europe. Nevertheless, McLuhan has touched upon a fascinating issue concerning the relationship of script and telecommunication, for there is something to be said about the essential differences between the phonetic alphabet as a simple code on the one hand and, on the other, the square-block character script, legal contracts, signatures, forms, various styles of font type like italics and cursive in alphabetical or nonalphabetical script, not to mention other marks or patterns that cannot be reduced to simple uniform code when it comes to telecommunication. In the age of the typewriter, the degree of difficulty in reproducing the square-block character script and other complex fonts in alphabetical writing was severely constrained by the simplicity of the technology itself. The limitation of the typewriter was overcome by the introduction and popularization of the facsimile machine and then by the more sophisticated computing technology. With *kanji* (square-block character) script in mind, Japanese companies dominated the facsimile machine industry and accounted for more than 90% of worldwide sales in the 1980s-90s.[26] The fax machine and today's computer are capable of transmitting a vastly greater amount of information than the short, readable code for each character, as with

26. Michael J. Enright, "Japanese Facsimile Industry in 1990."

the typewriter. Commenting on *kanji* script and forms, contracts, and signatures, which "pose problems that the encoding of characters cannot deal with," John R. Pierce and A. Michael Noll pointed out in 1990: "mere readability doesn't suffice. In a real-estate transaction, for instance, offers should look right, and they should be signed. Fax makes it possible to send such documents, or an image of them, more quickly and conveniently than by mail. And one can send advertising copy, or marked-up text, or a host of other things that electronic mail deals with awkwardly or not all."[27] Of course, since the authors published that view, the encoding technology and memory chips of the computer have evolved further to elbow out the fax machine, making the functionality of electronic word processing in any known scripts or fonts possible and practical. Today, due to the ease of character input on the cell phone, text messaging has become by far the single most popular form of telecommunication in the sinographic world.

A similarly materialist view of writing and technology is what drives Joyce's literary experiment in *Finnegans Wake*, and here is how the novel allegorizes the history of inscription:

> A bone, a pebble, a ramskin; chip them, chap them, cut them up allways; leave them to terracook in the muttheringpot: and Gutenmorg with his cromagnon charter, tintingfast and great primer must once for omniboss step rubrickredd out of the wordpress else is there no virtue more in alcohoran. For that (the rapt one warns) is what papyr is meed of, made of, hides and hints and misses in prints. Till ye finally (though not yet endlike) meet with the acquaintance of Mister Typus, Mistress Tope and all the little typtopies. Fillstup. So you need hardly spell me how every word will be bound over to carry three score and ten toptypsical readings throughout the book of Doublends Jined (may his forehead be darkened with mud who would sunder!) till Daleth, mahomahouma, who oped the closeth thereof the. Dor. (20)

The mini mock history of literacy, print, and civilization gives the illusion of a voice discoursing in puns and nonsense words whereas what is really happening in what Shannon would call "time series" is the movement of a reading-head *avant la lettre* or our eyes doing the visual scansion of "Typus," "Tope," "typtopies," "toptypsical," "wordpress," "prints," "." and so on in rapid typographical procession. The Latin word *typus*, which derives from the Greek *typos*, suggests a "mark," "impression," or "impressed form" on a prepared surface like ramskin or papyrus. This manner of creating surface

27. John R. Pierce and A. Michael Noll, *Signals: The Science of Telecommunications*, 23.

"words" or "verbivocovisual" prints cannot but make a new demand on the movement of "arche-writing," submitting it to the test of the Joycean wordpress and the materiality of its "archetypt" (263). The materiality of print technology frames the local meaning of cross-linguistic alphabetical letters, units of letters, and graphic symbols with spaces around them, as well as two-dimensional surfaces, typographical positions, and so on, always under technological constraints.

iSpace: Joyce's Paper Wounds

One of the things we may learn from the Joycean letter sequences is to approach the phonetic alphabet as a system of actual or potential ideograms. The notion of ideogram (ideo+gram or N-gram) is to be understood in the sense of *Gedankenschrift* or "thought writing," including numerals, punctuation marks, unutterable signs, and other abstract graphic marks, not to be confused with pictographs or pictures. And such is how the sign "iSpace" makes its first appearance in the *Wake*:

> These paper wounds, four in type, were gradually and correctly understood to mean stop, please stop, do please stop, and O do please stop respectively, and following up their one true clue, the circumflexous wall of a single-minded men's asylum, accentuated by bi tso fb rok engl a ssan dspl itch ina, — Yard inquiries pointed out —> that they ad bîn "provoked" ay Λ fork, of à grave Brofèsor; àth é's Brèak—fast— table; ;acùtely profèšš̀ionally *piqué́d*, to=introdùce a notion of time [ùpon à plane (?) sù " fàçe'e'] by pùnct! ingh oles (sic) in iSpace?! (124)

The double entendre of writing and wounding in the quote is carried out through the movement of graphic marks that visualize the "bits of broken glass and split china" by mangling the word spaces as "bi tso fb rok engl a ssan dspl itch ina." The idea of making holes in iSpace literalizes the act of punctuation and writing as a source of paper wounds. This passage throws the reader into the *mise en abîme* of graphic spacing, punctuation marks, irregular types, and letter sequences.

Eugene Jolas, who was the founder of the avant-garde journal *transition* and was responsible for publishing fragments of Joyce's *Work in Progress*, immediately grasped the significance of this iconoclastic act when he declared in 1929 that "the real metaphysical problem today is the word."[28]

28. Eugene Jolas, "The Revolution of Language and James Joyce," 79.

Graphic spacing is taken as an assault on logocentrism as it dissolves the familiar word image and becomes itself the originary act of writing in iSpace. The latter certainly anticipates the Derridian notion of spacing and *différance* for grammatology; but, more appropriately, "iSpace" is about the ideographic prolepsis of modern technology, ranging from cybernetics (the punning on "plane" in the quote puts us in mind of Norbert Wiener's antiaircraft feedback loop) to the Internet, bearing the news of "iPhone," "iVision," "iTunes," "iLove," and "iPolitics" of the future. Most symptomatic of all is the appearance of "iEnglish" itself on the Internet. Joyce's literary experiment suggests that the ideographic view of alphabetical writing did not originate with Shannon or Wiener but rather asserted itself through an extraordinary period of intellectual fermentation in the early decades of the twentieth century marked by a fascination with technical inscription, psychic energy, and prosthetic machines.

Joyce conjured up the printed sign "iSpace" long before the coming of the Internet or the iPod. Sharing the fate of many such graphic aberrations introduced into the mother tongues by writers and poets, "iSpace" has remained stubbornly borderline and obscure in print media long after its inventor was canonized by literary history, theory, and criticism, as well as public and academic institutions. The novelty of his vision and techne of writing never ceases to surprise the generations of readers who have since grown up and experienced the dramatic unfolding of biocybernetic events in their own lives. Like it or not, the lowercase typeface "i" in "iSpace"—to be more precise, the "i+Word"—is evolving into a veritable new idiom and ideo-graphein in the expanding cyberspace of electracy, much like that other ubiquitous letter "e-".[29] These experiments have brought to light the nature of the entanglements between the literary imagination and technoscience that this book explores. The crux of the matter is not whether the letter "i" means "intelligent," "information," "Internet," "I," or "imaginary" or simply represents an inverted exclamation mark that has no corresponding phonetic equivalent in the spoken language, but rather that the ideographic structure of "i+Word" (or even i+word) provides the sole semantic guarantor for any or all of the meanings one can possibly attribute to the letter "i."

29. As in the case of acronyms, anagrams, prefixes, and other ideographic functions of the alphabet, the sign "e-" corresponds to the word "electronic" or "electro-"as an *idea* rather than to the phonemic sequence of the multi-syllabic word or prefix it is taken to represent. This applies to "e-mail," "e-museum," "e-trade," "eBay," "eBook," "e-music," "e-medicine," and so on regardless of how one pronounces the letter "e" in English or some other language.

This semantic indeterminacy is bound to raise the cognitive question of how the eyes and brain of a reader pick up alphabetical letters and words visually in the act of reading. This is usually a subject for specialists in neuropsychology and related sciences but should be of some interest to literary scholars as well. When Roman Jakobson provided his analysis of a linguistic disorder known as "ataxia," which is a form of "aphasia," he identified the following cognitive trait in word recognition as pathology. A patient who suffers from ataxia, according to him, has "only an integral, indissolvable image of any familiar word, and all other sound-sequences are either alien and inscrutable to him or he merges them into familiar words by disregarding their phonetic deviations."[30] Although the indissolvable image of a word applies to speech events in the context of Jakobson's discussion, the pathological type he singles out has interesting implications for visual word recognition as well. If the inability to distinguish phonemes as the minimal entities of speech events is pathological, what do we make of the ordinary reader's tendency to fix on the indissolvable image of a word as an integral, scriptic unity on the page? Is it normal or pathological? Recent studies in experimental psychology have provided compelling evidence to show that the "word shape"—or information in the shape of an entire word—plays an important role in our cognitive act of reading or "visual word recognition."[31] As it happens, people do not read each individual letter in a word except in a relatively rare condition following brain injury known as word-form dyslexia.[32]

30. Roman Jakobson, "Two Aspects of Language and Two Types of Aphasic Disturbances," 108.

31. There has been an ongoing discussion about transposed-letter sequences in alphabetical writing. Investigation into the scrambling of letters in a nonword or what researchers call "transposed-letter confusability" casts an interesting light on the problem of visual word recognition. See M. Perea and S. J. Lupker, "Does *jugde* Activate COURT? Transposed-Letter Confusability Effects in Masked Associative Priming," and M. Perea and S. J. Lupker, "Transposed-Letter Confusability Effects in Masked Form Priming." Although we are better at guessing a word than guessing individual letters in the word ("word superiority effect"), the fact that "word shape" can be disrupted by the transpositions or scrambling of letters also raises the issue of where the individual letter stands in relation to "word shapes." For a recent discussion of this problem, see D. G. Pelli, B. Farell, and D. C. Moore, "The Remarkable Inefficiency of Word Recognition." For other related studies, see K. Mayall, G. W. Humphreys, and A. Olson, "Disruption to Word or Letter Processing? The Origins of Case-Mixing Effects"; R. Shillcock, T. M. Ellison, and P. Monaghan, "Eye-Fixation Behaviour, Lexical Storage and Visual Word Recognition in a Split Processing Model"; S. Andrews, "Lexical Retrieval and Selection Processes: Effects of Transposed-Letter Confusability"; L. X. McCusker, P. B Gough, R. G. Bias, "Word Recognition Inside Out and Outside In"; A. F. Healy, "Detection Errors on the Word *The*: Evidence for Reading Units Larger Than Letters"; G. M. Reicher, "Perceptual Recognition as a Function of Meaningfulness of Stimulus Material."

32. See E. K. Warrington and T. Shallice, "Word-Form Dyslexia."

Despite his phonocentrism criticized by Derrida, Saussure did seem to take notice of the propensity of alphabetical writing to slide in the direction of ideographical aberration. According to the notes of his student Emile Constantin, which was not published until 1993, Saussure made an interesting observation on the subject. He remarked once in his 1910 lectures on orthography: "One must not forget that the written word eventually becomes, through force of habit, an ideographic sign [un signe idéographique]. *The word has a global value* <[independently of the letters of which it is formed]>. We read in two ways: spelling out unfamiliar words and reading familiar words at a glance"[33] (my emphasis). By the "ideographic sign," Saussure refers not to Chinese characters but alphabetical writing. Whether the truth of his observation can fully be corroborated by cognitive sciences, it is interesting that Saussure's discovery of the "global value of the word" leaning toward ideography seems to contradict his well-established notion of writing as a visual representation of the spoken language as much as it disputes Jakobson's famous diagnosis of ataxia. As to what extent this remarkable insight is also connected with his unfavorable view of "spelling pronunciations" in speech where "visual images lead to wrong pronunciations" is something one can, of course, debate further.[34] His mention of the force of habit does resonate with the degenerate view of alphabetical writing Derrida has analyzed in *Of Grammatology*.[35] Whether Derrida became aware of Saussure's insight about the "global value" of the phonetic word after the publication of Constantin's notebooks in 1993 is unclear to me. Perhaps it would not have mattered much since what he said about Hegel could have applied to Saussure just as well. Hegel, as we know, had an intuitive grasp of the hieroglyphic potential of alphabetical writing, which led Derrida to call him the last philosopher of the book and the first thinker of writing (26). Reflecting on the acquisition of literacy, Hegel had written that "acquired habit later also suppresses the specificity of alphabetic writing, which consists in seeming to be, in the interest of sight, a detour [*Umweg*] through hearing to arrive at representations, and *makes it into a hieroglyphic script for us*, such that in using it, we do not

33. The original quote goes as follows: "On ne doit pas oublier que le mot écrit finit par devenir par habitude un signe idéographique. Le mot a une valeur globale, <[indépendamment des letters dont it est formé]>. On lisons de deux façons: en épelant pour les mots inconnus et en lisant d'un seul coup les mot connus." See Saussure, *Ferdinand de Saussure: Troisième cours de linguistique générale (1910–1911) d'après les cahiers d'Emile Constantin*, 63–64.

34. Saussure, *Course in General Linguistics*, 31.

35. See Derrida, *Of Grammatology*, 31.

need to have present to our consciousness the mediation of sounds"[36] (my emphasis). Hegel attributes the ideographical tendencies of the phonetic alphabet to the force of habit, a kind of degenerative aberration. The fact that both Hegel and Saussure confront the problem of visual word recognition should be taken seriously because there is much more to their insights about the ideographic potential of alphabetic writing than the metaphysical defense they shore up against writing in general.

The intractability of the ideographic within the system of alphabetical writing can further be interrogated by reexamining the important role the ideographic sign played between modernism and science in the early twentieth century. W. J. T. Mitchell has shown that "Wittgenstein's use of the hieroglyphic as a model for the picture theory of language and Ezra Pound's fascination with Chinese picture-writing as a model for the poetic image might be taken as marking the boundaries of this role."[37] The idea of the ideogram, being misinterpreted by Pound and others as picture-writing, was undoubtedly intended to help defamilarize alphabetic writing for the purpose of vorticist poetry. But another function, with broader contemporary implications, is strongly suggested; namely, that the ideogram concretizes an isomorphism between the machine and the human mind, or as Pound puts it, "Man is—the sensitive part of him—a mechanism, for the purposes of our further discussion, a mechanism rather like an electric appliance, switches, wires, etc.… In the telegraph we have a charged surface attracting to it, or registering movements in the invisible ether."[38] In the manuscript from which Pound constructed his revised version of Fenollosa's essay, the latter refers to "radiation" and "coronal" harmonies that can be produced by an ideogram.[39] Pound found this conception

36. As quoted in Derrida, *Of Grammatology*, 25

37. W. J. T. Mitchell, *Iconology: Image, Text, and Ideology*, 29.

38. Ezra Pound, *The Spirit of Romance*, 92–93. As early as 1886, Charles Howard Hinton had presented a theory of the invisible ether that anticipated this modernist view of machine. Conceiving the ether medium as a *cosmic phonograph*, Hinton wrote: "For suppose the æther, instead of being perfectly smooth, to be corrugated, and to have all manner of definite marks and furrows. Then the earth, coming in its course round the sun on this corrugated surface, would behave exactly like the phonograph behaves. In the case of the phonograph the indented metal sheet is moved past the metal point attached to the membrane. In the case of the earth it is the indented æther which remains still while the material earth slips along it. Corresponding to each of the marks in the æther there would be a movement of matter, and the consistency and laws of the movements of matter would depend on the predetermined disposition of the furrows and indentations of the solid surface along which it slips." See Charles Howard Hinton, *Scientific Romances*, 196–97.

39. Daniel Tiffany suggests that the radioactive properties of the ideogram appealed to Pound as a means of "radicalizing" the electromagnetic spectrum. See Tiffany, *Radio Corpse: Imagism and the Cryptaesthetic of Ezra Pound*, 225. See also Laszlo Géfin, *Ideogram: History of a Poetic Method*.

particularly amenable to his own theory of "radioactive" images and went so far as to assert that "[the] true science, true thinking is ideogrammic in the sense that the general is composed of *definite particulars known directly* by the thinker."[40] Pound's language, with its cryptic allusion to mathematical symbols and their implications for thinking the finite and infinite, is certainly related to the mathematics of his time but it was a mathematics already in the process of being replaced by rigorous statistical thinking.[41]

While Wittgenstein focused his attention on logic and language games, Pound interpreted the ideogram as an aspiration toward the immediacy of knowledge that no spoken word could possibly mediate for science.[42] This understanding was based on a theory of image he put forward in the 1914 "Vorticism" manifesto, in which he argues that an image is real because "we know it directly" and "every concept, every emotion, presents itself to the vivid consciousness in some primary form." He further contends that art and science have many things in common since "the imagiste's images have a variable significance, like the signs a, b, and x in algebra" and that "any mind that is worth calling a mind must have needs beyond the existing categories of language, just as a painter must have pigments or shades more numerous than the existing names of the colours."[43] It is not that the phonic aspect of alphabetic writing had lost its valence for Pound or for other avant-garde writers but rather that, under the regimen of prosthetic machines (gramophone, telegraph, telephone, typewriter, radio, film, etc.), there had emerged a new awareness of the ideographic or other potential in alphabetic writing among the experimental writers, and no less among the engineers and scientists who designed the prosthetic machines. In retrospect, Derrida's critique of phonocentrism on behalf of writing came truly, and belatedly, in the wake of a modernist philosophical movement.

Be that as it may, the modernist movement as exemplified by Joyce's *Finnegans Wake*, Mallarmé's poetry, Duchamp's installations, or Eisenstein's experiments with ideogram in film swung against Hegel's degenerative view of writing, not out of volition, but because the artists had no choice but to respond to the proliferation of prosthetic machines and technological reorganization of socioeconomic life in their time. After World

40. Pound, *Machine Art and Other Writings: The Lost Thought of the Italian Years*, 158.

41. On the impact of this transformation on the social sciences, see my discussion of the Bourbaki mathematicians in the next chapter.

42. For a clarification of Wittgenstein's semiotic approach to mental imagery and hieroglyphics, see Mitchell, *Iconology*, 14–27.

43. Ezra Pound, "Vorticism," 464, 466, 463, 466.

War II, the long-awaited arrival of the computing machine and information technology upon the scene of writing brought about a number of new developments that further deepened the modernist experiments with ideography, typography, and the universal writing machine. This brings us back to Shannon's information theory and what it can tell us about the random processes and the probability of meaning in the psychic machine.

Schizophrenic Writing at Bell Labs

It is a well-known dictum in information theory that a message (or letter sequence or character string) being transmitted over the communication channel has nothing to do with semantics or linguistic content. At the risk of repeating myself, any information exists only insofar as there is a choice of alternative messages or alternative sequences of letters. If there were only one message in the whole world, there would be no information and no need for a transmission system because that message would have been on record at the receiving point. If there were two messages, the chance of transmitting the correct information would be 50/50, etc. In short, information is related primarily to the factor of uncertainty or probability from the standpoint of mathematics. This explains why the entropy of a language relates to nonsense in the same manner as it is related to sense. If the redundancy rate is zero, Shannon shows that any sequence of letters is a readable text in the language and any two-dimensional array of letters can form a crossword puzzle. He calculates the redundancy of English within certain limits at the rate of roughly 50 percent, which makes large crossword puzzles possible. As the redundancy rate is lowered to 33 percent, three-dimensional crossword puzzles become a possibility. Literary critics may gain some new insights into Joyce's multilingual riddles in the *Wake* by analyzing their stochastic dimensions across several languages, although they would quickly come to the realization that the task is not easy to carry out.

In its nonthreatening guise, nonsense appears to be an endless source of play and pleasure across cultures and civilizations, past and present. The "Jabberwocky" verse from Lewis Carroll's *Through the Looking-Glass* is the best-known nonsense poem written in English and, indeed, this work might have inspired the kind of nonsense word experiments that led to James Joyce's *Finnegans Wake*. Not surprisingly, Y. R. Chao became the first Chinese translator of Carroll's novel in 1922, and this translation was an extraordinary feat. For not only is Chao able to retain Carroll's play on each

individual word by making up new Chinese characters but he manages to reproduce the meter and rhyming pattern of Carroll's English verse.[44] As another twist to this fascinating story about nonsense, Warren Weaver was an avid reader of Lewis Carroll. He built a private collection of 160 different editions of *Alice in Wonderland* in as many as forty-two languages and asked Chao to add his Chinese translation to that collection. Weaver was particularly keen on the puns, nonsense, and jokes from the Mad Tea-Party scene and published a literary study titled *Alice in Many Tongues*.[45]

Gilles Deleuze is among a handful of philosophers in the twentieth century who paid attention to the problem of nonsense and tried to explain it in relation to sense. Other major philosophers of the time, such as Maurice Merleau-Ponty and Jean Hyppolite, reflected on sense and nonsense but did not have much to say about nonsense. Merleau-Ponty's *Sense and Non-Sense* (1966) explored the phenomenology of objects, visuality, things, perception, and other familiar philosophical issues concerning existence; but Lacan's work, communication technologies, and the cybernetic game with letters, numbers, and other such symbols probably did not mean much to him and were left out of the discussion.[46] Hyppolite, on the other hand, was concerned with the relationship between being and sense through language in *Logic and Existence* (1953).[47] Although he showed a lively interest in cybernetics, Hyppolite did not take the next step in his book by relating Hegel's discussion of language, mathematics, consciousness and self-consciousness to the cybernetic machine of his time as Mark Taylor would do half a century later.

Deleuze was an exceptional philosopher of his time. Not only did he take the "Jabberwocky" verse seriously but he gave a marvelous reading of Carroll's portmanteau words to explore the structure of sense and nonsense.[48] In *The Logic of Sense*, he suggests that there is no structure without series and that Carroll has established "a serial method in literature" that brings about the distribution of singular points in the structure of language (Deleuze, *The Logic of Sense*, 51). Deleuze explains singularity in terms of a mathematical curve, a physical state of affairs, or a psychological state and goes on to remark:

44. In an article, Yuen Ren Chao explains how he rendered the "Jabberwocky" verse into Chinese. See Chao, "Dimensions of Fidelity in Translation With Special Reference to Chinese," *Harvard Journal of Asiatic Studies* 29 (1969): 127–28.

45. See Warren Weaver, *Alice in Many Tongues: The Translations of Alice in Wonderland*.

46. See Merleau-Ponty, *Sense and Non-Sense*.

47. See Hyppolite, *Logic and Existence*.

48. See Deleuze, *The Logic of Sense*, 42–47.

> Singularities are turning points and points of inflection; bottlenecks, knots, foyers, and centers; points of fusion, condensation, and boiling; points of tears and joy, sickness and health, hope and anxiety, "sensitive" points. Such singularities, however, should not be confused either with the personality of the one expressing herself in discourse, or the individuality of a state of affairs designated by a proposition, or even with the generality or university of a concept signified by a figure or a curve. The singularity belongs to another dimension than that of denotation, manifestation, or signification. It is essentially pre-individual, non-personal, and a-conceptual. (52)

In his own way, Lacan would locate the game of even and odd in this distribution of singularities where each throw of the dice in a game of chance is already a series prior to concept or thought. By analyzing the series and their distributions, Deleuze discovers that "the logic of sense is necessarily determined to posit between sense and nonsense an original type of intrinsic relation, a mode of copresence" (68) and that "no less than the determination of sense, nonsense enacts a *denotation of sense*" (69). This is an important insight, and it asks us to be attentive to the functions and abysses of nonsense as these have something to do with our psychic life. Deleuze points out that when the logicians speak of nonsense, "they offer laboriously constructed, emaciated examples fitting the needs of their demonstration, as if they had never heard a little girl sing, a great poet recite, or a schizophrenic speak" (83). In his view, "Jabberwocky," Joyce, and schizophrenics promise to give us some unusual insights about the important role of nonsense in the psychic life.

In his own reading of *Finnegans Wake*, Lacan has tried a different approach by using the Borromean knot to tease out the implications of the novelist's play with symbols, linguistic or otherwise. Proceeding from "symbol" to "symptom," Lacan wants to demonstrate with his mathemes and diagrams what Joyce can inform us about the symbolic, the real, and the unconscious. In "Joyce le Symptôme," he points out that elaborate punning in *Finnegans Wake* is present not only in every line of the work but in each single word. What is so peculiar about these verbal puns is that the "meaning" that we habitually attach to words gets lost in the process of symbolization.[49] The loss of meaning, or *sens*, however, brings us a bit closer to the real. The real, as Lacan would insist elsewhere, "is completely denuded of meaning (*sens*). We can be satisfied, we can be sure that we are dealing with something of the real [*réel*] only when it no longer has

49. Lacan, "Joyce le Symptôme," 165.

any meaning whatsoever. It has no meaning because it is not with words [*mots*] that we write the real. It is with little letters [*petites lettres*]."[50] As discussed in the next chapter, the distinction between the word and the letter—the Joycean "litter"—was fundamental to how Lacan reinterpreted the Freudian notion of the unconscious through the lens of information theory and cybernetics.

Lacan reiterated this point in his Kanzer lecture at Yale University in 1975. Interestingly, he began the talk by alluding to Joyce, and when he was challenged by Geoffrey Hartman, Louis Dupré, and other Yale faculty on the question of symbol, meaning, and mathematics, he fell back on the distinction between the word (language) and the letter (writing), as we can see in the following excerpt from the transcript of the questions and responses:

> HARTMAN: The quarrel concerns the interpretation of the symbolism of mathemes.
>
> DUPRE: But that's the problem: what is the exact status of the symbolism of mathemes? Is it a universal symbolism or a . . .
>
> LACAN: It is an elaborated symbolism, always elaborated by means of letters.
>
> HARTMAN: But what of words (*quid des mots*)? Even if analytic science contains mathemes, there is the question of the practice and of the translation of these mathemes in analytic practice, which is verbal, isn't it?
>
> LACAN: There is nonetheless a world between the word and the letter. (Lacan, "Conference et entretien," 30–31; English translation at http://web.missouri.edu/~stonej/Kanzer_seminar.pdf, p. 17)

It appears that the theoretical distinction Lacan assumes here between the word and the letter has eluded the understanding of his interlocutors in that conversation, which is fascinating to follow. Lacan is arguing—with explicit and implicit references to Joyce in the Kanzer lecture—that the world, or the gap, that separates the word from the letter and mediates between them cannot always guarantee the return of meaning through verbal articulation.

50. See Jacques Lacan, "Conference et entretien dans des universities nord-americaines: Yale University, Kanzer Semina," 29. Lacan's Kanzer lecture took place at Yale University on November 24, 1975. The English translation is by Jack W. Stone at http://web.missouri.edu/~stonej/Kanzer_seminar.pdf.

Precisely in the Lacanian sense, the loss of meaning in the letter is what inevitably results from Shannon's processing of Printed English for information theory. I should add, though, that Printed English takes us beyond the conventional division of labor between the mathematical uses of alphabetical symbols in algebra and the natural languages used in written communication, which is implied in the above-quoted conversation. For the object of Shannon's analysis is English writing, not algebra, and there is no doubt about that. But he is more concerned with the stochastic implications of this writing than with its sense. This has caused N. Katherine Hayles to surmise that the bracketing of semantics in information theory was a strategic choice because "he did not want to get involved in having to consider the receiver's mindset as part of the communication problem,"[51] which brings us back to the point raised by Morse's partner Vail in the nineteenth century concerning the status of the question "Are you there?" for the communication machine.

Hayles's observation is related to an alternative or competing theory of information proposed by British information theorist Donald MacKay in the early 1950s.[52] Unlike Shannon, MacKay insisted on the machine's ability to measure psychological states and this position ignited a flurry of debates about the missed opportunities to choose between these two models or decide whether semantics and psychology should be included in the theoretical construct of the communication machine. The problem with MacKay's argument is that it assumes too much about the sovereignty of linguistic meaning and fails to examine its own paranoia about the dissolution of sense. One must ask what caused MacKay and others to insist on the presence of meaning in the communication machine. Shannon's Printed English raises more radical philosophical issues concerning the whereabouts of "meaning" or "blanks" in the psychic machine than does MacKay's conventional model. This is something that has been largely overlooked by the scholarship on informatics because most critics are still preoccupied with the priority of linguistic meaning and semantics and want to side with MacKay.

Take the peculiar twenty-seventh letter. This is a sign for "space" that belongs to one of "the states" of the alphanumerical system: $S_1, S_2, \ldots, S_n$ in

51. Hayles, *How We Became Posthuman*, 54.

52. For Hayles's discussion of Shannon, see *How We Became Posthuman*, 18–19. Hayles also mentions Hans Moravec's attempt to modify and revalue Shannon's model of communication (53–54). For a critique of her interpretation of Shannon versus MacKay, see Mark B. N. Hansen, "Cinema Beyond Cybernetics, or How to Frame the Digital Image."

the Markov chain. By virtue of being a non–phonetically marked symbol, the twenty-seventh letter activates the statistical structure of the twenty-six-letter alphabet, although it can hardly function in this capacity until the remaining twenty-six letters in the system are made to function simultaneously as equivalent, ideographical signs. The verb "activate" highlights an aspect of the phonetic alphabet that is prone to statistical treatment by virtue of its evolution from ancient alphanumerical systems, for numerical signs were closely linked to the origin of writing. As mentioned before, the word *spr* for *scribe* in Phoenician originally derived from the verb *to count* and only later began to acquire the meaning *to write*.[53] In the spirit of ancient alphanumerical *spr,* Shannon's "space" letter once again brings the statistical structure of the alphanumerical system to light. To the best of my knowledge, the only theorist from the Prague Linguistic Circle who paid any passing attention to this development was Josef Vachek (1909–97).[54] In "Remarks on Redundancy in Written Language with Special Regard to Capitalization of Graphemes," Vachek refers to the concept of "graphemic zero" and defines it as the "empty spaces between written (or printed) words in the graphical context." The concept of graphemic zero allows Vachek to grasp some essential differences between writing and speech. Contrary to Hayles's notion of speech or phoneme as a division of continuous stream of breath, Vachek writes: "One does not find in equivalent spoken contexts any acoustic 'zeros,' i.e. any brief pauses separating spoken words—if such pauses do exist, there must be some specific reason for their occurrence . . . whereas the above-noted graphemic zeros function automatically and quite consistently."[55] Clearly, Vachek's visual marking of "space" lacks the rigor of Shannon's twenty-seventh letter or what Derrida has done with the idea of spacing although, to his credit, Vachek stands out as the lone functionalist who persisted in the study of writing and even devoted an essay to the subject of "Written Language and Printed Language" when the majority of his fellow linguists were still preoccupied with phonemes.

As mentioned earlier, the "space" letter in information theory should not be taken at face value or confused with the "empty spaces between written (or printed) words," as it is a mathematical symbol like any of the

53. See C. Bonnet, "Les scribes phoenico-puniques," 150.

54. Vachek was a leading functionalist and authored numerous articles on the subject of "written language" that, unfortunately, have not drawn as much attention as some of the other members of the Prague School due to the phonocentric biases of modern linguistics.

55. See Josef Vachek, *Written Languages Revisited*, 152–53. Vachek is also the author of *Written Language: General Problems and Problems of English*.

remaining letters in the twenty-seven-letter alphabet. Shannon has calculated that the "space" symbol in English within a given parameter has a probability of 0.182, which is higher than the most frequently employed letter *E*, which stands at 0.107. What it means is that random processes that produce letter sequences are more dependent on the stochastic frequency of the letter "space" than they are on any of the other letters in Printed English, whether or not they appear in words or nonwords. Following Shannon's pioneering work, Guilbaud attempted a comparative calculation for English, French, Italian, and Spanish to show that the probability of an equivalent "space" letter in each of these European languages sharing the Roman alphabet is uniformly higher than that of the most frequently used vowel letter, *E* or *A*. For example, the "space" letter is 17% in French, English, and Spanish and slightly lower in Italian and German at 16% and 14%.[56] Compare these with the most frequently used vowel *E* or *A* in each of the above languages at 16%, 10%, 11%, 10%, and 14% respectively. Only in German does the frequency of the letter "space," which stands at 14%, equal that of the letter *E*, which also stands at 14%.[57] Note that Guilbaud's 17% for the "space" letter and 10% for the letter *E* in English are somehow lower than Shannon's calculations at 18.2% and 10.7% respectively. The discrepancy is attributable to the size of the samples taken and, according to Guilbaud, his average is based on a larger pool of English samples. Be that as it may, Guilbaud's conclusion is the same as Shannon's; namely, the letter "space" is used more frequently than the letter *E*. This should help explain why James Joyce's tampering with the spacing mechanism of the letter sequences in *Finnegans Wake* is more radical and challenging than Ernest Vincent Wright's 50,000-word novel *Gadsby* (1939) or Georges Perec's French-language novel *A Void* (*La disparition*, 1969) each of which plays with lipograms by leaving the letter *E* out of the entire work. James Thurber's *The Wonderful O* (1957) about some pirates who ban the use of *O* on an island also highlights the statistical nature of alphabetical writing but technically is inferior to the above novels due to the lower frequency rate of the letter *O*, which, like *N* and *R* in English, stands at 5%.[58]

Guilbaud's observation is illuminating with respect to how we reevaluate the mathematical figuring of letter sequences in alphabetical writing

56. Georges Th. Guilbaud, *What Is Cybernetics?*, 72–73.

57. Intuitively, this makes sense. There's one space per word (if we define a word as a string of characters that begins with a space and has no other spaces). The longer the average word in a language, the smaller the percentage of spaces, and German text has many long words because compounds are readily formed.

58. For the statistical ratio of letter *O* in English, see Guilbaud, *What Is Cybernetics?*, 72.

and what it can tell us about "meaningful" word units. When visualized, letter sequences may appear as nonwords or ungrammatical units but from a mathematical viewpoint, the stochastic structure in them has little need for visualization or phoneticization to be conceptually valid. Shannon's zero-order approximation to English prose, for example, which gives random combinations of independent and equiprobable symbols, might generate the following: "XFOML RXKHRJFFJUJ ZLPWCFWKCYJ FFJEYVKCQSGHYD QPAAMKBZAACIBZLHJQD." These combinations do not make sense in English. However, as soon as the probabilities and ratios of the twenty-seven letter alphabet of Printed English are incorporated into the random processes, we are beginning to get a sequence of recognizable word units. Thus a less random sequence is produced in Shannon's experiment that looks like this: "THE HEAD AND IN FRONTAL ATTACK ON AN ENGLISH WRITER THAT THE CHARACTER OF THIS POINT IS THEREFORE ANOTHER METHOD FOR THE LETTERS THAT THE TIME OF WHO EVER TOLD THE PROBLEM FOR AN UNEXPECTED."[59] Shannon's reader may be tempted to scrutinize the semantic content of these letter sequences the same way James Joyce's readers have endeavored to make sense of *Finnegans Wake*. Why a frontal attack on an English writer? What writer?

Semantic treasure hunts with Shannon cannot but lead to dead ends since his tests are designed not to produce meaningful sentences but to determine the ratio of randomness in "unconsciously" formed letter sequences in English. The assumption is that the unconscious processes of language are expected to function automatically like a psychic machine. The way in which Shannon obtained the above-quoted passage was to begin by choosing a pair of words at random in a text (whose source remains unknown). His human subject is asked to read through the work until he or she encounters the second of these words again, and the word immediately following it is registered. Then the new word is sought out in a new context, and the word following its next appearance is again registered, and so on. This laborious process, which produced the passage we have just seen, obeys the simple rules of repetition and statistics rather than issue from the center of authorial consciousness. What is so surprising is not that the random process tends to produce "nonsense" but that some of the results border on the threshold of semantic legibility insofar as the average reader is concerned. How do we account for this?

59. Shannon and Weaver, *The Mathematical Theory of Communication*, 44.

John R. Pierce, Shannon's long-time colleague and coauthor of an essay in 1948, is one of the few interpreters of Shannon's work amongst the contemporary scientists who pondered on the theoretical implications of Shannon's mathematical work for understanding art, literature, and music. Pierce himself was a well-known pioneer in the development of satellite communication systems at Bell Labs and was a prolific science fiction writer who wrote under various pseudonyms such as J. J. Coupling.[60] As early as 1949, he experimented with the stochastic construction of music scores modeled directly on Shannon's work on Printed English. Pierce went on to develop computer music after retiring from Bell Labs and was a professor of music at Stanford University for twelve years. In "Chance Remarks," published one year after Shannon's own "Mathematical Theory of Communication," Pierce offered his interpretation of the passage from Shannon quoted earlier: THE HEAD AND IN FRONTAL ATTACK ON AN ENGLISH WRITER THAT THE CHARACTER OF THIS POINT IS THEREFORE ANOTHER METHOD FOR THE LETTERS THAT THE TIME OF WHO EVER TOLD THE PROBLEM FOR AN UNEXPECTED. To the question what sense this stochastically produced passage could make, Pierce argues that "certain passages in *Ulysses* and *Finnegans Wake* are scarcely more intelligible. Despite an apparent lack of connexion, the passage has some subject interest. I have a sympathetic concern for the predicament of the English writer. I would like to ask the author more about him. Unfortunately, there is no author to ask. I shall hear no more unless, perhaps, chance should answer my questions. One wonders if Dr. Shannon's work has philosophical implications."[61] It certainly does.

Pierce's approach to Joyce's literary experiment is governed by the same stochastic concerns that lead him to make a critical remark about Swift's earlier imagining of the literary machine in the Grand Academy of Lagado. He states: "One can only admit that Swift had the general idea first, but that he may have been wrong in rejecting it summarily."[62] Surreptitiously, Pierce steps into the role of the Lagado professor talking back to the author of Gulliver's story while raising the terrifying specter of an "authorless" text: IT HAPPENED ONE FROSTY LOOK OF TREES WAVING GRACEFULLY AGAINST THE WALL. The conditions under which James Joyce's

60. Pierce was the vice president of research for Bell Laboratories and was centrally involved in the development of the first commercial communications satellite *Telstar 1*, which was launched in 1962.

61. Originally published in "Chance Remarks" under the pseudonym J. J. Coupling in *Astounding Science Fiction* in 1949. Pierce had it reprinted in *Science, Art, and Communication*, 125–26.

62. Pierce, *Science, Art, and Communication*,131.

work is invoked by both Shannon and Pierce call for further reflection. Our discussion of *Finnegans Wake* speculated on how Joyce's word machine could be related to the specific issues brought up by information theory so as to warrant Shannon's and Pierce's attention.[63] There is no doubt that Shannon's and Pierce's understanding of Joyce is vastly different from how literary critics have approached his difficult works and, interestingly, it is always Joyce's "illegible texts" that have drawn the mathematicians' attention. Difficult as they are, Joyce's texts are still considered "authored" texts in contrast with the above-quoted passage from Shannon—"THE HEAD AND IN FRONTAL ATTACK ON AN ENGLISH WRITER . . ."—which is composed of chance elements that obey the laws of statistical structure of the language, and which seems to pronounce the death of the author before Barthes, Foucault, and others learned why and how the author died.

This manner of decentering the author through the stochastic processes of the psychic machine certainly predated French Structuralists' similar moves. Are there meaningful historical connections between the theoretical work at Bell Labs and French Structuralism that we can detect? The answer is yes, and as demonstrated in the next chapter, what we usually take to be French theory has in fact been a round-trip translation of American theory (game theory, cybernetics, and information theory) across the disciplines. For the moment, let's pursue the interesting point Pierce has raised about the philosophical implications of information theory and offer some further reflections on the (il)legibility of Joyce's or Shannon's statistical constructs to pursue that thinking.

Pierce put his favorite stochastic example—"IT HAPPENED ONE FROSTY LOOK OF TREES WAVING GRACEFULLY AGAINST THE WALL"—together with other stochastic samples to illustrate how a particular passage from Joyce's *Ulysses* typically resonates with randomly produced letter sequences on the one hand and with schizophrenic writing on the other. When we juxtapose his stochastic sample with a passage from Joyce and with the writing of a schizophrenic mind, it is not always self-evident which of the three makes better sense. Pierce cites the following passage from Episode 18 Penelope of Joyce's *Ulysses*: "that was a relief wherever you be let your wind go free who knows if that pork chop I took with my cup of tea after was quite good with the heat I couldnt smell anything

63. Pierce also mentions the stochastic work of Marcel Duchamp who "allowed a number of threads to fall on pieces of cloth and then framed and preserved them." Pierce, *Science, Art, and Communication*,133.

off it Im sure that queerlooking man in the porkbutchers is a great rogue."[64] This is contrasted with a piece of schizophrenic writing he obtained elsewhere: "Epaminondas was one who was powerful especially on land and sea. He was the leader of great fleet maneuvers and open sea battles against Pelopidas but had been struck on the head during the second Punic war because of the wreck of an armored frigate" (Pierce, 132). Curiously, the last sentence in the quote instantly reminds us of the beginning of Shannon's stochastic phrase "THE HEAD AND IN FRONTAL ATTACK ON AN ENGLISH WRITER . . ." a remarkable coincidence unless we believe that either Pierce or one of his Bell Labs colleagues was the schizophrenic in question. In any case, Pierce relies on these experiments to prove that the removal of inhibitions in the mind of a schizophrenic or a creative artist—which comes to the same thing—can give full rein to chance elements or stochastic processes and result in innovative works of literature.[65] This conclusion sounds surprisingly unoriginal compared with some of the unexpected and unresolved questions implied by the stochastic experiments Pierce and his colleagues conducted at Bell Labs. Let's formulate one of the questions tentatively as follows: Is nonsense or illegibility related to an unconscious mechanism so that it can be instantly recognized as such by the mind?

The linguist Y. R. Chao gestured toward this interpretation at the Macy Conference when he argued that negative feedback existed at the level of linguistic experience when people automatically recognized nonsense as the condition of sense.[66] But Chao did not further pursue the subject in the direction of psychoanalysis and ponder whether the unconscious was structured like writing or language, as Freud and Lacan would elaborate each in a different register. The role that the unconscious is brought into play in the production of sense and nonsense is strongly implied by Shannon's work on the stochastic of the English language. This assumption is sometimes brought into the open by the early computer modeling of neurosis or verbal learning behavior in the late 1950s and the 1960s.[67]

64. Joyce, *Ulysses*, 763. Pierce's quote of Joyce is not a verbatim copy and contains an interesting substitution of "mind" for "wind" such as: "That was a relief whenever you let your mind go free who knows if that pork shop I took with my cup of tea after was quite good with the heat I couldn't smell anything off it I am sure that queer looking man in the…" See Pierce, *Science, Art, and Communication*, 132.

65. Pierce, *Science, Art, and Communication*, 132.

66. See Chao, "Meaning in Language and How It Is Acquired," 49–67.

67. See my discussion of Kenneth Colby's neurotic machine and PARRY in chapter 5.

In 1959, Edward A. Feigenbaum pioneered a computer simulation program called EPAM (Elementary Perceiver and Memorizer) in order to study the (unconscious) mechanisms in elementary human learning processes. This was a time when the Ebbinghaus-type experiment was commonly conducted on human subjects at psychological laboratories, often involving the use of random letter combinations and pairs of three-letter nonsense syllables. EPAM was designed on that basis to simulate the rote memorization of nonsense syllables in associate pairs or serial lists. The assumption behind the program is that the brain is an information processor with sense organs as input channels and effector organs as output devices. Certain elementary information processes participate in the cognitive activity of all individuals and these processes allow the individuals to discriminate, memorize, and associate verbal items.[68] As Joseph Weizenbaum has pointed out, Feigenbaum wanted his program to produce a model of cognitive processes whose behavior would closely approximate that of human subjects engaged in memorizing nonsense syllables. The central idea is for EPAM to store *images* or graphic descriptions of the syllables presented to it, not the actual syllables themselves. The nonsense syllable DAX, for example, is described by the vertical leading edge in the first letter, which contains a loop, with the second letter, containing a horizontal bar, and so on. This *image* of the syllable is then discriminated from the other *images* of syllables already stored and is thus added to the memory.[69] What it suggests to us is that the simulated elementary learning behavior implicates a mechanism of ideographic symbol processing rather than that of deep grammatical structure or linguistic meaning. This intuition is entirely consistent with the ideographic turn of Shannon's Printed English.

We have seen how Printed English arrived in the wake of Basic English and modernist ideographic experimentation to fulfill the mission of universal communication boldly envisioned by C. K. Ogden and I. A. Richards in the interwar years. However, universal communication presupposes a universal psychic mechanism to guarantee its global reach. When Winston Churchill made his triumphant remark that "the empires of the future are the empires of the mind," he took Basic English as an instrument of imperial domination, but neither he nor Ogden could tell us at the time how English or any other language could wield such formidable psychic power across races, nations, and linguistic boundaries. By implicit agreement,

68. Edward A. Feigenbaum, "The Simulation of Verbal Learning Behavior," 299.
69. Joseph Weizenbaum, *Computer Power and Human Reason*, 160–64.

they believed that the human mind worked universally with linguistic symbols and was susceptible to being transformed by them. All this happened, of course, before the invention of information theory and cybernetics. Did a new theory of the mind emerge in the postwar years? How did it relate to the development of new communication projects? For instance, would Ogden or Richards find Shannon's and Pierce's approach convincing and agree that the mind was a psychic machine governed by a statistical structure and capable of engendering random symbols, sense and nonsense?

The Cybernetics Group

In the analysis leading up to the present section, we have seen how Shannon worked on the statistical properties of alphabetical writing including Basic English, *Finnegans Wake,* and other English prose to establish a mathematical model of Printed English. It turns out that the architects of Basic were no strangers to either information theory or cybernetics, and as a matter of fact one of them, I. A. Richards, was invited to the Macy Conference of the cybernetics group.[70] As Steve Heims's research has shown, under the leadership of core members of that group—von Neumann, Norbert Wiener, Margaret Mead, Gregory Bateson, Warren McCulloch, and the psychoanalyst Lawrence Kubie—a total of ten Macy Conferences were convened over a period of seven years (1946–53).[71] These meetings were held to promote what the cybernetics group termed the interdisciplinary studies of the machine and the brain as analogous communication systems. In those years, the neurophysiologist McCulloch presided over the meetings and regularly asked a select group of leading scholars from diverse disciplinary backgrounds to present their research at each conference. Shannon was invited to three of the Macy Conferences and gave one of his papers on "The Entropy of English," among other things. He and Richards

70. There is no evidence of direct association of C. K. Ogden with the cybernetics group, perhaps due to his estrangement from Richards. Steve Heims mentions, however, that one of Ogden's research assistants, Molly Harrower, worked closely with Lawrence Kubie and McCulloch after she arrived in America to work with one of the founders of Gestalt psychology, Kurt Koffka, at his suggestion. She was a Macy Foundation fellow. See Heims, *The Cybernetics Group*, 138–39.

71. Heims's *The Cybernetics Group* and Jean-Pierre Dupuy's *The Mechanization of the Mind* are both excellent but complementary studies on this group. Heims's study is highly informative and filled with good sociological observations. Dupuy, a second-generation cybernetician, asks important questions about the intellectual and theoretical value of the work of the first generation.

were both present at the eighth conference in 1951, at which Shannon displayed his famous maze-solving mouse Theseus. Richards gave a paper called "Communication between Men: Meaning of Language."

The eighth conference of the cybernetics group took place on March 15–16, 1951, in New York City. The speakers covered a wide range of topics such as human communication, communication between animals, communication between the sane and insane, intelligent machines, and the search for basic symbols."[72] Richards's paper emphasizes a normative approach to human communication that is rooted in his and Ogden's earlier work on *The Meaning of Meaning* and Basic English (Ogden and Richards, *The Meaning of Meaning*, 22–23).[73] It is interesting that two years after the Macy Conference, Richards adapted information theory and Shannon's model of communication to his own normative theory of linguistic exchange, the result being a couple of diagrams published in his "Toward a Theory of Comprehending" (Figs. 12–13).[74] Richards's attempts at schematic abstraction bear interesting but superficial (visual) resemblance to Shannon's original diagram in *The Mathematical Theory of Communication*, which we have already examined. The fact that Shannon had things to say about the statistical work of Basic in his seminal work on Printed English never registered with Richards. And there is a curious mental warp here in the interchange of what one discipline regards as "valid information" as opposed to the other. Since Richards was not designing an actual communication machine as did Shannon, it is not immediately obvious what the "noise" is doing in his diagrams. Jakobson, for example, excluded this element when he adapted Shannon's diagram to Karl Bühler's organon model of communication for structural linguistics. To understand the sources of Richards's concern with noise, we must turn to the earlier work he did with Ogden and, in particular, *The Meaning of Meaning: A Study of the Influence of Language upon Thought and of the Science of Symbolism*.

Basic English was created under the aegis of an organization called the Orthological Institute, founded to restore proper meaning to English words.

72. See Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber, eds., *Cybernetics: Circular Causal and Feedback Mechanisms in Biological and Social Systems: Transactions of the Eighth Conference, March 15–16, 1951*.

73. Richards, "Toward a More Synoptic View," 124. This essay was originally published under a different title, "Communication between Men: Meaning of Language," in H. von Foerster, Margaret Mead, and Hans Lukas Teuber, eds., *Cybernetics: Circular Causal and Feedback Mechanisms in Biological and Social Systems: Transactions of the Eighth Conference*.

74. Richards, "Toward a Theory of Comprehending," 22–23. This essay first appeared under the title "Towards a Theory of Translating" in *Studies in Chinese Thought*, ed. Arthur F. Wright.

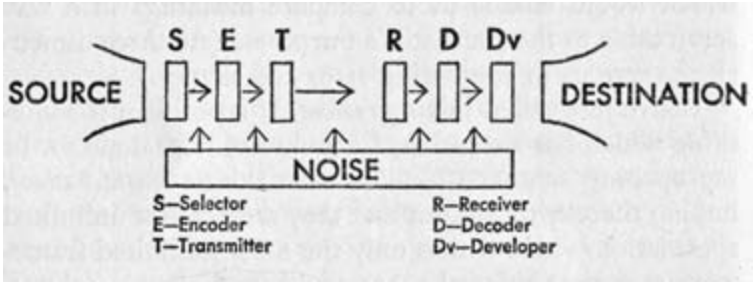

Figure 12. I. A. Richards's diagram on interlingual communication. From "Toward a Theory of Comprehending," in *Speculative Instruments* (Chicago: University of Chicago Press, 1955), 22.

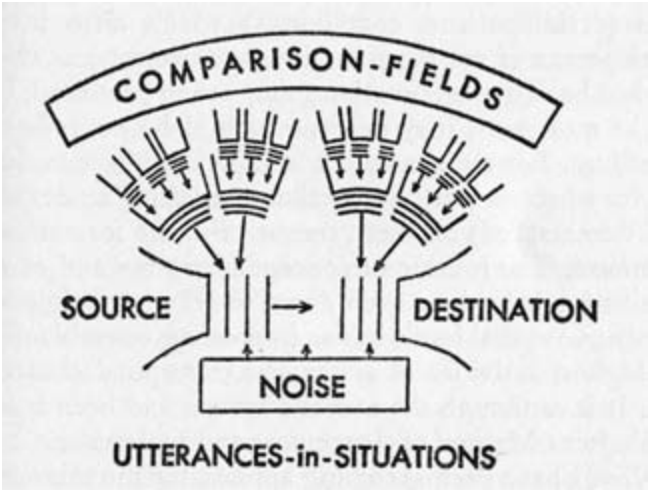

Figure 13. I. A. Richards's diagram on the nexus of utterances-in-situations. From "Toward a Theory of Comprehending," in *Speculative Instruments* (Chicago: University of Chicago Press, 1955), 23.

After having purged verbal redundancies from a humongous vocabulary of 25,000 words—to reckon by the Oxford Pocket English Dictionary—the 850 pure "roots" came to constitute the newly rationalized system of Basic. Startling as it may sound, the avowed aim of *The Meaning of Meaning* and the Basic project, being the fruits of a collaborative effort between Richards and Ogden, was "the eugenics of language."[75] In this influential study,

75. C. K. Ogden and I. A. Richards, *The Meaning of Meaning: A Study of the Influence of Language upon Thought and of the Science of Symbolism*, 135.

Ogden and Richards have tried to rule out abnormality, pathology, or any potential psychic noises that could interfere with a proper understanding of words and their meanings. They state the following: "for the analysis of the sense of 'meaning' with which we are here chiefly concerned, it is desirable to begin with the relations of thoughts, words and things as they are found in cases of reflective speech *uncomplicated by emotional, diplomatic, or other disturbances*" (10, my emphasis).

Richards's practical criticism carried a similar positivist credo with ideological underpinnings, which Fredric Jameson has identified symptomatically as the "political unconscious" of the New Critics, who vigorously defended literary studies against any breach of textural boundaries.[76] Jameson's trope of "the unconscious" was appropriate to the context of his criticism but he did not work the idea out to discover the historical interplay of Basic, cybernetics, neurophysiology, information theory, and psychoanalysis. In this study, we have good reason to push the question of the political unconscious in the direction of the psychic machine, which Jameson did not do. For example, does the political unconscious in Richards's diagrams reside in the box where he marks "noise"? What does it tell us about the place of the unconscious in Shannon's own conceptualization of communication?

We have already mentioned MacKay's attempt to locate "the place of 'meaning'" in the theory of information. As we have seen in the work of Ogden and Richards, a theory of meaning is a very different thing from the theory of information as understood by Shannon or Lacan. But Mackay wants to have his cake and eat it too by collapsing different projects into one updated metaphysical endeavor.[77] "By the theory of information," writes MacKay, "we shall mean broadly the theory of processes by which representations come into being, together with the theory of those abstract features which are common to a representation and that which it represents." MacKay seems not concerned by the possibility of nonmeaning or

76. Fredric Jameson, *The Political Unconscious: Narrative as a Socially Symbolic Act*.

77. In chapter 2, I have discussed how Warren Weaver tried to articulate verbal meaning to information theory when he first initiated the project of machine translation. He met with skepticism from Wiener and Shannon. The subsequent developments in machine translation do not suggest that meaning has been built into information theory. They suggest that the application of some aspects of information theory has been successful in some areas of artificial intelligence but not in others. Mark Hansen believes that "with his definition of (received) meaning as 'the selective function of the message on an ensemble of possible states of the C.P.M.,' Mackay provided a basis for '(re)thinking the relation between information and image beyond cybernetics.'" I am not sure whether Hansen's claim is based on phenomenological observation or on information theory itself. See Hansen, "Cinema Beyond Cybernetics," 75.

nonsense in the symbolic order as he goes on to specify what he means by representation: "By a representation of X we shall mean a set of events or objects exhibiting in at least one respect (even if only statistically) the pattern of relationships between the components of the situation X. By information we shall mean that which justifies representational activity: that to which logical appeal is made to justify a representation."[78] The desire for the adequatio of representation and the plenitude of meaning strongly echoes that of Ogden and Richards, who wanted verbal communications to be uncomplicated by extraneous noise, dubbed "emotional, diplomatic, or other disturbances."[79] Mackay's project, which tried to revive a much older theological concern with meaning, is contradicted by the psychoanalytical insights we may glean from the making of information theory itself.

We have seen how Shannon designed clever guessing games to arrive at the laws of Printed English. Of course, Shannon's guessing games would not work without his positing a priori the mind's automatic, unconscious processing of written symbols, in spite of the fact that he does not use the word "unconscious." When his colleague Pierce started to compare the writing sample of a schizophrenic—which Ogden and Richards would dismiss as "disturbances"—with the stochastic production of Printed English, he did push the implicit association of the written symbol with the unconscious into the open. Neither, however, went further than strongly implying a connection between the written symbol and the psychic machine.

Among those who pursued active research projects on this topic were some of the core members of the Cybernetics Group, especially Kubie and Mead. McCulloch, who spurned psychoanalysis, would on many occasions challenge Kubie on the question of the unconscious. As the cyberneticians were engaged in their lively and sometimes difficult debates at the Macy Conferences, Jacques Lacan followed the cybernetic development in the United States from a distance and began to reinterpret the Freudian notion of the unconscious in terms of a psychic machine. As the next chapter

78. Donald M. MacKay, *Information, Mechanism, and Meaning*, 80.

79. The technical distinction between signal and noise in Shannon's original diagram is made to help the engineer design communication channels. It is Richards's diagram, rather than Shannon's, that has invited an interpretation beyond the telos of communication engineering. This is why Hayles's criticism of Shannon's distinction between signal and noise is off the mark when she says that the signal and noise distinction has a conservative bias that privileges stasis over change because "noise interferes with the message's exact replication, which is presumed to be the desired result. The structure of the theory implied that change was deviation and that deviation should be corrected." It is difficult to see how the idea of uncertainty and probability central to information theory can have anything to do with stasis versus change. See Hayles, *How We Became Posthuman*, 63n32.

shows, not only was Lacan thoroughly familiar with Wiener's *Cybernetics*, but he read Kubie's article on neural networks published in *Psychoanalytic Quarterly*. In his seminars of 1954–55, he explicitly brought up the neural network studies on the octopus done by John Z. Young, whose work had been discussed at the ninth Macy Conference in March 1952.[80]

Richards and MacKay's attempt to tame information theory with a normative view of language is strikingly at odds with how Lacan understood Shannon and the question of "noise" during the same period. In fact, information theory provided the scientific rigor Lacan needed to repudiate Ogden and Richards's semantic approach to language. In "The Instance of the Letter in the Unconscious," Lacan dismisses the semantic theory of language as "the heresy that leads logical positivism in search of the 'meaning of meaning,' as its objective is called in the language [*langue*] in which its devotees snort." He adds that "it can be seen here how this sort of analysis can reduce the text the most highly charged with meaning to insignificant trifles. Only mathematical algorithms resist this process; they are considered to be devoid of meaning, as they should be."[81] The next chapter elaborates on Lacan's symbolic order by closely examining his relationship with mathematics in game theory and cybernetics.

Steve J. Heims's study has shown that the participants in the eighth meeting of cybernetics were greatly intrigued by how human subjects consistently made "nonrational choices" and how their decisions could be guided by random processes. This is exactly how Lacan came to reframe Freud's notion of the unconscious and came up with the idea of the symbolic order. His discussion of "empty signifiers" by recourse to the mathematical symbol would have interested Lawrence Kubie, Margaret Mead, and other members of the Macy Conference. At the eighth meeting, for example, a young scientist named Alex Bavelas reported on how he used a series of experiments to test the ways in which human subjects communicate using written symbols. One of his experiments involved a group of five people. Each subject was given a card containing five ideographic symbols including an asterisk, a triangle, a circle, etc., and he or she was told that each of the others had a card of five symbols. The group was informed beforehand that there was only one symbol common to all five cards and their task was to identify that symbol. The subjects were forbidden to see or hear each other (i.e., preclusion of the imaginary order in the Lacanian sense) and were allowed to communicate only by sending written

80. Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science*, 109.
81. Jacques Lacan, *Écrits: The First Complete Edition in English*, 416.

messages through the slits in their cubicles (which anticipated how Lacan demonstrates the symbolic order with the game of even and odd in his reading of "The Purloined Letter" in the 1954–55 seminar). By observing how the group established connectivity (neighbor to neighbor in a circle or all four connecting through a central subject) in the course of carrying out the task, Bavelas showed that mathematically precise concepts of connectivity, communication, and information transfer could be established outside of the usual circuit of linguistic exchange.[82]

In the general discussion that followed Bavelas's presentation, Lawrence Kubie and Margaret Mead brought up the question of the unconscious and wanted to know whether a written symbol on Bavelas's card was truly random or had unconscious meanings that might have biased the subjects' choices.[83] Mead was particularly sensitive to how the scientists treated their random symbols. "You can use information about the unconscious to be sure that you have randomized the right elements, but if you carry that over into real life, with a statement that a thing like an asterisk is of very little importance," she said, "you would make an enormous error."[84] Kubie was a core member of the cybernetics group and a professional psychiatrist with a strong interest in hypnosis. He tried very hard, often without success, to persuade his colleagues that communication can occur without the subject's conscious participation in the process. In the question he posed to Bavelas, he raised an interesting point about the relationship between cognition and the organization of knowledge through language:

> In your experiments, Dr. Bavelas, the items with respect to which communication occurs are such items as circles, triangles, asterisks, marbles, and so forth; that is, items easily named and specified in English. But suppose you deal with such an item as "an irregularly shaped, wet, smooth object changing rhythmically in brightness." Perceptually, this is something very simple, since such an object is easily identified and recognized; to designate it unambiguously in English, however, requires telling a rather long story. Items with respect to which communication may occur often differ in "word-nearness" or "word-remoteness," that is, in linguistic distance. I wonder, therefore, whether you have any data on how the mechanism of communication

82. Heims, *The Cybernetics Group*, 221.

83. Heims, *The Cybernetics Group*, 221–22.

84. Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber, eds., *Cybernetics: Circular Causal and Feedback Mechanisms in Biological and Social Systems: Transactions of the Eight Conference, March 15–16, 1951*, 44.

> is influenced by systematically changing the linguistic distance of the various items entering the communication network. (von Foerster, Mead, and Teuber, *Cybernetics*, 29–30)

Bavelas had undertaken his research for the Air Force of the United States and was not motivated to interpret his data in purely intellectual terms. He could not, therefore, come up with an answer that would satisfy Kubie. This was to be expected because the military-industrial-academic complex of postwar research decided to a large extent the kinds of questions and projects that the scientists were pursuing at the time. It is suggested that Norbert Wiener laid the first groundwork for the invention of cybernetics during World War II when he submitted a top-secret 120-page report called *Yellow Peril* (classified and named after its bright yellow covers, with obvious racial connotations) to the National Defense Research Committee in 1942.[85] This document outlined the new antiaircraft fire control theory that would become the idea of negative feedback in cybernetics. Warren Weaver was the director of the NDRC Section D-2 and was responsible for mobilizing the nation's best mathematical minds, including Wiener, to serve in the Fire Control Division. One of the first projects Shannon completed after graduation from MIT was an NDRC contract called Project 7, which involved mathematical studies relating to fire control.[86] Steve Heims's study shows clearly how cybernetics in postwar America continued to answer the need to build up and improve military technologies for the purpose of conducting regular as well as psychological warfare.[87]

Shannon was also present at the eighth meeting of the cybernetics group and was an important interlocutor in the group. He heard Bavelas's presentation, which invoked information theory, but he did not see any relevance that his work would have to what Bavelas was trying to accomplish. In his view, information theory was strictly concerned with the efficient means of transmitting messages on a communication channel whereas Bavelas had a very different goal. Bavelas was interested in how people networked and collaborated to get things done or how many errors they would make on each trial (Heims, *The Cybernetics Group*, 24). Commenting on the psy-

85. See Flo Conway and Jim Siegelman, *Dark Hero of the Information Age: In Search of Norbert Wiener, the Father of Cybernetics*, 116–18.

86. David A. Mindell, *Between Human and Machine: Feedback, Control, and Computing before Cybernetics*, 289.

87. Heims, *The Cybernetics Group*, 1–13.

chological reaction that Bavelas's human subjects exhibited toward their error after each trial, Shannon remarked:

> I also think that the poorer results you obtained when they were given the amount of error were really an indication of the irrationality of people, because in a game situation the additional information certainly could not hurt you if you were perfectly rational; that is, if you choose the best strategy, additional information can only make it better from the point of view of reducing errors, if you play the game by the most rational means. If you had five Von Neumanns sitting in your cubicles, the answer should be better or at least as good with the additional information. (38)

Of course, irrationality or neurosis is not something Shannon himself was prepared to deal with, but his comments inadvertently bring the specter of the schizophrenic back into the picture that we have already encountered in Pierce's interpretation of Shannon. As indicated earlier, Shannon (and Pierce) had treated the stochastic properties of Printed English in his earlier experiments at Bell Labs *as if* there was an unconscious psychic mechanism governing the mind of every English speaker through which passed random letter sequences and word sequences without his or her conscious knowledge.

Shannon's subjects made errors in the guessing games and were duly corrected, but this process did not affect his design of efficient channels of communication. He simply assumed that the unconscious process would run its course and work automatically like a machine. In the unpublished "A Mind-Reading Machine," written one year after the eighth Macy Conference, Shannon constructed a model of the psychic machine that played the game of chance or, in the language of game theory, penny-matching games.[88] Presumably, until one can abolish the phenomenology of consciousness or else enable the machine to acquire consciousness, a mind-reading machine has no choice but operate at the unconscious level. This raises the interesting possibility of the machine's equivalent of schizophrenic breakdown and the death drive. When Lacan began to rework the Freudian notion of the unconscious in 1954, he contemplated this possibility.

Shannon's artistic tour de force the Ultimate Machine illustrates his intuitive grasp of a fundamental problem of the unconscious that Freud has termed the death drive. A recent kinetic sculpture by Hanns-Martin

88. Shannon, "A Mind-Reading Machine," 688–90. This essay bears the date March 18, 1953, at Bell Labs.

Wagner is modeled after Shannon's machine (Fig. 14). The idea of this machine was originally proposed by Shannon's colleague Marvin Minsky, an AI engineer, in 1952. Shannon was greatly taken by the idea and went ahead to build a few models.[89] The beauty of this machine is that it does nothing but switch itself off. When British writer Arthur C. Clarke visited the dream factory called Bell Labs in the midfifties, he saw the prototype on Shannon's desk and returned haunted by it afterward. He describes Shannon's Ultimate Machine in *Voice Across the Sea* as follows:

> Nothing could look simpler. It is merely a small wooden casket the size and shape of a cigar-box, with a single switch on one face.
>
> When you throw the switch, there is an angry, purposeful buzzing. The lid slowly rises, and from beneath it emerges a hand. The hand reaches down, turns the switch off, and retreats into the box. With the finality of a closing coffin, the lid snaps shut, the buzzing ceases, and peace reigns once more.
>
> The psychological effect, if you do not know what to expect, is devastating. There is something unspeakably sinister about a machine that does nothing—absolutely nothing—except switch itself off.[90]

Is the machine built to be schizophrenic or suicidal? Shannon used to say "I've spent lots of time on totally useless things," and the Ultimate Machine would have to be one of them.[91] Like all works of art, this machine tells us something about ourselves and our world. Clarke notes the devastating effect of the Ultimate Machine on nearly everyone who came in contact with it and adds that even "distinguished scientists and engineers have taken days to get over it. Some have retired to professions which still had a future, such as basket-weaving, bee-keeping, truffle-hunting or water-divining. They did not stop to ask For Whom the Bell Labs Toll."[92]

The toll—coming as it were not so much from Bell Labs as from MIT—would soon announce the suicide of the youngest member of the cybernetics group, Walter Pitts. Pitts was a mathematical genius and helped Mc-

89. The most recent display of this machine was in a special exhibition at the Heinz Nixdorf Museum in Paderborn, Germany. The exhibition is called "Codes and Clowns: Claude Shannon–The Juggling Scientist." on 6 November 2009 to 25 April 2010. See http://en.hnf.de/Special_exhibitions/Shannon/Shannon.asp.

90. Arthur C. Clarke, *Voice Across the Sea*, 159.

91. *Problemy Peredachi Informatsii*, "Claude Elwood Shannon," *Problems of Information Transmission* 37, no. 2 (2001): 89; translated from the Russian journal *Problemy Peredachi Informatsii*, no. 2 (2001): 3–7.

92. Clarke, *Voice Across the Sea*, 159.

Figure 14. Hanns-Martin Wagner's The Most Beautiful Machine, modeled on Shannon's Ultimate Machine. Used by permission of Hanns-Martin Wagner.

Culloch produce some of his most important work on neural networks. The young man suffered from a severe case of mental disorder and was judged "very sick" by Kubie and "schizophrenic" by Ralph Gerard and others (Heims, 155). In his study of the Macy Conferences, Heims makes a poignant observation about a central irony of this group: while the brilliant scientists and social scientists gathered and engaged in their heated discussions of the mind, brain, and the machine, the youngest and brightest regular member, Walter Pitts, was visibly sinking into mental disintegration toward the last few meetings.[93] Nevertheless, the scientists at the Macy Conferences, including Pitts and McCulloch, strenuously denied the reality of the unconscious and distanced themselves from the vagueness of psychoanalytical concepts. In spite of the force of this collective resistance, the specter of schizophrenia repeatedly asserted itself and pushed the question of the unconscious into the open at the Macy Conferences.

The majority of the scientists in that group found the notion "the unconscious" objectionable, but they seemed to take "consciousness" in stride as if this concept could stand alone. Their extraordinary inattention to the discursive structure of scientific knowledge was pointed out by

93. Heims, *The Cybernetics Group*, 154.

Mead, who commented that when the scientist (such as Leonard Savage) accused the psychoanalyst (Kubie) of making mere conjectures about the unconscious, he was acting in the conscious realm and not at all reflecting on his own conditions of knowledge.[94] Mead made a valid point there. It is interesting that, among the other cyberneticians, Norbert Wiener did not express his essential objections to psychoanalysis and, unlike McCulloch or Pitts, he believed the discipline could be rethought in terms of information, communication, and feedback (Heims, 126). But in my opinion, there is another reason why psychoanalysis would return to haunt the cyberneticians. This has to do with some of the guessing games adopted by Shannon and by other cyberneticians, which owed their existence to the psychic models developed by the first generation of psychoanalysts at the turn of the twentieth century such as Carl Jung, Eugen Bleuler, and Ernest Jones. The psychoanalysts, in particular, relied on their word-association games and automatic writing, which would later be associated with the work of the Surrealists, to compel random selections of written or linguistic symbols by the human subject, sometimes under hypnosis and sometimes not. These games were manipulated to help the psychoanalyst map out the ways in which the unconscious would assert itself through the symbolic circuit.

The Psychic Machine

The publication of Carl Jung's *Studies in Word-Association* in 1904 was an important event in the field of psychopathology. It marked the beginning of the author's friendship and collaboration with Sigmund Freud, which lasted through 1913.[95] Freud wrote: "Jung has shown what a subtle reagent for psychical states we possess in the association experiment as thus interpreted."[96] Jung hypothesized that people connect their ideas, feelings, and experiences through mental associations that can lead to what he calls "the complexes." He designed a word-association game dubbed "the association experiment" to ascertain how arbitrary psychical acts exhibited mental groupings that could yield valuable information about the unconscious. The game was subsequently adopted by many neurologists and psychiatrists

94. Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber, eds., Cybernetics: *Circular Causal and Feedback Mechanisms in Biological and Social Systems: Transactions of the Eighth Conference*, 127.

95. See Eugen Bleuler, "Consciousness and Association," 275.

96. Sigmund Freud, *The Psychopathology of Everyday Life*, in *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, vol. 6: 254.

in Germany, America, and elsewhere. Max Wertheimer and Julius Klein, both students of Hans Gross—one of the founders of modern criminal investigation—tried to develop techniques based on Jung's word-association game to establish psychological evidence in criminal proceedings.[97]

The word-association game shares a number of important features with the games that Shannon, Pierce, and Bavelas would adopt many decades later for information theory and cybernetics. They all include the following elements: human subjects, written and/or verbal symbols, randomness and chance production of symbols, identification of patterns, and in many cases, strict time constraints and the use of one or several devices or machine. Jung's association experiment consists of some simple steps, the most important of which is the precise measurement of time intervals. The analyst calls out a *stimulus word* to the human subject, who is asked to react as quickly as possible with the first word that comes into his or her mind. Although the selection of stimulus words is apparently random, there is a set vocabulary of 100 words out of which Jung regularly selects individual words (Tables 1 and 2). He explains that this set of words took its present form as a result of his clinical experience and that the mix of different grammatical features is arranged to touch upon all the complexes that commonly occur in practice.[98] Jung emphasizes that the association experiment investigates not just *one* component of the mind, since no psychological experiment can possibly be concerned with a single isolated psychic function—no psychic occurrence is a thing in and by itself but rather is the result of the entire psychological past. He treats the association experiment as a kind of "pastime" or a game between investigator and subject, not a mere linguistic exercise. Words *simulate* "actions, situations, and things" and put the subject in them. "If I were a magician," says Jung, "I should cause the situation corresponding to the stimulus-word to appear in reality and, placing the subject in the centre, I should then study his reactions" (Jung, "The Association Method," 444). The computer simulation models that emerged half a century later in cognitive science begin to embody this dream with claims to theatrical or virtual reality. Chapter 5 discusses this development.

In his studies of hysteria, Freud shows that a symptom is essentially a symbol for ideas (fundamentally sexual) that are not present in consciousness but are repressed by strong inhibitions. The repression occurs when

97. See Freud, "Psycho-Analysis and the Establishment of the Facts in Legal Proceedings," 106; Jung, "New Aspects of Criminal Psychology," 586–96.

98. See Jung, "The Association Method," 441.

Table 1. The set of 100 German words adopted in Carl Jung's association experiment. From Carl Jung, "The Association Method," *Experimental Researches* (1907), 440–41.

1. Kopf	34. gelb	67. Rübe
2. grün	35. Berg	68. malen
3. Wasser	36. sterben	69. Teil
4. singen	37. Salz	70. alt
5. Tod	38. neu	71. Blume
6. lang	39. Sitte	72. schlagen
7. Schiff	40. beten	73. Kasten
8. zahlen	41. Geld	74. wild
9. Fenster	42. dumm	75. Familie
10. freundlich	43. Heft	76. waschen
11. Tisch	44. verachten	77. Kuh
12. fragen	45. Finger	78. fremd
13. Dorf	46. teuer	79. Glück
14. kalt	47. Vogel	80. lügen
15. Stengel	48. fallen	81. Anstand
16. tanzen	49. Buch	82. eng
17. See	50. ungerecht	83. Bruder
18. krauk	51. Frosch	84. fürchten
19. Stolz	52. scheiden	85. Storch
20. kochen	53. Hunger	86. falsch
21. Tinte	54. weiss	87. Angst
22. bös	55. Kind	88. küssen
23. Nadel	56. aufpassen	89. Braut
24. schwimmen	57. Bleistift	90. rein
25. Reise	58. traurig	91. Türe
26. blau	59. Pflaume	92. wählen
27. Lampe	60. heiraten	93. Heu
28. sündigen	61. Haus	94. zufrieden
29. Brot	62. lieb	95. Spott
30. reich	63. Glas	96. schlafen
31. Baum	64. streiten	97. Monat
32. stechen	65. Pelz	98. hübsch
33. Mitleid	66. gross	99. Frau
		100. schimpfen

Table 2. The English translation of the set of 100 words adopted in Jung's association experiment. From Carl Jung, "The Association Method," *Experimental Researches* (1907), 440.

1. head	34. yellow	67. carrot
2. green	35. mountain	68. to paint
3. water	36. to die	69. part
4. to sing	37. salt	70. old
5. death	38. new	71. flower
6. long	39. custom	72. to beat
7. ship	40. to pray	73. box
8. to pay	41. money	74. wild
9. window	42. stupid	75. family
10. friendly	43. exercise-book	76. to wash
11. table	44. to despise	77. cow
12. to ask	45. finger	78. friend
13. cold	46. dear	79. happiness
14. stem	47. bird	80. lie
15. to dance	48. to fall	81. deportment
16. village	49. book	82. narrow
17. lake	50. unjust	83. brother
18. sick	51. frog	84. to fear
19. pride	52. to part	85. stork
20. to cook	53. hunger	86. false
21. ink	54. white	87. anxiety
22. angry	55. child	88. to kiss
23. needle	56. to pay attention	89. bride
24. to swim	57. pencil	90. pure
25. journey	58. sad	91. door
26. blue	59. plum	92. to choose
27. lamp	60. to marry	93. hay
28. to sin	61. house	94. contented
29. bread	62. darling	95. ridicule
30. rich	63. glass	96. to sleep
31. tree	64. to quarrel	97. month
32. to prick	65. fur	98. nice
33. pitty	66. big	99. woman
		100. to abuse

these ideas are charged with painful affects and are therefore incompatible with ego-consciousness. Jung believes that such complexes of ideas can show up in the association experiment, as everybody has one or more complexes that manifest themselves in some way in association. In a typical test, the subject is given the instruction: "Answer as quickly as possible with the first word that occurs to you" (441). The speed of the subject's reaction is recorded before the analyst moves to the next word down the list, and this process continues until a large number of repetitions yield a series of pairs of words that constitute a pattern of *associations*. Repetition requires the subject to hear the same stimulus word and reproduce the reaction word, and the success or failure of the reproduction is factored into the overall picture of the complexes. All this is carefully monitored by a 1/5-second stopwatch. The measurement of time intervals between the stimulus word and the subject's reaction is called the reaction-time ratio. If the average time between a stimulus word and the subject's reaction is 2.5 seconds, then 3 seconds is considered a prolonged reaction-time, which could indicate the presence of "feeling-toned complexes."[99]

Table 3 is one fragment of a case analyzed by Jung in his association experiment. We are told that a thirty-two-year-old professional musician came to seek medical help when he developed a nervous condition after a series of failed relationships. The italicized words are the associations that were either not reproduced or wrongly reproduced upon repetition during the test. Jung remarks on prolonged reaction-times and associations linked to thoughts of suicide. For example, the word "angel" triggers a delay as long as 8/5-seconds and the word "ill" even longer. Jung notes further that "the incorrect reproductions to the repeated stimulus-words are those that are directly constellated by a feeling-toned complex or those that immediately follow a critical one, and therefore fall within the area of the persevering feeling-tone."[100] Does this experiment lead to reliable information about the subject? How scientific is the psychoanalytic method? Will psychoanalysis remain a difficult art of interpretation, as Jung has noted about Freud's work?[101] These questions troubled Jung and the other practitioners of psychology and psychoanalysis deeply.

99. *Jung*, "The Reaction-Time Ratio in the Association Experiment," 221–71. The so-called average in the reaction-time ratio is determined according to the subject's gender and education background. Jung finds women and the uneducated lagging behind men and the educated but does not provide a proper explanation. The ideological implication of these statistics should not be underestimated.

100. Jung, "Experimental Observations on the Faculty of Memory," 278–79.

101. Jung, "Psychoanalysis and Association Experiments," 290.

Table 3. Fragment of case no. 1 in Carl Jung's association experiment. From Carl Jung, "Experimental Observations on the Faculty of Memory," *Experimental Researches* (1907), 275.

Stimulus-word	Reaction	Reaction time (secs.)	Reproduction	Remarks
1. *head*	*empty*	3.2	to see	Complex underlying the illness.
2. *green*	*lawn*	2.2	colour, tree	Probably perserverating feeling-tone.
3. *water*	*to drown*	2.2	deep	The patient had had thoughts of suicide as a result of his illness.
4. *to stab*	*dead*	1.8	unpleasant	—
5. angel	beautiful	8.0		Here the feeling-tone of the previous reaction has probably perseverated. Word not a first understood. Erotic reminiscences easily aroused by this word.
6. long	table	2.8	—	—
7. *ship*	*crew*	3.0	to travel, to drown	Suicide by drowning.
8. to plough	peasant	2.0	—	—
9. wool	sheep	2.0	—	—
10. friendly	very	2.8	—	Affair with the lady.
11. desk	high	3.6	—	Prolonged reaction time due to perseverating feeling-tone.
12. *to ask*	*difficult*	3.2	to put	Same complex.
13. state	beautiful	2.4	—	—
14. obstinate	very	2.0	—	1st fiancée.
15. stalk	green	2.2	—	—
16. to dance	good	2.2	—	—
17. lake	stormy	2.0	—	—
18. ill	unpleasant	8.8	—	Illness
19. conceit	very	2.8	—	Relations with the lady.
20. to cook	good	2.0	—	—
21. ink	black	1.8	—	—
22. wicked	very	4.8	—	1st fiancée.
23. pin	prick	1.4	—	—
24. *to swin*	*not*	2.8	good	Suicide.
25. *journey*	*difficult*	2.4	long	Perseverating feeling-tone.
26. blue	colour	2.0	—	—

The introduction of 1/5-second stop-watch helped mitigate subjectivism and enabled the analyst to measure the patient's reaction time for possible symptoms of inhibition. There was also another technological apparatus—the Deprez-d'Arsonval galvanometer—which became very popular. This machine advanced bold claims about its ability to give objective representations of feeling-tones and psychic states. Swiss neurologist Otto Veraguth was the first to adopt it in conjunction with word-association tests to measure "galvano-psychophysical reflexes" in 1906. Jung improved the apparatus by attaching an automatic ergograph writer to register the traces of galvanometric oscillations during the association experiment. Galvanometers can be very sensitive to external stimuli. When a small electric current (about two volts) is conducted through the human body, say, the palms, the galvanometer will respond to the increase in the amount of the current, that is, the lowering of the electrical resistance of the body. This change in the amount of the current causes the coil and its attached mirror to rotate around a vertical axis. As Figure 15 indicates, Jung added a movable slide with a visor to the scale of the galvanometer. The slide, pushed forward by the hand, always follows the moving mirror reflection. To the slide is

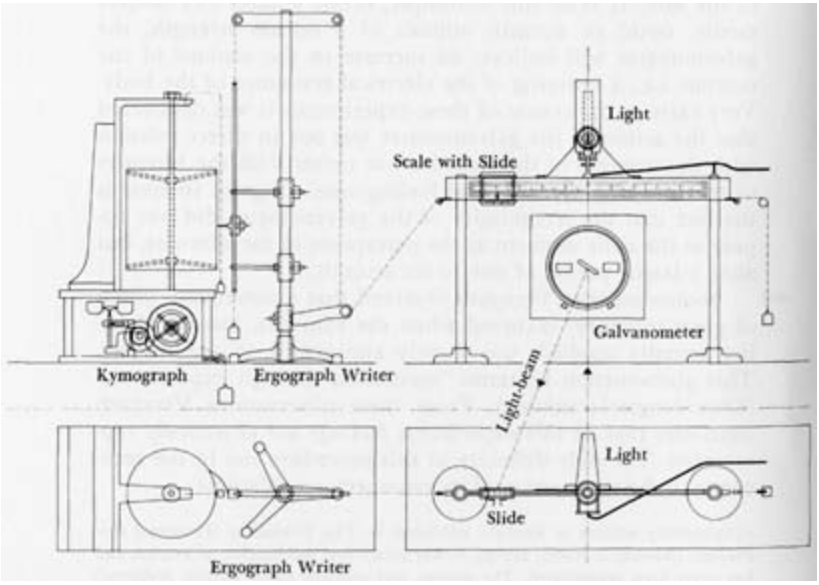

Figure 15. The design of Carl Jung's galvanometer-ergograph writer. From Carl Jung, "On the Psychological Relations of the Association Experiment," in *Experimental Researches* (1907), 484. Used by permission of the Foundation of the Works of C. G. Jung.

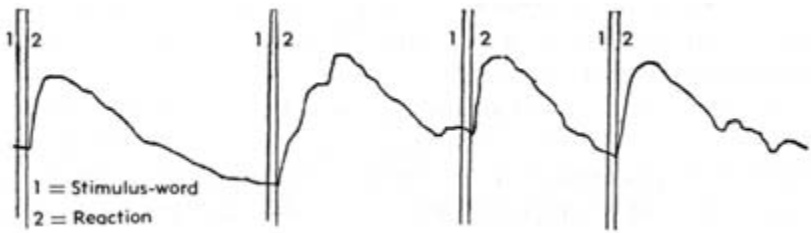

Figure 16. Graphic representation of galvanic oscillation. From Carl Jung, *Experimental Researches* (1907), 487. Used by permission of the Foundation of the Works of C. G. Jung.

fastened a cord leading to the ergograph writer, whose penpoint marks the movement of the slide on a kymographic tambour fitted with endless paper. Figs. 16 and 17 illustrate the kind of feeling-tone curves that Jung's ergograph writer traced in the course of the association experiment.[102] The vertical lines in Figure 16 mark the moment at which the stimulus word was given to the subject. The curve rises sharply and then slowly falls. After the apparatus has been readjusted to register only the strongest feeling-tones, the curve begins to show a distinct pattern as in Figure 17. It illustrates that the ninth stimulus word caused the longest delay in the subject's reaction. That word is "pretty."[103] The galvanometric oscillations appear to confirm what his 1/5-second stop-watch reveals about the hidden complexes.

But what does the structure of the association game tell us about the relationship between symbol and the unconscious? As we have seen, Jung's incorporation of a 1/5-second stopwatch, the built-in repetition mechanism, and the galvanometer amounts to treating the unconscious as an automaton. This technical imperative embodies what Freud has called the *Wiederholenzwang* (repetition automatism) of the unconscious, a point that would be picked up by Lacan in his critical reevaluation of Freud's contributions to psychoanalytic theory.[104] The unconscious in this sense also anticipates how Shannon and Turing would approach the mind as a thinking machine. Both Shannon's mind-reading machine and Turing's learning machine are machines that, strictly speaking, think unconsciously, i.e.,

102. Both the description and the design are found in Jung, "On Psychophysical Relations of the Association Experiment," 484.

103. Jung conducted the association experiment on a young man who got married the week before and whose wife was considered not very "pretty" by others (ibid., 487).

104. In the English-speaking world, Ernest Jones adapted Jung's experiment to his research and diagnostic practices. See Ernest Jones, "The Practical Value of the Word Association Method in Psychopathology" in his *Papers in Psycho-Analysis*, 395–425.

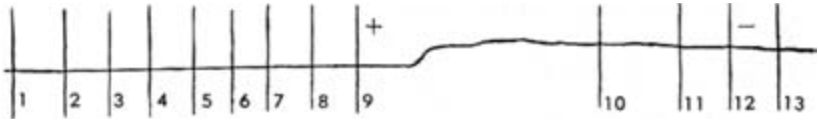

Figure 17. Graphic representation of a strong feeling-tone curve. From Carl Jung, *Experimental Researches* (1907), 487. Used by permission of the Foundation of the Works of C. G. Jung.

manipulating symbols unconsciously and blindly. In Shannon's Printed English, the unconscious machine is capable of putting out nonsense letter sequences as well sensible ones, such as the sample verse Pierce has given us. Does this amount to saying that the machine of the unconscious is fundamentally schizophrenic?

When Deleuze and Guattari proposed schizoanalysis in opposition to psychanalysis in *Anti-Oedipus*, they envisioned something like this:

> To discover beneath the familial reduction the nature of the social investments of the unconscious. To discover beneath the individual fantasy the nature of group fantasies. Or, what amounts to the same thing, to push the simulacrum to the point where it ceases to be the image of an image, so as to discover the abstract figures, the schizzes-flows that it harbors and conceals. To substitute, for the private subject of castration, split into a subject of enunciation and a subject of the statement relating only to the two orders of personal images, the collective agents of enunciation that for their part refer to machinic arrangements. To overturn the theater of representation into the order of desiring-production: this is the whole task of schizoanalysis.[105]

Multiple flows and bodies without organs are mobilized to displace the single subject of enunciation: call it the family, the law of the father, Oedipus, or the capitalist machine. The problem is that the schizophrenic was no stranger to the cybernetic machine even at its moment of inception, and one might suggest that schizophrenia has been the haunting figure in the development of the capitalist communication machine.

We must bear in mind that symbols that are universally adopted by information theory, cybernetics, and computer technology are discrete units—letters and numbers—rather than spoken or semantic units. McCulloch recalled that when he first embarked on the study of neurophysiology and then cybernetics, he had wanted to pursue a philosophical

105. Deleuze and Guattari, *Anti-Oedipus: Capitalism and Schizophrenia*, vol. 1, 271.

question: "what is a number, that a man may know it, and a man, that he may know a number?"[106] Did the pioneers in psychoanalysis take a similar interest in numerical symbols as an alternative to semantics in their approach to the mind?

In *The Psychopathology of Everyday Life*, Freud offers some preliminary speculations about how the unconscious deals with number. He suggests that numerical symbols—especially obsessive ones—behave very much like the slip of the tongue, the slip of the pen, or what he has demonstrated in the dreamwork. He recounts how his own mind tends to "plunge into an arithmetical train of thought which arrives all at once at the desired number" and how "the numbers are so freely at the disposal of my unconscious thinking, whereas I am a bad reckoner and have the greatest difficulties in consciously noting dates, house numbers and such things."[107] Citing Jung's "Essay on the Understanding of Number Dream" (*Ein Beitrag zur Kenntnis des Zahlentraumes*) and Jones's "Unconscious Manipulation of Numbers," Freud argues that numerical associations are prone to manipulation by the unconscious and to the patterns of condensation and compromise-formation that one finds in verbal associations. Therefore, random action can never be truly random insofar as the psyche is concerned and that "one cannot make a number occur to one at one's own free choice any more than a name" (*The Psychopathology of Everyday Life*, 240). Freud's observations were confirmed by the clinical observations of Alfred Adler, Carl Jung, Ernest Jones, and others.

If Freud came somewhat close to the notion of statistical probability tending toward a possible resolution of the relationship of chance and determinism, he did not seriously pursue that line of thought. Those who did pursue the thought with intellectual rigor were, for the most part, game theorists and mathematicians like Turing, Wiener, von Neumann, and Shannon. However, these mathematicians did not express much interest in the kind of questions Freud and other psychoanalysts posed to the human psyche. The rare thinker who burst on the postwar intellectual scene and began to engage Freud as well as the above mathematicians across the disciplinary divides was the French psychoanalyst Jacques Lacan.

106. Warren S. McCulloch, *Embodiments of Mind*, 2.

107. Sigmund Freud, *The Psychopathology of Everyday Life*, in *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, vol. 6: 250.