A Dream Before the Dawn of the Digital Age? Finnegans Wake, Media, and Communications

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A DREAM BEFORE THE DAWN OF THE DIGITAL AGE?
FINNEGANS WAKE, MEDIA, AND COMMUNICATIONS

by

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INTRODUCTION

In the early stages of developing *Finnegans Wake*, James Joyce invited a few literary friends to his apartment for a reading. Irish critic Mary Colum recalls, "When the reading, made memorable by his beautiful voice, was over, Joyce stood before me for a moment or two, and I shook in my shoes. 'Well?' he questioned. 'What do you think?' I summoned my courage up and answered with what I fear was pomposity: 'Joyce, I think, it is outside literature.'"[1] Shortly afterwards, the Colums departed for Switzerland, not to see Joyce for a month. "My husband went to see him on our return," remembers Colum. "Joyce seemed to have spent some time chewing over the comments his audience had handed out to him [at the reading]. 'Your wife,' he said sternly, 'said that what I read was outside literature. Tell her it may be outside literature now, but its future is inside literature.'"[2]

Twenty years after the publication of *Finnegans Wake* in 1939, Richard Ellmann prefaces the first edition of his biography of James Joyce with: "We are still learning to be James Joyce's contemporaries."[3] This thesis looks at a specific way in which Joyce's genre-shattering terminal work *Finnegans Wake* pointed to the future. In its interrogation of literary and linguistic communications, the work anticipated and complicated discoveries made in the field of information theory that occurred a decade after its publication. Following a long tradition of observing the presence of both mathematical and literary tendencies in Joyce's work, this thesis explores the tension between these two modes by looking at the *Wake* through the lens of Claude Shannon's communication

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[1] Mary Colum and Padraic Colum, *Our Friend James Joyce* (Garden City, N.Y.: Doubleday, 1958), 130.
[2] Colum and Colum, *Our Friend James Joyce*, 130.
[3] Richard Ellmann, *James Joyce* (New York: Oxford University Press, 1959), 563.

channel, finding that a close reading of the work reveals *Finnegans Wake*'s attitudes towards its own encoding and decoding. *Finnegans Wake* offers both *text*, which offers meaning in a more traditional sense, enclosing a methodical transposition of reality within the written word, and *metatext*, in that it comments on its own possibilities of reception or non-reception. In its commentary on the nature of its own creation and reception, *Finnegans Wake* brings its readers face to face with its famous difficulty: its plenitude of meanings both overwhelming and inspiring.

With respect to the encoding of consciousness in *Finnegans Wake*, Joyce's experimentation with form can be contextualized within the renovation of the novel; a changing world impacted by rapid technological changes demanded the necessity of equally modern representational forms. As an example, Erich Auerbach views the modernist stream of consciousness, as popularized by authors like Joyce and Virginia Woolf, as paradigmatic of the era:

> It is easy to understand that such a technique had to develop gradually and that it did so precisely during the decades of the first World War period and after. The widening of man's horizon, and the increase of his experiences, knowledge, ideas, and possible forms of existence, which began in the sixteenth century, continued through the nineteenth at an ever faster tempo — with such a tremendous acceleration since the beginning of the twentieth that synthetic and objective attempts at interpretation are produced and demolished every instant.[4]

"The increase of … experiences, knowledge, ideas" that continued "with such a tremendous acceleration since the beginning of the twentieth [century]" came about as a result of the social and technological changes at the beginning of the 20th century. In order to better capture the complexity of an inner consciousness affected by ever-

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[4] Erich Auerbach, *Mimesis: The Representation of Reality in Western Literature*, trans. Willard R. Trask (Princeton, N.J.: Princeton University Press, 2003), 549.

increasing amounts of information, Joyce borrowed from a wide variety of media old and new: he was inspired by the attributes of new streaming forms such as radio and Muzak as well as older communicative technologies such as the written letter.[5]

Within the text, Joyce anticipates and embraces the possible sources of noise (defined as external factors that degrade the initial state of a message) in a chain of information transmissions, eschewing the information-theoretic solution of error-correcting codes to minimize loss. In Joyce's chain of transmissions, he seemingly not only anticipates the communication channel articulated by Claude Shannon but challenges its feasibility in practice. By experimenting with a number of different communication channels stacked back-to-back, and revealing what happens when their limits are reached, *Finnegans Wake* embraces entropy as a generative condition of textuality.

Finnegans Wake holds two beliefs in tension about the nature of writing and communications; both drift in and out of the foreground at different moments in the work. The work alternately engages with a scientific mode reflected in its eagerness to cling as closely to reality as possible and a literary mode reflected in the way it embraces multiple decodings of itself. *Finnegans Wake* both anticipates the sender-receiver model of communications in its belief in the project of translating reality via the written word, and yet understands its practical limitations when applied to the project of interpreting literature. Joyce spent sixteen years thinking about the best way to approximate reality in literature, yet was able to joke that at the end of the day, all writing is just shitstains on a page. His work is an acknowledgement of the tradeoff at the heart of its writing: to wield

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[5] Jeffrey Masten, Peter Stallybrass, and Nancy J. Vickers, *Language Machines: Technologies of Literary and Cultural Production* (New York: Routledge, 1997), 1.

language as one's chosen medium for representing reality means to acknowledge the implications of its generative nature.

Finnegans Wake confounds the expectation of what a novel is and celebrates the imprecision of meaning. In a final chapter, prompted by Finnegans Wake's musings on communication but moving past the subject of the work, this thesis offers a quantitative model for thinking about one of Joyce's central concerns: humor. The chapter offers a basic model for thinking about how to formalize one kind of miscommunication in terms of the distance between the priors of the sender and receiver. As such, the thesis proposes an operational approach for minimizing miscommunication via an application of Bayes' Theorem: the sender's dynamic updating of the receiver's prior such that the receiver's resultant posterior is approximately equal to the sender's initial prior. In conclusion, this thesis hones in on a singular problem that can be addressed by this quantitative model and informed by the vocabulary of information theory: the understanding of modern humor, the likes of which Joyce himself, punster that he was, might have appreciated were he still alive today.

Writing Finnegans Wake

Joyce published four works of prose in his lifetime, of which *Finnegans Wake* was his last, after the short-story collection *Dubliners* (1914) and the novels *A Portrait of the Artist as a Young Man* (1916) and *Ulysses* (1922)*. Joyce consistently pushed the boundaries of style; each work was distinct from the one before it. His bibliography might even be said to reflect in miniature the stylistic path that the novel itself traversed, from the Flaubertian *Dubliners* to the postmodern *Finnegans Wake*.

Well-read as he was, Joyce was actively conscious of the role that these different representational forms played in the translation of reality. Between 1903 and 1904, he kept a series of notebooks outlining his own aesthetics. That Joyce unselfconsciously "signed his name and the date after each observation as if to guarantee its importance as well as to identify its authorship" was no coincidence; Joyce's faith in intertextuality had him anticipating that one day he would be translated as he too was translating Aristotle and Aquinas.[6]

His early notebooks and critical writings later served as the basis for Stephen Hero, which then evolved into the discussion of aesthetics in "A Portrait of a Young Man." As Ellmann suggests, "[Joyce] moves, then, from bald statement in the Paris and Pola notebooks to a mixture of narrative essay and dramatic presentation of his theories in Stephen Hero, and finally to the sheerly dramatic presentation in the Portrait."[7] Joyce's translation of the same idea between these different mediums, gradually evolving from stark to stylistic, captured his early adeptness at negotiating the fluidity between these two modes of representation, even before he was able to do it all in a single work as he would later do with *Ulysses*.

Despite differences in delivery, his work can be said to have focused on three main concepts: Dublin, consciousness, and time. On the progression of the ideas underpinning Joyce's work, Ellmann writes, "In all his books up to *Finnegans Wake* Joyce sought to reveal the coincidence of the present with the past. Only in *Finnegans Wake* was he to carry his conviction to its furthest reaches, by implying that there is no

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[6] James Joyce, *The Critical Writings of James Joyce*, ed. Mason Ellsworth and Richard Ellmann (Ithaca, N.Y.: Cornell University Press, 1989), 141.

[7] Joyce, *The Critical Writings of James Joyce*, 141.

present and no past, that there are no dates, that time — and language which is time's expression — is a series of coincidences which are general all over humanity. Words move into words, people into people, incidents into incidents like the ambiguities of a pun, or a dream."[8] "The Dead," the novella-length final short story in *Dubliners*, finds a man haunted by the eerie tangibility of his wife's dead former lover. Both *A Portrait of the Artist as a Young Man* and *Ulysses* claim that ordinary Irish men are like the epic Greek heroes of old (Daedalus and Odysseus, respectively).[9] *Finnegans Wake* generalizes this idea to move beyond a singular, specific convergence of past and present.

One interpretation of *Finnegans Wake* is that it concerns itself with the dream life of a family of recurring characters: the father Humphrey Chimpden Earwicker (also known as HCE and associated with multiple different variations of those letters), the mother Anna Livia Plurabelle (ALP, likewise), twin sons Shem and Shaun, and daughter Issy. Margot Norris also suggests that Finnegans Wake is "the dream" of his earlier texts, "as though his earlier texts contained hidden truths, secret feelings and desires … [revealing] the earlier text to have had an unconscious life (which we can equate with the potential of language)," given that "his preparatory moves in December of 1922 [for writing Finnegans Wake] included sorting out old notes for *Ulysses* … [of which the] unused notes alone weighed twelve kilos."[10]

With *Finnegans Wake*, the impetus for the project was to do what he had done in *Ulysses* — to capture the essence of the day — for the night. This was a much more

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[8] Ellmann, *James Joyce*, 563.

[9] Another singular coincidence of past and present: in the "Calypso" chapter of *Ulysses*, Molly Bloom asks "What had Gretta Conroy on?", referencing one of the principal characters in "The Dead."

[10] Margot Norris, "Finnegans Wake," in *The Cambridge Companion to James Joyce*, ed. Derek Attridge (Cambridge: Cambridge University Press, 2004), 156.

difficult endeavor. Joyce took great pains to write the work. He wrote it amidst growing

blindness and waning support from former enthusiasts.[11] Part of the reason that writing

Finnegans Wake was so difficult had to do with structural difficulties as a result of the

novel domain of the project. Structurally, the novel was much harder to write than

Ulysses, where "the ports of call at least were known beforehand."[12] Ellmann writes, "He

had begun his writing by asserting his difference from other men, and now increasingly

he recognized his similarity to them. This point of view was more easily demonstrable in

sleeping than in waking life … by day we attempt originality; by night plagiarism is

forced upon us."[13] Joyce worked for 16 years to achieve this sense of "plagiarism." To

capture the intricacies of sleeping life Joyce could not borrow as liberally from an

existing structure like he did with Homer's Odyssey in *Ulysses*. The problem space of

Finnegans Wake — replicating a more subterranean level of consciousness — was unlike

that of any existing work.

     To achieve this effect, Joyce toiled to seamlessly move "words … into words." In

doing so, he picked up again the problem he had encountered with *Ulysses*. "He

sometimes used Ulysses to demonstrate that even English, that best of languages, was

inadequate … at a time when others were questioning the liberties he took with English,

Joyce was conscious only of its restraints upon him."[14] Even before *Finnegans Wake*,

Joyce often found himself constrained by English, saying, "I'd like a language which is

above all languages, a language to which all will do service. I cannot express myself in

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[11] Ellmann, *James Joyce*, 601.
[12] Ellmann, *James Joyce*, 565.
[13] Ellmann, *James Joyce*, 728.
[14] Ellmann, *James Joyce*, 410.

English without enclosing myself in a tradition."[15] To get around this, Joyce coined his own neologisms, first English; later multilingual. Donald Theall writes that Joyce's methodical construction of prose bears similarities to scientific processes. "Joyce approaches language as a mathematical structure and as an engineering problem. At the very simplest level of playing with the phonological material, he employs the science of historical phonetics in designing many of his overlayerings and chainings of linguistic units."[16]

The Emergence of Information Theory

Joyce's production of *Finnegans Wake* can be contextualized within larger cultural conversations surrounding information and its transmission following the technological developments of the early 20th century, the greatest scientific legacy of which is the emergence of the field of information theory. *Finnegans Wake* precedes some of these conversations but anticipates the formation of a coherent body of theory concerning the processes of communication. The emergence of information theory occurred in a historical moment influenced by wartime necessity; the founders of information theory were directly involved on the mathematical fronts of the wartime effort. Though William Aspray posits that these scientists were already "well along the way to developing the theory of communication prior to the war" because of the "rapid growth of television and radio", the catalyst for a coherent body of theory was the Second

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[15] Ellmann, *James Joyce*, 410.
[16] Donald F. Theall, *James Joyce's Techno-Poetics* (Toronto; Buffalo: University of Toronto Press, 1997), 53.

World War and the need for efficient means of encoding, decoding, and transmitting information.[17]

In 1948, Claude Shannon, who worked on cryptography for the American war effort during World War II, published his landmark paper "A Mathematical Theory of Communication." Former IEEE Fellow and Princeton professor Sergio Verdu later hailed it as "the Magna Carta of the information age" and writes that its publication definitively marked the birth of the field of information theory.[18] In his paper, Shannon cited the earlier work of Harry Nyquist and R.V.L. Hartley as the basis of his own theory of communication. Nyquist in 1924 had published a paper that discussed the relationship between transmission rate and the number of signals being transmitted. In 1928, Hartley discovered that the logarithmic function is the one best suited for measuring information. Hartley first solidified the principle that "information" could be defined as the outcome of a selection among a finite number of possibilities, writing that

$$H = n \log s$$

where H is the amount of "information" associated with n selections and s is the number of symbols available in each selection.

[17] William Aspray, "The Scientific Conceptualization of Information: A Survey," *Annals of the History of Computing* 7, no. 2 (April 1985): 138.

[18] S. Verdu, "Fifty years of Shannon Theory," *IEEE Transactions on Information Theory* 44, no. 6 (October 1998): 2057.
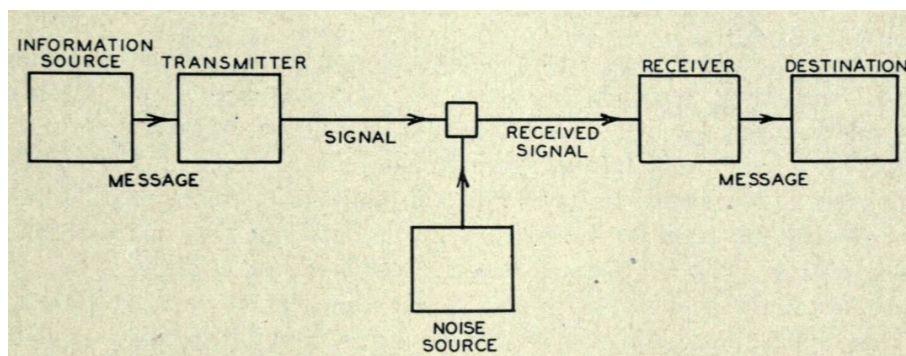
Fig. 1 — "Schematic diagram of a general communication system."[19]

The diagram represents the basic mathematical model for Shannon's communication

system. Shannon proposed that such a system consists of five components: an

information source, a transmitter (encoder), a noisy channel, a receiver (decoder), and a

destination. Integral to this formulation is the identification of an information source as a

stochastic process: the sequence of signals released by the information source are

governed by a set of probabilities.[20]

In order for information theory to be conceived of as a scientific discipline, there

had to be a way to quantify and parameterize the concept of information. In order to

achieve this, Shannon divorced the concept of raw information from meaning, writing,

"Frequently the messages have *meaning*; that is they refer to or are correlated according

to some system with certain physical or conceptual entities. These semantic aspects of

communication are irrelevant to the engineering problem."[21] Shannon's definition of

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[19] C.E. Shannon, "A Mathematical Theory of Communication," *The Bell System Technical Journal* 27, no. 3 (1948): 381.

[20] Sequences of symbols in natural language, for example, are probabilistic; the word "ice" is more likely to be followed by the word "cream" than it is to be accompanied by the word "bath." Most language models are probabilistic in nature, an extension of John Rupert Firth's oft-repeated quote "You shall know a word by the company it keeps." Named after his work, the noisy channel model in natural language processing is a practical application of this phenomenon. In NLP, the noisy channel model is a probabilistic framework for unscrambling a distorted input.

[21] Shannon, "A Mathematical Theory of Communication," 379.

information posits that information depends on uncertainty, or randomness. The larger the number of possibilities of messages, the larger the amount of information ultimately transmitted. Intuitively, the base case is that if a message will be transmitted with a probability of 1 (for example, if two people already know what they are having for dinner that night), then there is no need for the message to be communicated at all.

Shannon defined the term "entropy" as a unit of measurement for information. On the relevance of the word "entropy," which has physics connotations, to describe the idea of orderliness in the communication channel, Aspray writes, "This tie between thermodynamics, statistical mechanics, and communication theory suggests that communication theory involves a basic and important property of the physical universe and is not simply a scientific by-product of modern communication technology."[22]

Verdu points out the limitations of the earlier papers: "Nyquist and Hartley had not quantified the effects of noise, nor had they modeled sources of information probabilistically."[23] In addition to the contribution of defining information as a stochastic process, Shannon, unlike his predecessors, accounted for the possibility of errors in transmission. A noise source complicates Shannon's model. Noise creates a nonzero probability of error in transmission; the received message is distorted, defined as a function of both the initial transmitted signal and the noise variable. It follows that there exists a way to recover or correct the distorted message. The introduction of an error-correcting code is inversely related to the rate of transmission. Shannon demonstrated that a code exists where the rate of transmission can approximate the capacity of the channel.

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[22] Aspray, "The Scientific Conceptualization of Information: A Survey," 124.
[23] Verdu, "Fifty years of Shannon Theory," 2058.

Yet though Shannon had made strides to systematize information theory as a quantitative science, it was not until a few years later that other scientists would seize the opportunity to integrate information theory with statistics. In 1951, Solomon Kullback and Richard Leibler published "On Information and Sufficiency," introducing the idea of a "measure of the 'distance' or 'divergence' between statistical populations in terms of our measure of information" that "generalize[d] to the abstract case Shannon's definition of information."[24] In 1959, with the publication of "Information Theory and Statistics," Kullback would expand upon the necessity of this "directed divergence" (now more commonly known as Kullback-Leibler (KL) divergence) and the addition of a more statistical basis to the field of information theory. Yet even as he criticized the existing gap between the fields of statistics and information theory, Kullback demonstrated that there did exist a natural connection, reaffirming Shannon's success in defining a theoretical framework for information abstract enough to encompass all mediums and that ultimately had its roots in the physical world. "Speaking broadly, whenever we make statistical observations, or design and conduct statistical experiments, we seek information. How much can we infer from a particular set of statistical observations or experiments about the sampled populations?" writes Kullback.[25]

As promised, Kullback and Leibler generalized the notion of Shannon entropy from absolute to relative. Formally, the KL divergence captures the asymmetric difference between two probability distributions P and Q where P is the true or target probability distribution and Q is an approximation. The KL divergence of Q from P,

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[24] S. Kullback, S and R.A. Leibler, "On Information and Sufficiency," *Annals of Mathematical Statistics* 22, no. 1 (1951): 79.
[25] Solomon Kullback, *Information Theory and Statistics.* Wiley Publication in Mathematical Statistics, (New York: Wiley, 1959), 3.

known as *KL (P || Q),* measures the information lost when Q is used to approximate P.

This is also known as the relative entropy of P with respect to Q. In the simple case, two

identical distributions will have a KL divergence of 0.

$$D_{KL} (P \parallel Q) = \Sigma_{x \in X} P(x) \ log \frac{P(x)}{Q(x)}$$

More colloquially, the KL divergence measures the amount of information lost when a

Spanish speaker is relied upon to translate a paragraph of French. The use case of

language modeling is actually a common one for KL divergence, and the example also

illustrates the intuitive asymmetry of KL divergence: a French speaker may be better or

worse at translating a paragraph of Spanish.

It was not until a few years after Joyce's death that information scientists would

piece together earlier discoveries into a quantitatively defined system that accurately

generalized the transmission of information and sources of its inevitable loss. However,

while the early information theorists were interested in efficient communication, Joyce

was fascinated by the creative possibilities made possible by *inefficient* communication.

Where Shannon was interested in noise only insofar as he was interested in its correction,

Joyce argued in favor of its amplification. Furthermore, Joyce was not only interested in

the addition of noise — he was interested, like Kullback and Leibler, in the loss as a

result of the existence of certain asymmetric priors held by the sender and receiver.

Finnegans Wake celebrates random readings that have nothing to do with the author's

intention: either as a result of noise, or as a result of asymmetric priors. Roy Benjamin

reads the celebration of noise in *Finnegans Wake* as an explicitly political choice, a literal

resistance of the master narrative, writing, "The values of destructive noise in the Wake

include the undermining of old codes, the loosening of old constraints, and the

overthrowing of old structures of power; the values of constructive noise include the evolution of complexity, the emergence of order out of chaos, and the cooperation of order and disorder in stochastic noise. Many of the conflicts in the Wake can be seen in terms of a power struggle to overcome, possess, and monopolize noise. It is a war both between and within generations that can be resolved in no final victory or defeat."[26]

Finnegans Wake as Medium and Message

Occurring in parallel to the development of information theory was the rise of the Toronto School of media studies, a scholarly network centered around Marshall McLuhan that did much to popularize the idea that cultures were shaped by their communications technologies. As evident from the focus inherent in "information" vs. "media/medium," while both fields were interested in the problem of communication, each field had an emphasis dictated by its origins. Information theory, descended from mathematics, was concerned with the precise, quantitative measurement of information and the essential unity of all information with respect to transmission. Media studies as pioneered by Marshall McLuhan had its origins in the literary criticism he was taught at Cambridge, and was contextual and applied, concerned with the poetic analysis of specific cultural artefacts.[27] While information theorists had not tended to engage directly with literary works, for this new and influential school of thought about media and society, Joyce's *Finnegans Wake* was a key text.

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[26] Roy Benjamin, "Noirse-Made-Earsy: Noise in Finnegans Wake," *Comparative Literature Studies* 50, no. 4 (2013): 673.

[27] Donald F. Theall, *The Virtual Marshall McLuhan* (Montreal; Ithaca: McGill-Queen's University Press, 2001), 4, 7.

That the work of modernist artists was at the forefront of McLuhan's mind is no coincidence, according to Donald Theall, who wrote his doctoral thesis *Communication Theory in Yeats, Pound, Eliot and Joyce* at the urging and under the advisement of McLuhan.[28] Theall writes, "McLuhan stresses a set of themes directly attributable to modernist and avant-garde artists ... media production and dream, space-time and the arts, external landscape and the urban landscape … language and other sign systems as code, the recognition of the book as a medium, orality/literacy and tactility, synaesthesia and the intrasensory, syncretism and the orchestration of the arts, and the artwork as machine."[29] McLuhan was interested in Joyce (and *Finnegans Wake*) in particular, believing that the *Wake* was a distinctly modern work, that it "could not have [been] conceived … in any other age than the one that produced the phonograph and the radio."[30] Theall himself also writes that "awareness of machinery, science, and technology as aspects of the everyday world of contemporary humankind abounds in *Finnegans Wake*."[31] Media theorists looked to the *Wake* for answers because of Joyce's conviction that "the future is always already present in the past."[32]

Theall writes, "Marshall McLuhan was fascinated by the *Wake*'s paradoxical techniques and their interface with a world that was rapidly and inevitably changing."[33] He additionally claims that media studies' obsession with McLuhan as a father figure ignores the influence that Joyce had on McLuhan, writing, "McLuhan's becoming the guru of cyberculture has inhibited or prevented many theorists and practitioners from

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[28] Theall, *The Virtual Marshall McLuhan*, 153.
[29] Theall, *The Virtual Marshall McLuhan*, 163.
[30] Theall, *The Virtual Marshall McLuhan*, 157.
[31] Theall, *James Joyce's Techno-Poetics*, 51.
[32] Theall, *James Joyce's Techno-Poetics*, 51.
[33] Theall, *The Virtual Marshall McLuhan*, 156.

realizing the full, vital importance of Joyce as one of the key, if not the key figure, in anticipating the emergence of a phenomena that would culminate in our contemporary cyberculture."[34] McLuhan was simply the "first major popularizer and adaptor of Joycean insights to a media, technology, and culture discourse that has become the unacknowledged basis for our thinking about technoculture."[35]

In keeping with his own theory that technology represented amputations or extensions of existing human faculties (the wheel as an extension of foot, for example), McLuhan recognized Joyce as "probably the only man ever to discover that all social changes are the effect of new technologies (self-amputations of our own being) on the order of our sensory lives."[36] More specifically, McLuhan read each of the ten thunders in *Finnegans Wake* as corresponding to a distinct technological era. "Each [of the thunders] is a cryptogram or codified explanation of the thundering and reverberating consequences of the major technological changes in all human history," writes McLuhan.[37] This thesis follows with this long tradition of reading *Finnegans Wake* within the history of technology, media, and communications, though it will approach McLuhan's vision of the technological Wake more cautiously, as a question rather than a resolved statement. Throughout, this thesis will ask: how does Finnegans Wake represent the encoding, decoding, and mediation of information? And how does it draw on the history of technology in doing so?

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[34] Theall, *The Virtual Marshall McLuhan*, 161.
[35] Theall, *The Virtual Marshall McLuhan*, 161.
[36] Marshall McLuhan and Quentin Fiore, *War and Peace in the Global Village* (New York: McGraw-Hill, 1968), 4-5.
[37] McLuhan and Fiore, *War and Peace in the Global Village*, 4-5.

This thesis's first chapter, "Streams," explores how Joyce grapples with the concept of encoding consciousness in *Anna Livia Plurabelle* (Book 1, Chapter 8).[38] A standalone chapter released as *Work in Progress* before the full work took shape, *Anna Livia Plurabelle* served to appease wary detractors unsure of the feasibility of Joyce's last mission: to effectively capture the dream-like language of the night, as he had done for the day with *Ulysses*.[39] High stakes accompanied its original release. The work bore the burden of defending Joyce's project; it was a status update that proved the possibility of the work's ultimate completion. As such, exploring *Anna Livia Plurabelle* provides a useful glimpse into Joyce's original impetus for writing *Finnegans Wake*. *Anna Livia Plurabelle* proves that from its inception, *Finnegans Wake* was always an exercise in borrowing from modern communications technologies to create new literary form. This chapter examines the *Anna Livia Plurabelle* project in the context of how information was encoded at the time (primitive streaming technologies) and briefly situates Joyce's innovation in literary form within the larger history of the development of the modernist novel.

The second chapter, "Letters," turns to the material processes underlying chains of information transmission, asking how processes of decoding are complicated by the inevitability of messages being lost in translation. "Letter" focuses on Book 1, Chapter 5, which follows the journey of a physical letter that supposedly contains precious evidence intended to absolve HCE. Initially written by ALP, the letter ends up in a dung heap to be discovered by a hen named Biddy. This chapter argues that Joyce's demonstration of the

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[38] In this thesis, *Anna Livia Plurabelle* will refer to the eponymous standalone chapter, and ALP will refer to the character.
[39] Ellmann, *James Joyce*, 708.

limitations of materiality shows him embracing so-called "hardware failures" as creative rather than simply destructive. Joyce's exploration of the imperfectly mediated nature of language is a self-referential acknowledgment of the impossibility of a universal reading of his own work.

The third chapter, "Bits," offers an operational model for understanding humor as a communications problem by adopting an explicitly information-theoretic framework. Prompted by Joyce's interest in the productive nature of miscommunication as well as his interest in humor, this chapter examines the problem of miscommunication in humor, suggesting that world-building in joke setup can be modeled as a Bayesian updating of priors, where the goal of the comedian is to minimize the KL-divergence between their own priors and that of the audience. The chapter then generalizes this observation to propose a few different applications of the model to problems of natural language understanding both interpersonally and at scale.

CHAPTER I: STREAMS

If it were meaningless it could be written quickly, without thought, without pains, without erudition; but I assure you that these twenty pages now before us cost me twelve hundred hours and an enormous expense of spirit.[40]

On November 30, 1929, James Joyce, a lover of the movies, invited Sergei Eisenstein to his Rue de Grenelle apartment in Paris, and played him a recording of the last few pages of *Anna Livia Plurabelle* on the gramophone.[41] *Anna Livia Plurabelle*, initially published as *Work in Progress* and later included in *Finnegans Wake* as the eighth and final chapter of Book I, is a gossipy conversation between two washerwomen doing the week's laundry by the River Liffey about "giddy-gaddy, grannyma, gossipaceous Anna Livia" (ALP), who is herself a personification of the very river where they are washing.[42]

Eisenstein, a Soviet filmmaker and film theorist, had read parts of the *Wake* prior to the meeting (having asked his friend Leon Moussinac, a Parisian culture and film critic, to send him issues of publications where parts of the *Wake* had appeared).[43] Details of the meeting appeared in Eisenstein's essay "A Course in Treatment," where he claims the two discussed the representation of the interior monologue across artistic mediums. Eisenstein recalls, "When Joyce and I met in Paris, he was intensely interested in my plans for the inner film-monologue, with a far broader scope than is afforded by

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[40] Ellmann, *James Joyce*, 610.

[41] Louis Armand, "JJ/JLG," in *Roll Away the Reel World: James Joyce and Cinema*, ed. John McCourt, (Cork: Cork University Press, 2010), 139.

[42] James Joyce, *Finnegans Wake* (New York: Penguin Books, 1999), 195.

[43] Gösta Werner and Erik Gunnemark, "James Joyce and Sergej Eisenstein," *James Joyce Quarterly* 27, no. 3 (1990): 494.

literature."[44] With *Anna Livia Plurabelle*, the nucleus out of which *Finnegans Wake* grew, Eisenstein was already convinced of the cinematic quality of Joyce's prose; he attributed the strengths of Joyce's writing to its success at imitating the particularities of his own preferred medium.

Eisenstein was right that Joyce's formally experimental stream of consciousness in *Anna Livia Plurabelle* drew in part from filmic montage techniques. The high modernist transformation of the novel was characterized in part by a struggle to identify the most accurate manner of encoding reality into literature. This problem was addressed through the exploration of new representational forms, and some of these were inspired in part by the technological apparatuses — like film — that had changed the very reality novelists were now trying to represent. This chapter introduces another new technological framework for exploring the Joycean stream of consciousness in *Anna Livia Plurabelle*: the media streams invented in his lifetime.[45] Joyce's attempt to represent reality in literature found him looking towards technological apparatuses with their own systems of encoding information; the form and content of *Anna Livia Plurabelle* registers the influence not only of the techniques of film but also the technological attributes of the media stream. Joyce's attempt to capture the vastness of human consciousness found an apt counterpart in the media stream, with its newfound ability to capture ever-increasing amounts of information.

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[44] Sergei Eisenstein, "A Course in Treatment," in *Film Form: Essays in Film Theory*, trans. Jay Leyda (New York; London: Harcourt, Brace, Jovanovich, 1977), 104.

[45] With a disclaimer that there are of course limitations inherent in any such metaphor (i.e. "X is film," X is radio", "X is a computer"). Discussing the limitations of metaphors like these can be thought of as an estimation of the KL divergence between the X and Y, where the X is being used to approximate Y (here, the media stream is being used to approximate the Joycean stream of consciousness as modeled in *Anna Livia Plurabelle*).

Anna Livia Plurabelle is streams and dreams: a chapter set by a river done in a rivery prose, and "the fiction of a text created spontaneously and in an *ad hoc* fashion … written in the same way dreams are constructed, out of the transmutation of bits and pieces of experience and memory."[46] The "bits and pieces of experience and memory" in this chapter include a conversation between his sisters about the beauty of Livia Schmitz's hair and the observation of women washing clothes on the bank of the river Eure.[47]

The Modernist Novel and the Science of Precision

In his essay "The Serious Artist," published in 1913, Ezra Pound, famous shepherd of modernist literary talent — and one of Joyce's early supporters — wrote, "Bad art is inaccurate art. It is art that makes false reports … the serious artist is scientific in that he presents the image of his desire, of his hate, of his indifference as precisely that, as precisely the image of his own desire, hate or indifference. The more precise his record the more lasting and unassailable his work of art."[48] More specifically, if there is a "scientific" process that characterizes the creation of artwork, it could be conceived as the artist's best attempt at encoding reality: reality compressed into representational forms. *Finnegans Wake* wrestles with the ways in which language and the novel form might be remade as a technology for apprehending reality.

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[46] Norris, "Finnegans Wake," 156.
[47] Norris, "Finnegans Wake," 154.
[48] Ezra Pound, "The Serious Artist," in *Literary Essays of Ezra Pound*, ed. T.S. Eliot (Norfolk, Conn.: New Directions, 1954), 43, 46.

In the wake of novel social and technological changes at the turn of the twentieth century, such a project became more challenging; a new, rapidly changing technological reality had rendered the old compression schemes obsolete. David Trotter writes that the modernist novel experienced a crisis of self-worth in relation to its capability of representing this changed reality, producing a demand for new representational forms. "There was a feeling ... that the novel as traditionally conceived was no longer up to the job: that its imaginary worlds did not, in fact, correspond to the way one's fellows spent their entire lives … the very formlessness which had once made it the adequate "expression" of a previous age, an age not yet formless enough to require "something stricter," now prevented it from expressing a modernity characterized above all by the loss of form."[49]

The novel developed in part through a tension between naturalist and symbolist modes, or what older theorists might have called mimesis and poiesis. Trotter writes, "Emile Zola had sought to modernize literature by making it less literary: writers should not flinch from unpoetic subject matter, and should treat whatever they wrote about with scientific exactitude and objectivity. Symbolism, on the other hand, modernized literature by making it more literary. Symbolism's indeterminacies preserved literature from science and common sense."[50] Yet even in his formulation of these two opposing forces, Trotter acknowledges the impossibility of one work fully belonging to one camp or the other. With *Ulysses*, Trotter suggests, Joyce developed a work that swung between these two poles in its "rapid appropriation and abandonment of styles."[51] Even with its formal

[49] David Trotter, "The modernist novel," in *The Cambridge Companion to Modernism*, ed. Michael Levenson (Cambridge: Cambridge University Press, 1999), 69.
[50] Trotter, "The modernist novel," 73.
[51] Trotter, "The modernist novel," 83.

fluidity, *Ulysses* garnered the very praise that Zola, who argued for a "literature governed by science," might have striven for.[52] Edmund Wilson, in a review of *Ulysses* for the *New Republic* published on July 5, 1922, bestowed upon the work the honor of scientific accuracy, heralding *Ulysses* as "the most faithful X-ray ever taken of the ordinary human consciousness."[53]

Joyce's reformations of literary language drew on his long engagements with the history of the novel and its relation to the natural sciences. In a notebook entry written on March 27, 1903, Joyce drew on the Greek terms *tekhne* (precision and craftsmanship) and *mimesis* (the representation of reality) in retranslating Aristotle's *e tekhne mimeitai ten physin*, writing that he believed Aristotle meant that "the artistic process is like the natural process."[54] Joyce was additionally inspired by Flaubert; Scarlett Baron suggests that some of Stephen Dedalus's aesthetic theories in *Portrait* allude to a private letter Flaubert wrote on March 18, 1857 to Mlle. Leroyer de Chantepie. The letter contains Flaubert's own words on craft. He writes, "It is time to give Art — by a pitiless method — all the precision of the physical sciences!"[55] Though Joyce's prose could never be considered purely naturalistic, it drew on a history of motivation running through Zola and Flaubert; his consistent testing of the boundaries of style throughout his body of work reflected his desire to more accurately represent a physical world that was being transformed by science.

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[52] Émile Zola, "The Novel as Social Science," in *The Modern Tradition: Backgrounds of Modern Literature*, ed. Richard Ellmann and Charles Feidelson (New York: Oxford University Press, 1965), 271.
[53] Edmund Wilson, "Ulysses," Review of *Ulysses,* by James Joyce. *The New Republic*, July 5, 1922: 164.
[54] Joyce, *The Critical Writings of James Joyce*, 145.
[55] Scarlett Baron, ""Will You Be as Gods?" (U 3.38): Joyce Translating Flaubert," *James Joyce Quarterly* 47, no. 4 (2010): 522.

In the process of writing *Work in Progress*, Joyce was experiencing the onset of blindness. As Marshall McLuhan would later theorize more formally, part of the transformations that were occurring in the world in Joyce's lifetime were new technological apparatuses that extended people's sensorial capabilities beyond human limitations (like Joyce's own declining vision). These apparatuses increased the capability for people to make voyeuristic observations like those that inspired *Anna Livia Plurabelle*, and produced a world where people's minds swirled with more and more amounts of information.

Joyce's efforts to reformulate the novel was situated within a community of like-minded modernist thinkers. Christopher Butler writes, "Joyce indeed wanted to be interpreted; in this he follows one of the central aims of early modernism, which was to attract an audience which was willing to attempt to decode the relationships between stylistic medium and message."[56] But Joyce was picky about the type of reader he wanted to attract. Kevin Birmingham writes, "Rather than writing a novel for a million readers, Joyce said, he preferred to write novels that one person would read a million times. Modernists courted small numbers of avid, idiosyncratic readers scattered across countries and time zones, and one way to foster such a dedicated community was through boisterous magazines that could generate an ongoing creative exchange among far-flung readers and writers."[57] The reading guides for *Finnegans Wake* that have developed

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[56] Christopher Butler, "Joyce the modernist," in *The Cambridge Companion to James Joyce*, ed. Derek Attridge (Cambridge: Cambridge University Press, 2004), 83.
[57] Kevin Birmingham, *The Most Dangerous Book: The Battle for James Joyce's Ulysses* (East Rutherford: Penguin Publishing Group, 2014), 7.

subsequently have tended to encourage this kind of intensive, dedicated reading that aims to recover Joyce's intentions.[58]

The third version *Anna Livia Plurabelle* was published in one of these magazines dedicated to modernist innovations: *transition*, run by Eugene Jolas.[59] Jolas embraced a manifesto for his 'Revolution of the word' that he distilled down to directives such as "The writer expresses. He does not communicate."[60] Jolas embraced the nascent *Work in Progress*, and in turn, "[he armed] Joyce with an aesthetic and intellectual rationale that made *Finnegans Wake* congruent with other avant-garde movements of his day."[61] Joyce's attitude seemed to be that his job was principally to capture reality, not to coddle his reader: only to "express" as he saw fit, without the guarantee of "communication." Though his work was difficult to read, he insisted that he could "justify every line of his book."[62] Ultimately, Joyce refused to let the consideration of his work's reception derail the honesty of its creation. He was interested in the stream without regard for where the stream ended, or if it did at all.

Realism and Montage

Joyce's writing has frequently conjured up similarities to the stylistic tendencies of his contemporary filmmakers; for example, the titles of "Aeolus" have been compared

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[58] One of these reading guides includes Campbell's *Skeleton Key*, but over the past few years, a few online resources have cropped up as well, including *Glosses of Finnegans Wake*, where a digital version of the text is hyperlinked with explanations for specific words when appropriate, and FWEET (Finnegans Wake Extensible Elucidation Treasury), which crowdsources annotations from readers and is built more like a search engine. Media theorists like N. Katherine Hayles might argue that reading guides like these fundamentally change the reader's relationship with the text.

[59] Ellmann, *James Joyce*, 610.

[60] Norris, "Finnegans Wake," 160.

[61] Norris, "Finnegans Wake," 160.

[62] Butler, "Joyce the modernist," 83.

to the subtitles of early silent film.[63] Above all, Joyce's rapidly shifting literary modes

have been likened to the fragmentary cuts of montage. In Peter Bürger's influential

formulation, montage is a more honest art form because it "presupposes the

fragmentation of reality" and bypasses the "system of representation based on [its

transposition]."[64] Bürger cites Adorno's belief in the artifice of other representational

forms that engender a false sense of unity, writing, "The man-made organic work of art

that pretends to be like nature projects an image of the reconciliation of man and nature.

According to Adorno, it is the characteristic of the non-organic work using the principle

of montage that it no longer creates the semblance (*Schein*) of reconciliation … the

insertion of reality fragments into the work of art fundamentally transforms that work …

they are no longer signs pointing to reality, they *are* reality."[65]

Basic principles of montage, like the simultaneous cut, can be established

textually. Eisenstein "openly acknowledged cinema's debt to nineteenth century

literature," writes Baron.[66] In particular, Eisenstein admired Flaubert.[67] In the essay

"Through Theater to Cinema," Eisenstein praises the scene in *Madame Bovary* that

interlaces the conversation between Emma and Rodolphe, calling it "one of the finest

examples of cross-montage of dialogues."[68] Eisenstein writes, "This is an interweaving of

two lines, thematically identical, equally trivial … with the significance always

dependent on the juxtaposition of the two lines. Literature is full of such examples. This

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[63] Scarlett Baron, "Flaubert, Joyce: Vision, Photography, Cinema," *Modern Fiction Studies* 54, no. 4 (2008): 689

[64] Peter Bürger, *Theory of the Avant-Garde* (Minneapolis: University of Minnesota Press, 1984), 73, 78.

[65] Bürger, *Theory of the Avant-Garde*, 78.

[66] Baron, "Flaubert, Joyce: Vision, Photography, Cinema," 690.

[67] The other Flaubertian non-montage filmic technique is the relationship between Flaubert's famous use of free indirect style and the singular perspective it affords.

[68] Sergei Eisenstein, "Through Theater to Cinema," in *Film Form: Essays in Film Theory*, trans. Jay Leyda (New York; London: Harcourt, Brace, Jovanovich, 1977), 12.

method is used with increasing popularity by Flaubert's artistic heirs."[69] Baron writes, "It is reasonable to assume that Eisenstein might have had Joyce in mind as one of [these artistic heirs]."[70]

Though indebted to literature for pioneering a montage-like technique to capture the fragmentary reality of the external world, Eisenstein believed the ability to capture inner monologue "[found] full expression … only in the cinema."[71] Known for his use of montage, Eisenstein conceived of "thought process as a montage form."[72] In the essay "A Course In Treatment," he describes the "montage lists" capable of representing the inner world of man. "They would sometimes proceed with images. With sound. Synchronized or non-synchronized … in passionate disconnected speech. Nothing but nouns. Or nothing but verbs. Then interjections. With zigzags of aimless shapes, whirling along … then linked with polyphonic sounds. Then polyphonic images. Then both at once."[73] Eisenstein's excited description of the "montage list" mimics the dramatic, fragmentary techniques of montage itself.

Eisenstein praised Joyce's attempt as a writer to achieve the intention he believed was best captured by film. In the essay "Achievement," which concerns the absolute advantage of cinema over all other art forms, Eisenstein writes:

> The most heroic attempt to achieve [the full embrace of the whole inner world of man] in literature was made by James Joyce in *Ulysses* and in *Finnegans Wake* … here was reached the limit in reconstructing the reflection and refraction of reality in the consciousness and feelings of man. Joyce's originality is expressed in his attempt to solve this task with a special dual-level method of writing: unfolding display of events simultaneously with the particular manner which these events pass

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[69] Eisenstein, "Through Theater to Cinema," 13.
[70] Baron, "Flaubert, Joyce: Vision, Photography, Cinema," 705.
[71] Eisenstein, "A Course in Treatment," 105.
[72] Eisenstein, "A Course in Treatment," 106.
[73] Eisenstein, "A Course in Treatment," 105.

through the consciousness and feelings, the associations and emotions of one of his chief characters. Here literature, as nowhere else, achieves an almost physiological palpability.[74]

Here, Eisenstein's formulation of Joyce's writing ability recalls one of his own montages: the celebrated Odessa steps sequence in *Battleship Potemkin*, juxtaposing wide shots of the crowd of citizens fleeing from the soldiers ("unfolding [the] display of events") with individual shots of the citizens themselves: a woman, face contorted in horror, bloody pince-nez shattered in her eye ("the manner which these events pass through the consciousness and feelings").

In Eisenstein's exposition of Joyce's "dual-level method of writing," he acknowledged that Joyce had harnessed some of the compelling power of film — its "physiological palpability" — into literature. However, Eisenstein criticized Joyce for sharing "the sad fate of all the so-called 'left' tendencies in art that reached full flower with the entry of capitalism into its imperialist stage."[75] Eisenstein believed that artists like Joyce looked "inwards through *means* rather" than outwards "through *content*," and that the potential for artwork to "escape the fetters of bourgeois limitations … [lay] in a transition to a more perfected stage of all [the potentialities of means] — to cinema."[76] The revolutionary, anti-capitalist tendencies of cinema (and of montage) that Eisenstein is praising here leads to another reason why montage is an imperfect lens with which to view Joyce's stream of consciousness, which was not explicitly Marxist and desired principally to represent the reality of everyday life, invariably affected by capitalism.

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[74] Sergei Eisenstein, "Achievement," in *Film Form: Essays in Film Theory*, trans. Jay Leyda (New York; London: Harcourt, Brace, Jovanovich, 1977), 184-5.
[75] Eisenstein, "Achivment," 185.
[76] Eisenstein, "Achivment," 185.

However, Joyce is at times political, and consequently, does at times use the fragmentary technique of montage. Catherine Flynn identifies Joyce's use of montage-like techniques — not in *Anna Livia Plurabelle* but rather in the 1936 radio passage in Book II, Chapter 3. Here, Joyce uses the fragmentary, noisy effects of montage to comment on the fascist use of radio broadcasting in World War II, "[confronting] the power of authoritative discourse with an unruly assemblage of elements" and "[opposing] the presence or power of a single voice — Joyce's own perhaps but, more importantly, the voice of advertising and the political broadcasts that used that voice."[77] When Joyce uses montage, the effect is "noisy," radio-like, pushing the limits of what montage: more fragmentary than Flaubert's dual simultaneity.

The Stream as Container for the Infinite

Like Eisenstein, scholars from Auerbach onwards have often seen how Joyce's works seem to draw inspiration from film techniques. Another technological model, however, might be found in another closely contemporary invention: the stream. The stream can be conceived as a model of data transfer used to transmit large (if not infinite) amounts of data.[78] Streams are useful when the quantity of information demands an

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[77] Catherine Flynn, "Finnegans Wake's Radio Montage: Man-Made Static, the Avant-Garde, and Collective Reading," *James Joyce Quarterly* 52, no. 2 (2015): 287.

[78] In programming language theory, there exists a data structure known as a stream that models the concept of an infinite list (an ordinary list is finite and, depending on the programming language, must be initialized with a size). Here, the stream is a useful concept because there are many objects that should be modeled as infinite: a continuous stream of inputs read from a file assumed to be unbounded in length, or the infinite sequences of all natural numbers. Because of their infinite size, data structures must be evaluated "lazily." Since it is impossible to perform an operation on the infinite data structure, the evaluation happens in a piecewise manner and only insofar as the user demands it. The lazy evaluation paradigm can also be seen in the concept of media streaming, where packets of data are sent continuously to the user, allowing the user to play content before the file has been fully transmitted. The prominence of streaming technology today reflects technological developments that have demanded moving ever larger packets of information, and

alternative form of content delivery: when it is preferable to deliver the information in a continuous flow rather than discretely and all at once.[79] Joyce intended the publication of *Finnegans Wake* itself to be a kind of stream: he wrote to his benefactress Harriet Shaw Weaver that he wanted fragments "to appear slowly and regularly in a prominent place."[80]

Primitive media streams, the predecessors of the advanced streaming technologies and services we have today (YouTube, Netflix, Spotify), were just beginning to gain prominence during the period in which Joyce was beginning work on *Finnegans Wake*. In the 1920s, Major General George Owen Squier invented Muzak, a live stream of background noise that eventually gained notoriety for its usage in retail establishments. Squier was also known for inventing telephone carrier multiplexing, a method by which multiple signals are combined into one over a shared medium. In the first lines of a practical manual describing his inventions, Squier describes the importance of developing the necessary infrastructure for transmitting increasing amounts of information, the uniting force behind his technological accomplishments, writing, "Electrical transmission of intelligence, so vital to the progress of civilization, has taken a development at present into telephony and telegraphy over metallic wires; and telegraphy and, to a limited extent, telephony, through the medium of the ether by means of electric waves."[81] Such a

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streaming's efficiency has only been augmented by the digitization of media forms. The alternative to media streaming is the consumption of media in its already-complete format, as on a music record: one needs the entire record to play a single song. Like the infinite streams in programming languages, media streaming also allows for the representation of "infinite" kinds of content: for example, the livestream footage of a security camera.

[79] Non-streaming media (books) predated streaming media (radio, television).

[80] Dirk Van Hulle, "Textual Enactment: The Cognitive 'riverrun' and the 'Fluid Text' of Joyce's 'Anna Livia Plurabelle'," Dublin James Joyce Journal 8 (2015): 65.

[81] George Owen Squier and United States Army Signal Corps, *Multiplex Telephony and Telegraphy, by Means of Electric Weaves Guided by Wires.* (Washington: Government Printing Office, 1911), 7.

description maps onto Auerbach's claim that the modernist stream of consciousness is composed by "means of numerous subjective impressions received by various individuals." One could conceive of these "subjective impressions" as signals being received, multiplexed, and streamed: the union of Squier's inventions.

As the earliest widespread streaming form, Muzak offers an interesting test-case for Joyce's literary language. As Hervé Vanel has suggested, Muzak is a kind of environmental music par excellence, akin to the double blank page of McLuhan's *The Medium is the Massage* (an emblem of invisible environments).[82] Muzak has often been the subject of complaints about its elevation of the commercial over the artistic, as well as its embeddedness in consumer environments.[83] Yet what if we were to take seriously the possibility that *Finnegans Wake* is a kind of Muzak? Such a reading would focus on the impact of information on interiority and the difficulty of representing an "inner monologue" that was increasingly corrupted by more and more sources of stimuli.

Joyce's stream of consciousness is a literal stream, an immersive river environment in which consciousness is radically decentered. As one of Joyce's earliest reviewers, his friend Padraic Colum, noted, the events of the chapter are dictated by its movements, as the reader travels "along a river from its source to its mouth."[84] The chapter ends due to the widening of the River Liffey, when the washerwomen, on opposite sides of the Liffey, are no longer able to hear each other over the "chittering waters."

[82] Hervé Vanel, *Triple Entendre: Furniture Music, Muzak, Muzak-Plus* (Baltimore: University of Illinois Press, 2013), 47.
[83] Vanel, *Triple Entendre*, 48.
[84] Padraic Colum, "The River Episode from James Joyce's Uncompleted Work," review of *Anna Livia Plurabelle*, by James Joyce, *The Dial* (April 1928): 318.

His tittering daughters of. Whawk? Can't hear with the waters of. The chittering waters of. Flittering bats, fieldmice bawk talk. Ho! Are you not gone ahome? What Thom Malone? Can't hear with bawk of bats, all thim liffey-ing waters of. Ho, talk save us! My foos won't moos. I feel as old as yonder elm. A tale told of Shaun or Shem? All Livia's daughter-sons. Dark hawks hear us. Night! Night! My ho head halls. I feel as heavy as yonder stone. Tell me of John or Shaun? Who were Shem and Shaun the living sons or daughters of? Night now! Tell me, tell me tell me, elm! Night night! Telmetale of stem or stone. Beside the rivering waters of, hitherandthithering waters of. Night![85]

Joyce's stream of consciousness encompasses both the streams of the washerwoman-stone and washerwoman-elm. Auerbach writes, "The essential characteristic of the technique ... is that we are given not merely one person whose consciousness (that is, the impressions it receives) is rendered, but many persons, with frequent shifts from one to the other … it basically differentiates it from the unipersonal subjectivism which allows only a single and generally a very unusual person to make himself heard and admits only that one person's way of looking at reality."[86] As with the stream itself, the reader is not sure where the individual streams begin and end.

Here, as one washerwoman transforms into a tree ("I feel as old as yonder elm") and the other into a rock ("I feel as heavy as yonder stone"), the "hitherandthithering" waters of their chatter illustrates the transformational potential of such a conversation, making their otherwise odd physical changes seem totally commonplace. The "tittering daughters of" conjure up memories of ALP's sons Shem and Shaun, but also recur as the "chittering waters of," which then become the "flittering bats" who "bawk" as loudly as the sound of the "liffey-ing" waters, the "rivering" waters, the "hitherandthithering waters." The washerwoman-stone says, "Tell me, tell me tell me elm!" and eventually,

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[85] Joyce, *Finnegans Wake*, 215-216.
[86] Auerbach, *Mimesis*, 536.

the elm becomes absorbed completely, and Shem and Shaun are collapsed into the washerwomen: "Telmetale of stem or stone." The increasing complexity of these thoughts as they branch out into new and different ideas is symbolized textually with the widening of the Liffey.

"My ho head halls," says one washerwoman. We can almost hear the thoughts as they echo inside the head, recurring and manifesting new associations that drift into other thoughts: the sons and daughters and the waters and the bats and the bawks, the Shem and the stem and Shaun and the stone.[87] The conversation's transformational potentiality lies in its continuity: the new thoughts are physically connected to the old ones, rather than occurring as discrete units.

The scene for these transformations, at once mundane and transcendent, is two women at work chatting as they do laundry. As Helen Saunders has suggested, Joyce is "very attentive to the idea of laundries as rehabilitative moral sites and of laundry being inextricable from sinful, sexual behavior."[88] In one such scene in *Anna Livia Plurabelle*, "Lynd us your blessed ashes here till I scrub the canon's underpants. Flow now. Ower more. And pooleypooley" is directly followed by a voyeuristic exposition of Anna Livia performing her own act of washing: "First she let her hair fal and down it flushed to her feet its teviots winding coils. Then, mothernaked, she sampood herself with galawater and fragrant pistania mud, wupper and lauar, from crown to sole."[89] In contrast to Eisenstein's carefully curated historical dialectic, Joyce's stream is a riotous proliferation

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[87] *Hall* is German for echo.
[88] Helen Saunders, "'Dirty Cleans': Laundry in Ulysses," *James Joyce Quarterly* 55, no. 3 (2019): 343.
[89] Joyce, *Finnegans Wake*, 206.

of consumer desires and sexual voyeurisms that offer to capture the totality of history through their very mundane and everyday qualities.

Like Eisenstinian montage, the value of the Joycean stream lies in its continuous totality, but montage can be dissected in a way the stream cannot.[90] The shots that compose the Eisenstinian montage can be pulled apart, but the individual streams that compose the collective Joycean stream of consciousness cannot be disentangled from one other. This problem alludes to another difference between Eisenstinian montage and the Joycean stream: the Eisenstinian montage possesses a narrative bounded by its clearly demarcated beginning and ending, while the Joycean stream has no clear beginning or ending.

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[90] Admittedly, media streams can be demultiplexed, revealing the limitation of this metaphor as well.

CHAPTER II: LETTERS

This radiooscillating epiepistle to which cotton, silk or samite, kohol, gall or brickdust, we must ceaselessly return.[91]

On April 1, 1900, the *Fortnightly Review*, a prominent British literary magazine, published James A. Joyce (then an 18-year-old student at University College Dublin) for the first time; for this, Joyce earned twelve guineas and the profound admiration of his schoolmates.[92] Having obtained a French translation of Norwegian playwright Henrik Ibsen's *When We Dead Awaken*, Joyce was compelled to write a review.[93]

In his analysis of the first scene of the play, Joyce calls attention to the shortcomings of other critics, implying that they lack the sensibilities to treat Ibsen's work with the nuance it deserves. "It is as though the history of a tragic life were to be written down rudely in two columns, one for the pros and the other for the cons," laments Joyce. The act of literary criticism is one of translation: Joyce implies that in the hands of an unworthy critic, the dimensionality of Ibsen's play is noticeably reduced. On the contrary, Joyce's own eye is keen enough to discern the "shade of sadness" in "still young" Maja's "bright eyes" — *he* is up to the task of recreating the experience of the play into a piece of criticism worthy of its subject.

William Archer, Ibsen's English translator, later sent Joyce a message from Ibsen himself on April 23, who wished that he could "thank the author [of the review] if only I had sufficient knowledge of the language."[94] Joyce responded jubilantly: "I wish to thank you for your kindness in writing to me. I am a young Irishman, eighteen years old, and

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[91] Joyce, *Finnegans Wake*, 108.
[92] Ellmann, *James Joyce*, 74.
[93] Joyce admired Ibsen for his gift at representing "average lives in their uncompromising truth; his admiration translated later into his own work."
[94] Ellmann, *James Joyce*, 74.

the words of Ibsen I shall keep in my heart all my life."[95] But the reply Joyce received were not truly the "words of Ibsen" — they were the words of Archer, who made the exchange possible by mediating it with his translation.

This exchange over letters was an early moment when Joyce was forced to reflect on the materiality of communications, the role of human intermediaries, and the ways that information can and cannot be transmitted accurately across different mediums and languages. Early in his life, Joyce set out to conquer the difficulty of translation. Biographer Richard Ellmann emphasizes the impact of the letter on Joyce's encyclopedic transformation. "Before Ibsen's letter Joyce was an Irishman; after it he was a European. He set himself to master languages and literatures, and read so widely that it is hard to say definitely of any important creative work published in the late nineteenth century that Joyce had not read it."[96] Ellmann chooses to read Joyce's desire to "master languages and literatures" as a direct consequence of his experience with the language barrier between him and Ibsen, taking to heart Ibsen's admission: "if only I had sufficient knowledge of the language."

The young Joyce fantasized about pure, lossless communication. He emphasized the dire consequences of mistranslation in his earlier work: in the semi-autobiographical *A Portrait of the Artist as a Young Man* (1916), Joyce includes an ominous anecdote of Stephen being accused of heresy by a teacher due to a mistake in his essay.[97] The later

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[95] Ellmann, *James Joyce*, 74.

[96] Ellmann, *James Joyce*, 75.

[97] More literally, Joyce's early rejection of embodiment can be seen in the period of Stephen's life in which he fully rejects body for God: "His soul was fattening and congealing into a gross grease ... the body that was his stood, listless and dishonoured, gazing out of darkened eyes, helpless, perturbed and human." (*Portrait*, Chapter III). Here, Stephen bears a similarity to future liberal humanists interested in the triumph of cognition over embodiment. N. Katherine Hayles has commented on the principled glorification of anorexia, the disease that represents the erasure of embodiment to its logical, physical extreme.

Joyce would approach things differently. Though he would exhibit his mastery of languages and literatures in his encyclopedic work *Finnegans Wake*, and would still be preoccupied with questions of encoding and decoding information, the later Joyce would emphasize and embrace the human and non-human imperfection of mediated communications, which he came to understand as like the children's game of telephone.

This chapter examines the part of *Finnegans Wake* which concerns the material analysis of ALP's letter and occurs near the beginning of the novel. As HCE stands trial for his misdeeds, ALP's tea-stained testimony is brought forth as an important piece of evidence. The letter is dictated by ALP to her son Shem, a writer, transmitted by her son Shaun, a postman, and ultimately found in ruins in the middle of a muddy heap of fecal waste by Biddy Doran, a hen.

In multiple senses, the letter is itself an embodiment of the inseparability between medium and message. Talia Schaffer notes, "There are two meanings for the words "letter"; each of those meanings (epistle and alphabet) carries the dual burden of material signifier and ideological signified."[98] And, as Jed Rasula argues, yet another pun can be constructed from "letter" and "literal." Rasula writes, "The literal, as it is revealed in the Wake, is "letteral," as letters are primal gestures exactly like those ebullient slatherings of mud that Henry David Thoreau observed on the railway embankment at Walden Pond."[99] The puns on "letter" spin out even further and more widely. Etymologically, "letter" is the same as "literature," ("a man of letters"), so Joyce is commenting on the nature of fiction as well. "Letter" as well has a particular historical relation to the novel — the

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[98] Talia Schaffer, "Letters to Biddy: About That Original Hen," *James Joyce Quarterly* 29, no. 3 (1992): 624.

[99] Jed Rasula, ""Finnegans Wake" and the Character of the Letter," *James Joyce Quarterly* 34, no. 4 (1997): 519.

form in which Joyce is writing — which developed over time from works that were purely epistolary to works with clear narrative frames.

The convoluted journey of ALP's letter is a case study in the impossibility of the flawless mediation of language, or — as media theorist N. Katherine Hayles has articulated — the impossibility of abstract information "that can flow unchanged between different material substrates."[100] Hayles writes, "Like the human body, the book is a form of information transmission and storage, and like the human body, the book incorporates its encodings in a durable material substrate … the literary corpus is at once a physical object and a space of representation, a body and a message."[101] In the descriptions of the letter's itinerary, and his focus on materiality and destruction, Joyce represents information as embodied, and this embodiment as an inescapable infringement upon the message it stores. In this way, Joyce models communication realistically in all its imperfection, even offering a humorous take on the inevitability of communication gone awry. ALP's letter, in this sense, serves as a proxy for the entire book, so commonly described itself as "unreadable."

Matthew Kirschenbaum defines the "materiality" of inscriptions as encompassing both the conditions of forensic and formal materiality. Forensic materiality refers to the "micron-sized residue of digital inscription, where individual bit representations deposit discreet legible trails … the amazing variety of surfaces, substrates, sealants … that have been used over the years as computational storage media," whereas formal materiality refers to "the imposition of multiple relational computational states on a data set or digital

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[100] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago; London: University of Chicago Press, 1999), 54.
[101] Hayles, *How We Became Posthuman*, 28-29.

object," like the metadata on a digital image file.[102] Kirschenbaum (and Hayles) warn against ignoring materiality with respect to storage mediums, though with the acknowledgement that it is easy to ignore the existence of the low-level inscriptions that are magnetic markings indiscernible to the naked eye — and growing easier. As advances in storage technology became more and more impressive, with smaller drives being capable of storing an amount of information that became increasingly more difficult to physically conceptualize, the distance between the "flickering signifier" (Hayles's Lacanian term for the chaining of the layers of abstraction provided by the screen) and the low-level inscription becomes ever-greater. However, we cannot forget that even the most basic model of computation, the Turing machine, can be reduced to a series of read/write operations on an unbounded strip of tape.

Sidney Geller emphasizes the importance of materiality in a manual entitled "Care and Handling of Computer Magnetic Storage Media" released by the National Bureau of Standards in 1983, a year in which, at least compared to the present, users were confronted more aggressively with the material limitations of their computers. Chapter 1 of the manual, "Computer Magnetic Media Care and Handling Recommendations," begins with Geller submerging the reader directly into an explanation of the molecular composition of magnetic computer tapes and flexible disks in the first paragraph, in order so that he can say:

> Any embedding of debris into the media surface, or any distortion of the mylar base substrate material or the coating or both, or any breakdown or alteration of the chemical structure of the binder will result in a mispositioning of the media during operation, or a direct loss or misalignment of the coating or particle; this causes a loss of data contents. Studies have shown that other than those caused by unwanted magnetic

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[102] Matthew G. Kirschenbaum, *Mechanisms: New Media and The Forensic Imagination* (Cambridge: MIT Press, 2008), 12.

fields, that there is almost no loss of data contents which does not stem from an alteration in some physical or chemical property of the polymeric media components.[103]

In *Finnegans Wake*, Joyce's representation of information as material rather than abstract inevitably reveals its susceptibility to physical corruption, which he emphasizes through repeated references to decay and fecal matter. If we accept Shannon's notion of noise in a communication channel as simply an external stochastic process that alters the integrity of the original message, then we could conceive of these hardware failures as a sort of theoretical "noise." In other words, the medium is important because the fallible properties of its physicality can directly interfere with the accuracy of the transmitted information. The journey of the letter reflects some information-theoretic principles, predicting the creation of a model of information transmission that would only be scientifically quantified after Joyce's death, and serves as a self-referential acknowledgment on Joyce's part of the impossibility of a universal reading of *Finnegans Wake* writ large.

Joyce establishes the letter as a "proteiform graph," a living document that bears all the different marks of those who encounter it, and offers two different explanations for its "polyhedr[al]" quality. There is the "meltwhile" message, or the inevitability of data corruption — physical, external factors impinging upon the material base of the message — and there is the "multiplicity of personalities inflicted on the documents," or the influence of the asymmetric, individual contexts of the sender and receiver.[104] Through

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[103] Sidney B. Geller, *Care and Handling of Computer Magnetic Storage Media*. NBS Special Publication 500-101 (Washington: National Bureau of Standards, 1983), 5.
[104] The idea of asymmetric priors is explored at length in Chapter III.

bodily metaphors of reproduction and defecation, Joyce illustrates that all communications are caught up in cycles of generation and decay.

The Proteiform Graph

Joyce unfolds a theory of language in Chapter 5 of Book 1 that embraces the chaotic, reproductive nature of miscommunication. The chapter begins with a paean to the "Allmaziful" ALP[105] and lists the various titles of "her untitled mamafesta memorialising the Mosthighest."[106] Three full pages long, this painstakingly long list of the letter's interpretations — "*The Augusta Angustissimost for Old Seabastius' Salvation, Rockabill Booby in the Wave Trough, Here's to the Relic of All Decencies, Anna Stessa's Rise to Notice*"[107] — defines the letter by its ambiguous reputation and its metadata.[108] From the very beginning of the chapter, the reader is supposed to understand that the letter has no singular meaning. Its meaning is dynamic, changing upon contact with the reader in question, subject to their individual biases and conditioned on their prior knowledge. The pedantic, archival quality of the beginning of the chapter also reveals the character of the narrator, who treats the letter with the attitude of a professor, earnestly translating the shit-stained letter for the reader in an act of serious literary criticism.[109]

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[105]"Allseeing", "Allknowing" (111), "lake of alldevouring flame" (138) in *A Portrait of the Artist as a Young Man.*
[106] Joyce, *Finnegans Wake*, 104.
[107] Joyce, *Finnegans Wake*, 104.
[108] The titles are external to the message itself.
[109] The incongruity of tone and content here is a well-trodden comedic premise.

After listing its various names, the narrator follows with an interpretation of the letter itself:

> The proteiform graph itself is a polyhedron of scripture. There was a time when naif alphabetters would have written it down the tracing of a purely deliquescent recidivist, possibly ambidextrous, snubnosed probably and presenting a strangely profound rainbowl in his (or her) occiput. To the hardily curiosing entomophilust then it has shown a very sexmosaic of nymphosis in which the eternal chimerahunter Oriolopos, now frond of sugars, then lief of sualts, the sensory crowd in his belly coupled with an eye for the goods trooth bewilderblissed by their night effluvia with guns like drums and fondlers like forceps persequestellates his vanessas from flore to flore.[110]

The first two sentences — particularly the attribution of the text in question as the invention of "a purely deliquescent recidivist … presenting a strangely profound rainbowl in his (or her) occiput" — make clear that the narrator's scope is not limited to ALP's letter; the phrases "proteiform graph" and "polyhedron of scripture" just as easily evoke Joyce's own prose. "Polyhedron of scripture" suggests multidimensionality; the "proteiform graph" brings to mind "protein-form" (biological) and "Proteus" (shape-shifting).

The narrator criticizes the "naif [naive] alphabetters" who consider the writings nothing more than the "tracing of a purely deliquescent [deliquesce + delinquent] recidivist." In the dismissive hands of a "naif alphabetter," the letter, in multiple senses, (both the language it expresses and the materiality it possesses) is nothing more than the "tracing" of various permutations of these symbols. While the "naif alphabetters" may discount the letter as discrete, finite, and manipulable, "to the hardy student it reveals the eternal chimera-hunter pursuing his butterfly Vanessas from plant to plant, as well as a

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[110] Joyce, *Finnegans Wake*, 107.

multiplicity of coalescing personalities who merge, their contrarieties eliminated, into one stable somebody."[111] That Joyce uses the metaphor of reproduction to discuss the workings of language is no coincidence, as he is fond of frequently compounding words (rainbow + bowl = rainbowl, Lucan + Chapelizod = Lucalizod[112]) and knows that the sum is greater than the whole of its parts. Joyce's theory of language is one in which signs and symbols take on a life of their own.

The narrator offers an example of the communication involved in insects mating (entomophi*lust*, *sex*mosaic, *nymph*osis [emphasis added]), and the "effluvia with guns like drums and fondlers like forceps" connotes the role of pheromones. The power of language and communication is something that extends beyond the symbols of the human alphabet. This wild, naturalistic language — the "flayflutter" and "florilingua" — is later invoked again when the narrator observes that the tale told in the letter is an "oldworld epistola," universal across culture and species. "If juness she saved! Ah ho! And if yulone he pouved! The old-old stolium! … it is told in sounds in utter that, in signs so adds to, in universal, in polygluttural, in each auxiliary neutral idiom, sordomutics, florilingua, sheltafocal, flayflutter, a con's cubane, a pro's tutute, strassarab, ereperse and anythongue athall … this oldword epistola of their weatherings and their marryings and their buryings."[113]

The French aphorism "Si jeunesse savait, si vieillesse pouvait" roughly translates in English to "if youth only knew, if age only could."

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[111] Joseph Campbell and Henry Morton Robinson. *A Skeleton Key to Finnegans Wake* (New York: Harcourt, Brace and Company), 1944, 96.
[112] Campbell and Robinson, *A Skeleton Key to Finnegans Wake*, 97.
[113] Campbell and Robinson, *A Skeleton Key to Finnegans Wake*, 117.

> Si jeunesse savait, si viellesse pouvait
> If juness +she saved, if yulone +he pouved

The original sentiment is modified by more directly evoking "June" with "jeunesse," and the metaphor is parallelized by replacing the word that connotes age with a similarly seasonal substitute: "Yule," or December. Youth is also personified as female with the addition of "she," and age as male ("he"). Through this transformation, the French aphorism thus retains its original meaning while also gaining a double meaning as a commentary on May-December relationships, which has relevance to the charges being levied against HCE.

The intersection of communication and love here is manifold. The tale told in the letter is a love story, the purpose of communication is deeply intertwined with the preservation of human relationships, and there is a wild, procreative quality to language, which is capable of taking on an unpredictable and multiplicitous life of its own ("sexmosaic, chaosmos").

The Meltwhile Medium is the Message

As the letters "HCE" are proverbially dragged through the mud with the scandal of his trial, so too literally is the letter intended to absolve him. Much space is devoted to discussing the letter's materiality in its analysis. John Lurz writes that the "melted" message forces a reckoning with its embodiment: "From the latter perspective, a "positively distorted macromass" suggests that the effect of the melting is to grant an

insistent, corporeal presence to the piece of film."[114] The narrator comments that the letter "has acquired accretions of terricious matter whilst loitering in the past. The teatimestained terminal ... is a cosy little brown study all to oneself."[115] In documenting the chronological history and physical journey of the letter, Joyce reveals its susceptibility to data corruption ("accretions of terricious matter") and yet affirms the validity of the new, corrupted message ("cosy little brown study all to oneself"). Joyce's position on these distortions is clear; "accretions of terricious matter" is additive rather than destructive. In fact, as is appropriate for a writer who spent 17 years agonizing over *Finnegans Wake*, Joyce's references to various "brown" symbols slyly imply that all writing, perhaps *most* of all the original symbols encoded by the author, is, at the end of the day, just shitstains on a page.[116] Shit is also fertilizer; decay and generation are implied in one another.

The letter is discovered by Belinda (Biddy) Doran, a hen, who finds the letter in "the heart of the orangeflavoured mudmond."[117] Biddy "was scratching at the hour of klokking twelve looked for all this zigzag world like a goodish-sized sheet of letterpaper originating by transhipt from Boston…a teastain … marked it off on the spout of the moment as a genuine relique of ancient Irish pleasant pottery."[118] Just as he sneaks hundreds of references to rivers in *Anna Livia Plurabelle*, Joyce pays careful tribute to the history of writing materials in this chapter.[119] References to the history of writing are

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[114] John Lurz, *The Death of the Book: Modernist Novels and the Time of Reading* (New York: Fordham University Press, 2016), 86.
[115] Joyce, *Finnegans Wake*, 114.
[116] Brown: the color of handwriting ink prior to twentieth-century mass production, the color of tea-stains, and the color of shit. "Brown Betty" was the name of a popular teapot used throughout the British Isles.
[117] Joyce, *Finnegans Wake*, 111.
[118] Joyce, *Finnegans Wake*, 111.
[119] Lurz, *The Death of the Book*, 92.

littered throughout, from the ancient (the ostracon, broken shards of pottery that ancient Greeks used for carving short notes) to the modern (the mention of Boston and the implication of global trade in the material substrates). The fact of the "teastain," which acts as a sort of signature, is given as much significance as the contents of the letter. The word "teastain" also bears a resemblance to "testament" or "testimony," the purpose of the letter with respect to HCE's trial — Joyce seems to be saying that the "teastain" *is* the "testimony."

The chemical nature of the decomposition of the letter is also discussed. "Well, almost any photoist worth his chemicots will tip anyone asking him the teaser that if a negative of a horse happens to melt enough while drying, well, what you do get is, well, a positively grotesquely distorted macromass of all sorts of horsehappy values and masses of meltwhile horse."[120] The "horsehappy values and masses of meltwhile horse" result from the deformation of embodiment, though even the distorted photographic negative still produces something recognizable as related to the old horse, just an image that is "positively grotesquely distorted."[121] What is left after the body of the letter is deformed is "masses of meltwhile horse": a multiplicity of new meanings.

Joyce's depiction of the distorted message as one that is "melted" effectively characterizes both the physical damage done to the message as well as the visual effect of the damage itself. "*Finnegans Wake* labors to return literature back to letters, marking a transit from institutional supervision back to the antic rubble that is otherwise literally

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[120] Joyce, *Finnegans Wake*, 111.

[121] In 1992, science fiction novelist William Gibson and abstract artist Dennis Ashbaugh teamed up to create "Agrippa," which consisted of a 300-line poem written by Gibson stored on a floppy disk that came packaged with an artist's book of photographs and illustrations made by Ashbaugh. The text of the poem was designed to encrypt itself after a single reading, and the pages of the artist's book were treated with photosensitive chemicals that caused the images to fade over time. See Kirschenbaum, x.

beneath attention," writes Rasula. The process he describes is not unlike that undertaken by the Department of Defense in order to secure and destroy classified data. Kirschenbaum summarizes some of the approaches used for media sanitization, ranging from "simple overwrites" to "using magnetic fields to neutralize the polarity of the magnetic media" to "Option M" (disintegrate, incinerate, pulverize, shred, or smelt), which might include running over disk drives with a tank or physically bending them with a research magnet.[122]

Joyce's attention to embodiment with respect to the encoding of symbols in literature — his movement from "institutional supervision" to "antic rubble" — anticipates the emergence of scientific systems for analyzing the physicality of storage systems and the consequences of erasure — the field now known as computer forensics. "The most relevant forensic science precedent for computer forensics is the field of questioned document examination, which dates back to the end of the nineteenth century. It concerns itself with the physical evidence related to written and printed documents, especially handwriting attribution and the identification of forgeries," writes Kirschenbaum.[123] The narrator of Joyce's letter sequence can be seen as a prototypical digital forensics examiner.

Just as Shannon predicted that noise can be corrected with the addition of an external "correction channel," it is also theoretically possible to reverse, to an extent, the impact of these hardware failures. The material substrate of a piece of information may occasionally interfere with the accuracy of its transmission, but the conditions of its materiality also guarantee some promise of longevity. Kirschenbaum marvels at a

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[122] Kirschenbaum, *Mechanisms*, 26.
[123] Kirschenbaum, *Mechanisms,* 47.

German firm's ability to salvage hard drives extracted from the ruins of the World Trade Center. "The German firm, Convar, maintains an image gallery of salvaged [World Trade Center] hard drives in their press release area: they bear the marks of unimaginable stress and duress, scorched, scraped, and caked with primal grit and grime … given sufficient resources — that is, elite technical and financial backing — data can be recovered from media even under the most extraordinary conditions."[124]

However, Joyce would resist this fantasy of recovering messages from destruction. Near the very beginning of the letter's interpretation, Joyce's narrator alludes to the Biblical notion of dust (or "brickdust"), which God first invokes in Genesis to warn Adam of his fallibility: "For you are dust, and to dust you shall return." Ashes to ashes, dust to dust: the conservation of mass. To acknowledge that the message has a body, as Joyce does, is to recognize the inevitability of that body's decomposition, but also to understand that the body does not disappear, merely decomposing into something just as material and as productive of meanings.

The Multiplicity of Personalities Inflicted on the Documents

In both a literal and metaphorical sense, the physical letter is buried in the midden heap, and only brought back to life when someone cares to discover it. Joyce brings to attention the reader's role in creating the text — it is not only the original author who is responsible for the creation of the text, but the readers who translate the text through their effort. Rasula writes, "Readers are invariably the laborers who execute the work of playing the text … the holomovement of the Wake's texture insures that it is reader-

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[124] Kirschenbaum, *Mechanisms*, xii.

friendly; like a natural language, there will be repeated opportunities to practice the enunciative routines."

The text's configuration of its reader shifts through different modes, accounting for a variety of laborers, a "multiplicity of personalities."[125] Rasula suggests one such posture: the "gossip, rumor, accusation, and testimony" of the text keep the reader engaged with its "salacious innuendo," alerting the readers to their "necessarily voyeuristic" posture.[126] Alternatively, sometimes the tone of the narrator is instructional, actively motivating: like a real professor with an unwilling student, the narrator periodically encourages the reader to persist in their understanding of the difficult text through the chapter. "Now patience; and remember patience is the great thing," instructs the narrator authoritatively.[127] "You is feeling like you was lost in the bush, boy? … Gee up, girly!" orders the narrator later, a tone switch after a defeated admission in the previous sentence that the possibility of comprehension decreases with time: that as time passes between the current moment and the moment the letter was found, "the more we need the loan of a lens to see as much as the hen saw."[128]

Sometimes the narrator's ruminations venture beyond the register of comedy altogether. "Anyhow, somehow and somewhere; before the bookflood or after her ebb, somebody ...wrote it, wrote it all, wrote it all down, and there you are, full stop," says the narrator, in a tone of near-awe.[129] The message is always at the mercy of "the continually more and less intermisunderstanding minds of the anticollaborators," and is unavoidably

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[125] Joyce, *Finnegans Wake*, 107.
[126] Rasula, "'Finnegans Wake' and the Character of the Letter," 522.
[127] Joyce, *Finnegans Wake*, 108.
[128] Joyce, *Finnegans Wake*, 112.
[129] Joyce, *Finnegans Wake*, 118.

bastardized by their individual interpretations: "variously inflected, differently pronounced, otherwise spelled, changeably meaning vocable scriptsigns."[130] The "intermisunderstanding minds" brings to mind a bipartite graph, a visual, criss-crossed representation of the many-to-many mappings between the messages in the letter and the signals received by the readers, as illustrated by Shannon in his description of the fundamental theorem for a discrete channel with noise:
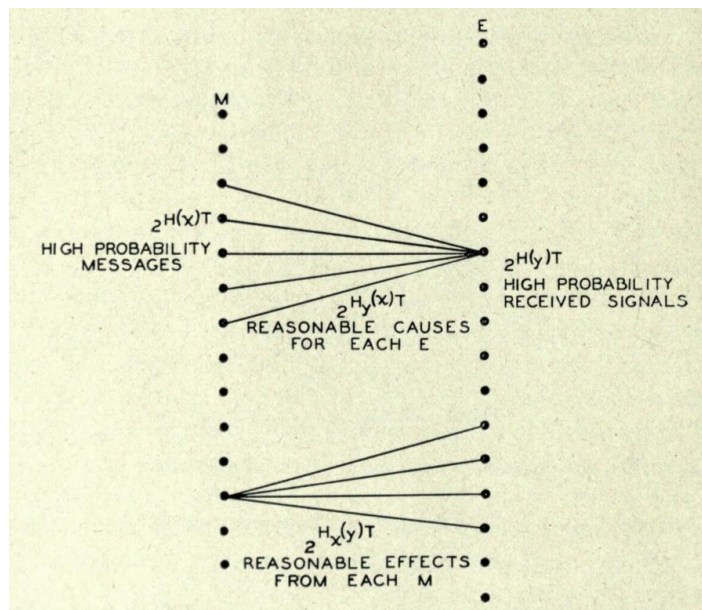
E

M

$2^{H(x)T}$
HIGH PROBABILITY
MESSAGES

$2^{H_y(x)T}$
REASONABLE CAUSES
FOR EACH E

$2^{H(y)T}$
HIGH PROBABILITY
RECEIVED SIGNALS

$2^{H_x(y)T}$
REASONABLE EFFECTS
FROM EACH M

Fig. 2 — "Schematic representation of the relations between inputs and outputs."[131]

What the journey of the letter represents (from ALP dictating to Shem who writes it down to Shem who delivers it to Biddy who finds it in the heap to the narrator and then to the reader) is a long chaining of mappings from a set of messages *M* to encodings *E*, where the encodings then become their own messages *M'* and are fed as inputs into

[130] Joyce, *Finnegans Wake*, 118.
[131] Shannon, "A Mathematical Theory of Communication," 412.

another communications system. Due to the compounding effect of this chain of transmissions, the meanings are not only "multiplicitous," they are in fact exponential:
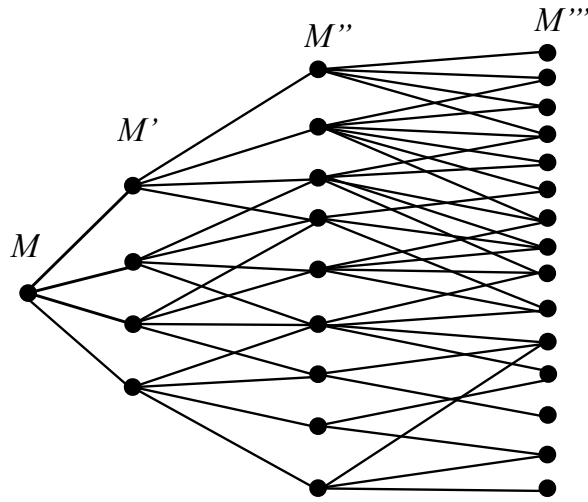

Fig. 3 — Generalization of Shannon's graph.

The narrator acknowledges the tiny probability of the reader somehow finding themselves at the end of this long and dynamically mediated chain of transmissions, and the inherent magic of its present realization. Because of this, we should be grateful for the opportunity to read the letter at all, says the narrator: "Sure, we ought really to rest thankful that at this deleteful hour of dungflies dawning we have even a written on with dried ink scrap of paper at all to show for ourselves."[132] There is a pervasive haunting of writing in the Western tradition by scenes of erasure, present even in the word "rase/raze," which connotes both removal and inscription.[133] Changing his focus for a second from defending the productive nature of these distorted cycles of communication,

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[132] Joyce, *Finnegans Wake*, 118.
[133] Roger Chartier, *Inscription and Erasure: Literature and Written Culture from the Eleventh to the Eighteenth Century*, (Philadelphia: University of Pennsylvania Press, 2007).

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Joyce zooms in on the current state of the letter. Within a single sentence he illustrates a single cycle of the oscillating epistle to which we must "ceaselessly return" — the process of inscription and erasure, regeneration and decay.

CHAPTER III: BITS

I hate signs that flash but don't change ... a sign shouldn't be allowed to flash unless it intermittently changes to some other information ... wasted suspense ... should be illegal. It always catches my eye and then I wait for something else ... "Tacos," and "Tacos." And what else? "Tacos." Anything else? "Tacos." Just stay on "Tacos." [134]

Introduction

Another word for a joke is a "bit." This chapter argues that there is an intuitive connection between information-theoretic principles and humor and discusses the implications of these findings. The connection is evident from the vocabulary of humor itself, where words that comedians use to describe the funniness of jokes include terms like "joke-density" and "subversion of expectation." In other words, humor is all about compression, and the tension between expectation and surprise. Like Joyce, comedians are also expert navigators and manipulators of noisy communication channels (and have a tendency to write self-referential material). It is easy to understand why Trevor Noah is offended by the inefficiency of a flashing sign that doesn't change; it is a wasted setup with no punchline.

Accounting for sources of distortion in communication channels

Vladimir Nabokov famously likened the experience of literature to the meeting of author and reader at the top of a hill. "Up a trackless slope climbs the master artist, and at the top, on a windy ridge, whom do you think he meets? The panting and happy reader, and there they spontaneously embrace and are linked forever if the book lasts forever." Sender and receiver both carry with them their individual contexts and subjective experiences; if compatible, the result is harmonious. Yet Nabokov's poetic anecdote

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[134] *Son of Patricia*, written by Trevor Noah, aired November 20, 2018, on Netflix.

implies a dynamism that isn't actually reflected within this particular communication system. The anecdote might be modified, more specifically, to be as such: rather than the "master artist" catching up to the "panting and happy reader," up the top of the hill of his own creation is the immovable author, waiting with bated breath for his readers to make the journey on their own.

The relationship between author and reader in the domain of literature is a special one in communication that illustrates the different considerations one must evaluate in order to maximize the likelihood of a message being sent and received successfully. As hinted in the previous chapter, "Letter," two sources of distortion in a communications channel include the compression scheme of the message and the lack of shared context between the sender of receiver. In short, either the sender must modify the message for the audience, which is sometimes impossible, or the audience must be modified for the message, which is sometimes inefficient. As with many other problems, the tradeoff is between efficiency and accuracy.

Altering the sender's encoding

Juba et. al (2011) suggests that in most cases it may be more feasible to alter the compression scheme of the message than the nature of the receiver's prior.[135] For example, in a single, dynamic conversation between two people regarding a technical concept, it may be more efficient for the sender to summarize the technical concept in a way that is ultimately comprehensible to the receiver rather than for the receiver to independently gain the background knowledge. One can envision a communication

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[135] B. Juba, A. Kalai, S. Khanna, and M. Sudan, "Compression Without a Common Prior: An Information-Theoretic Justification for Ambiguity in Language," in *The Second Symposium on Innovations in Computer Science, ICS 2011*, ed. Bernard Chazelle (Beijing: Tsinghua University Press, 2011).

system in which the sender continuously transmits as much information as necessary for the receiver to understand the concept, halting only when the receiver finally understands.

Altering the receiver's prior

The other case — the Nabokov case — is one where the message as it comes from the sender is fixed. As such, the burden of gaining the necessary information to understand the message falls on the receiver. People who learn Latin often do so for the explicit purpose of reading certain texts in the original language; the language has limited usefulness in other contexts. Some academics will spend their entire careers attempting to decode a single piece of text. In such cases, it seems unfair to claim that reading a summary of *Pride and Prejudice* can be likened to the experience of reading the unabridged text, when the writer, in their encoding of the message, has already taken great pains to ensure the suitability of the compression scheme to their intention, over the course of months or years of creation. To distill down Flaubert's deliberate, cinematic description of Emma at the ball to the mere facts of the matter ("Emma went to the ball, and it deepened the chasm between her and her oafish, provincial husband") is to ignore the effect of the compression scheme (or lack thereof) — which makes up the form — on the very nature of the message.

The intricacy involved in the design of the compression scheme on the part of the comedian is relevant for the study of humor, as many jokes are funny by virtue of the specific way they are encoded, meaning that they lose some element of their humor once explained. Thus, the approach to understanding humor is one where it makes more sense to alter the priors of the receiver than it does to change the nature of the compression. Within this approach there are two cases to consider. One case is that of the *fixed*

message, as in the example of the novel: in this finite communication channel, the sender

has sent out a joke into the ether and can no longer be reached. With respect to humor, a

fixed message might be a one-liner on a sitcom (assuming no live taping) viewed by an

audience months after the episode has been shot. The other case is that of a *dynamic*

message: in this communication channel, there is some level of continual back-and-forth

between the sender and receiver such that the sender can actually help the receiver update

their prior. With respect to humor, a *dynamic message* might be a live comedic

performance, in which the stand-up comic generates some amount of his or her material

on the fly based on the *feedback* from the audience: in particular, their laughter.

Previous work in computational humor

The famous Groucho Marx joke "I shot an elephant in my pajamas. How he got

into my pajamas I'll never know" is an example of a garden-path sentence that exhibits

syntactic ambiguity. A *garden-path sentence* is one in which receiver builds an erroneous

mental prediction for the sentence; the resulting process of *disambiguation* is something

that imposes a cost on the time and resources it takes to comprehend a sentence. Garden-

path sentences have been studied extensively in natural language processing as an

example of the difficulty that the subversion of expectations (high surprisal) can impose

on comprehension. Though not all garden path sentences are funny, the ideas of

expectation, surprisal, and ambiguity are extensible to the study of humor.

With humor specifically, there is previous work relating the concept of humor to

the information-theoretic concept of entropy: for example, the formalization of the funny

sound. Comedians know that there are certain sounds that are funnier than others,

including the hard "k" sound, which due to its hardness could be said to be a more

"intrusive" or "surprising" sound than others. Westbury et. al (2015) examines the entropic humor of nonsense words, finding that participants found nonsense words funny because the combination of letters were unexpected.[136] Gultchin et. al (2019) observes that specific words in real English that are rated highly funny include words like "codswallop", "kerfuffle", "glockenspiel", and "codswallop."[137]

He et. al (2019) formalizes a metric of humor with respect to homographic puns that is loosely based off of surprisal, positing that the success of a homographic pun can be attributed to *local-global surprisal*.[138] This is based on the observation that in a homographic pun, there is a pair of words w_p and w_a, where w_p is the pun word and w_a is the alternative word. For example, in the sentence "Yesterday I accidentally swallowed some food coloring. The doctor says I'm OK, but I feel like I've dyed a little inside," w_p is "dyed", and w_a is "died."

It makes sense that a joke is funny if it exhibits some level of surprisal or defies expectation. For example, some jokes rely on shock value. This observation is also backed by multiple formal theories of humor, including the incongruity theory of humor. However, this metric also exhibits a truth about constraints on the *range* of surprisal in order for a joke to land. *A joke cannot be comprehensible to the audience if the surprisal of its punchline is not within the realm of possibility*. If the punchline of a joke relies on a message that is not in the message space of the audience, it will not land. In the above

[136] C. Westbury et. al, "Telling the world's least funny jokes: On the quantification of humor as entropy." *Journal of Memory and Language*, 86 (2016).

[137] L. Gultchin et. al, "Humor in word embeddings: cockamamie gobbledegook for nincompoops." *Proceedings of the 36th International Conference on Machine Learning* (2019).

[138] H. He et. al, "Pun generation with surprise." *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1* (2019).

example, the notion of surprisal is given by the fact that the audience will expect the message "died" instead of the message "dyed", but understanding the joke still relies on the fact that the audience is familiar with the message "dyed."

Model

In the ideal case of communication, the sender and the receiver have a shared prior over the message space, but this is an unrealistic expectation, resulting in a highly brittle model. What we have in real life are two parties who do their best to approximate the priors of the other person in communication.[139] However, this approximation has loss. KL-divergence illustrates the loss between an actual prior P and the approximation of that prior P'. In this situation, there are two forms of KL-divergence at play: the distance between the actual priors of the sender P and the receiver Q, and the distance between the actual prior of the other party P and one's approximation of that prior P'.

For the purposes of this chapter, we will model the reason that someone doesn't get a joke as the result of misaligned priors (large KL-divergence) between the comedian and the audience member. We will define this prior as a discrete prior probability distribution P over a set of messages M and then relate $P(M = m)$ where $m \in M$ to Shannon's definition of surprisal.

The receiver has discrete prior probability distribution P over message space M. P is determined primarily by (1) the local context (the context in which the conversation is happening) and also to an extent by (2) the totality of the speaker's preexisting knowledge

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[139] An example of this is code-switching.

base of experiences. Both of these parameters will influence the probability distribution, but (1) will most likely determine the category of messages, while (2) will most likely influence the range of possibilities occurring within that category. In addition, though there are an infinite set of sequences of words, the probability distribution over messages is defined by a few spikes in the curve rather than distributed evenly across many different options. Apple's predictive text feature, for instance, only renders the three most likely options. We can say that a small number of messages captures a large share of the probability, i.e. three messages have a combined probability of α where $\alpha \approx 0.7$.

To illustrate the influence of (1) and (2), take, for example, when Alice asks Bob "What are we having for dinner?" The prior probability distribution that Alice, if Alice is an American woman, may have might look something like:

m	$P(M = m)$
chicken	0.418
beef	0.24
fish	0.13
duck	0.05
venison	0.003

However, if Alice is a vegetarian with limited exposure to foods of other cultures, *P* might look something like:

m	$P(M = m)$
kale salad	0.324
Impossible burger	0.21
mac & cheese	0.20
Khachapuri	0.0005
doro w'et	0

Assume that the vegetarian Alice has never encountered doro w'et, that well-spiced Ethiopian and Eritrean chicken stew often served atop a spongy fermented flatbread. To illustrate the influence of Alice's life experiences on the prior, the probability of $P(M = m)$ for an m she has never encountered would be 0.

Surprisal quantifies the uncertainty in a random variable and decreases monotonically as probability increases. An event that happens with $p = 1$ has a surprisal of 0, and an event that happens with $p = 0$ has an infinite level of surprisal. More formally:

$$S(m) = \log_2 \frac{1}{P(M = m)} = -\log_2(P(M = m))$$

where $m \in M$, the set of possible messages. It follows easily that we can relate the prior probability distribution P over messages M to the surprisal of the individual messages.

m	$P(M = m)$	$S(m)$
kale caesar salad	0.324	1.625
Impossible burger	0.21	2.251
mac & cheese	0.20	2.322
Khachapuri	0.0005	10.966
doro w'et	0	∞

To formalize Noah's distaste of the flashing taco sign:

m	$P(M = m)$	$S(m)$
tacos	1	0

Much like a child rolling their eyes at a parent who instructs them to "put a jacket on, you'll catch cold" every time they leave the house, people find it annoying to hear information they already know. To demonstrate the relationship between encoding length

and complexity, where more complicated information requires a longer encoding, information already known is information that can be left unsaid.

This principle applies even more in humor. Jokes are funny because they subvert expectations; even jokes where the punchline is clear from the beginning are nested with further opportunities for surprisal. What we have demonstrated above with respect to the surprisal of a *punchline* is only one type of surprisal (hereafter called *narrative surprisal*). Another axis of surprisal in humor could be deemed *delivery surprisal*: the subversion of the expectation that comedian X makes joke Y (e.g. the unexpected vulgarity of female comics like Margaret Cho, Sarah Silverman, and Ali Wong). Relating this to the information-theoretic communication channel, a funny joke is not only a function of the surprisal of its punchline (the message), but also a function of the specific courier of the joke (the sender) and its hypothetical destination (the receiver).

Examples

With respect to generating humor, one might conclude that maximizing surprisal is the correct approach, e.g. punchlines that exhibit higher surprisal are funnier than punchlines that exhibit lower surprisal. However, as with humor in general, the joke that is the most well-received by the audience is the joke that reflects its sensibilities. Different people have different thresholds for surprisal. In general, high surprisal jokes are riskier. In order for high surprisal jokes to land, the comedian has to accurately approximate the priors of the audience with no further manipulation. Low surprisal jokes

are safer: the callback that traditionally ends a stand-up set is usually well-received.[140] In cases where the comedian has correctly assessed that their audience has a high threshold for surprisal, high surprisal jokes can have more payoff because they lack the overt artificiality of a shared context engineered by the comedian. In the following section, we will deconstruct a few jokes with varying levels of *narrative surprisal*.

High surprisal (narrative, delivery)

Shock humor relies on the assumption that the audience has a high threshold for surprisal by ending on a punchline that is shocking or taboo. The punchline of such a joke is a message that exhibits a low probability of occurring because of social mores. In Dave Chappelle's *Sticks & Stones* (2019), he begins his set by telling a story about how Anthony Bourdain had the "greatest job that show business ever produced ... [eating] delicious meals with outstanding people. That man with that job hung himself in a luxury suite in France." Chappelle then circles back to a high school classmate of his who "got all the way from the hood to an Ivy League school with a full scholarship. From there, the motherfucker got himself into one of the best law schools in the country." Ultimately, the classmate ends up as a manager at Foot Locker. "The point of the story is ... never occurred to [him] to kill himself. He's alive and well in D.C. I even suggested to him that he should try it out. Like, I don't know, maybe...[141]

Though the set-up of the joke is, to an extent, predictable when Chappelle sets up a framework for the story that has to do with suicide, priming the audience from the very beginning, the joke still comes as a surprise in part because of its high *delivery surprisal*:

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[140] A *callback* is a joke that references one previously told in the set, which is thereafter established as shared context between the comedian and the audience.
[141] *Sticks & Stones*, written by Dave Chappelle, aired August 26, 2019, on Netflix.

the suggestive violence of the statement juxtaposed with its brusque, casual delivery. In particular, Chappelle is a more surprising messenger of this joke than another comedian might be; one would not expect a Black American man to speak so casually about death.

<u>Medium surprisal (narrative)</u>

There are many jokes that rely on a shared cultural understanding, alluding to an idea or another work considered part of the cultural canon. One such example is a joke from the second episode of the first season of Netflix television show *BoJack Horseman*: "What do you guys think I should <u>Ayako</u> for our <u>12-hour anniversary</u>? She wants a framed picture of my <u>mom's maiden name</u>."[142]

The joke is that Ayako is trying to fleece the speaker. In context, this quote is said by the well-meaning but gullible character Todd Chavez about his budding online romance with minor character Ayako, a young woman who works at a call center. This joke requires the audience to receive and identify the flags in order to land. Namely, the phrases critical to understanding the joke include "Ayako", "12-hour anniversary", and "mom's maiden name." In particular, the audience is expected to make a connection between these phrases: that the rushed relationship between Ayako, a foreign woman, and Todd, is due to her desire to commit bank fraud. The key piece of background information necessary to understand the joke is that asking for one's mother's maiden name is a common bank security question in the United States.

This joke relies on a specific bit of background information that is not top of mind for most viewers, yet can easily be recalled as a fact that many will be familiar with. Additionally, the information required to understand this joke precludes certain audiences

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[142] *Bojack Horseman*, season 1, episode 2, "BoJack Hates the Troops," written by Raphael Bob-Waksberg, aired August 22, 2014, on Netflix.

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from understanding the joke: for example, younger viewers of the show who may not yet have had the experience of setting up their own bank accounts, or international viewers of the show from cultures where it is not standard for women to take their husband's names after marriage.

Based off the superiority theory of humor, a one-liner like this one might make one laugh because it makes the receiver feel smart, by calling upon some hidden prior knowledge that they possess but don't intuitively connect on first glance with the setup of the joke. For example, the structure of a riddle is such that one is often unable to guess its solution on their first attempt but enjoy the punchline when it is ultimately revealed. As such, a one-liner like this one is a joke that exhibits medium surprisal, where $P(M = m)$ is small but not infinitesimal.

<u>Low surprisal (narrative)</u>

One-liners are highly compressed. However, some kinds of jokes allow for the dynamic updating of priors throughout the delivery. One such example is a stand-up set, which is often self-referential. The structure of a stand-up set provides great insight into the recursive nature of humor. Nested within a stand-up set are a few bits (short routines) that are loosely affiliated. Within those bits are a mixture of highly compressed inline jokes (similar to the example above) and jokes that are unfolded like a story as the audience's priors get updated to match those of the comedian's.

In Hannibal Buress's special *Comedy Camisado*, he performs a bit about the difficulty of losing his ID while touring, with a sub-bit about the difficulty of checking into a specific hotel without an ID. The problem is that the hotel was not something like Best Western or Super 8: something common enough for people to have a pre-existing

schema of (respectively, hotel chains like Best Western connote affordable family vacations, and motel chains like Super 8 connote the opposite of affordable family vacations, like Christopher Nolan's 2001 neo-noir psychological thriller *Memento*). In order to set the scene, he cleverly nested descriptions of the hotel throughout the story so that the audience would be able to understand the situation better:

> And she says, "No, I'm not looking at that. You might've just made that website up." What? What, you maniac? Are you suggesting that I learned how to design websites, so one day, I can sneak into the Embassy Suites? In Downey, California, 35 miles south of Los Angeles, you maniac? Is that what you're saying right now? Are you saying that I started Twitter and Instagram accounts with the same name, worked and built a following over the years, so one day, I can sneak into the $110-a-night Embassy Suites in Downey, California? $64 on Priceline. Is that what you're saying to me right now, you maniac? Are you suggesting that five years ago I hired David Letterman to introduce me on his show as Hannibal Buress… with a studio audience there, and he let me do five minutes of stand-up as Hannibal Buress, just so one day, one glorious day, everything would come together and I would be able to sneak into the Embassy Suites, the likely bed-bug-riddled Embassy Suites in Downey, California? Is that what you're saying, you maniac, you?[143] (emphasis added)

World building as a minimization of KL-divergence

The concept of the above joke can be modeled as Buress intentionally updating the audience's prior with more and more data about the Embassy Suites in Downey, California until the posterior distribution of the audience is close to Buress's own original prior. Let $P(\Theta_a)$ represent the prior probability distribution over messages of the audience and $P(\Theta_b)$ represent Buress's prior. Say that Buress's goal is to give the audience enough data in his setup such that their priors are approximately aligned:

$$P(\Theta_b) \approx P(\Theta_a \mid data)$$

Bayes' Theorem states that the posterior is proportional to the prior and the likelihood:

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[143] *Comedy Camisado*, written by Hannibal Buress, aired January 5, 2016, on Netflix.

$$P(\Theta_a \,|\, data) \propto P(data \,|\, \Theta_a) \times P(\Theta_a)$$

Bayes' Theorem updates an existing probability when confronted with new information. In order for the audience's prior probability to converge with his own, Buress needs to correctly approximate the audience's prior and come up with a likelihood function that moves the prior of the audience closer to his own.[144] In a joke setup, most of the new information that the comedian is giving the audience will be related to the punchline, so this makes intuitive sense.

A stand-up comedian responds dynamically to the reaction of the audience, where a stronger reaction (more laughter) indicates higher success. Observing this stand-up bit, the first time Buress mentioned the Embassy Suites only elicited a chortle, but by the time that he had given three new pieces of information about the Embassy Suites, the audience was roaring. After every joke, Buress assesses the reaction of the audience to see if he has done a good job updating their priors; this can be formalized as a check to see if the KL-divergence is beneath threshold α. In addition, the generation of the joke can be modeled as some black-box function of the KL-divergence.

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[144] It should be recognized that this approximation, as is characteristic of approximations, will have its own KL-divergence from the actual prior.

Algorithm 1 KL-divergence of p and q
---
  if $p == 0$ **then**
    return 0
  else
    return $\text{SUM}\left(p \cdot \log\left(\frac{p}{q}\right)\right)$
  end if

Algorithm 2 Working the audience
---
  while $\text{KL}(\Theta_b, \Theta_a) \geq \alpha$ **do**
    $distance \leftarrow \text{KL}(\Theta_b, \Theta_a)$
    $data \leftarrow \text{GEN\_JOKE}(\text{DISTANCE})$
    $\Theta_a \leftarrow \text{BAYESIAN\_UPDATE}(\Theta_a, data)$
  end while

After giving three new pieces of information, Buress identifies a turning point, recognizing that adding even more information about the Downey Suites would hurt the surprisal of his joke and ultimately penalize him in the reverse direction.

Applications

On first glance, the utility of these observations may seem limited. Even though the idea of a stand-up bit can be modeled as an ongoing minimization of KL-divergence with Bayesian updating, the practicality of the model depends on how accurately the priors of the sender and receiver can be approximated in the first place.

Consider the monopoly that streaming services like Netflix and YouTube have on the content consumption habits of the average American. If the prior probability distribution is modeled as a function of the content somebody has viewed in their lifetime, a stronger content recommendation system than the one that already exists could theoretically be implemented. For example, it could be possible to annotate an inline joke that relies on an allusion to another piece of pop culture that the viewer may not have

with a pop-up helping them surmount α. One could imagine that when Buress says that

he looks like Milhouse from the Simpsons without the glasses, and Netflix knows that a

viewer hasn't seen the Simpsons ($P(M = Milhouse) = 0$), then something could be

done about that gap. In addition, knowledge of the shows that people watch could inform

content creation decisions, not just on the level of the premise (i.e. Netflix creates *Selling*

Sunset because it blends two popular genres, reality television and home improvement),

but on the level of inline jokes or allusions to a corpus of works that many people are

familiar with.

Another possible application of this engineered low-surprisal joke model which

may be of particular interest to computer scientists is a social one. Having shown that it is

possible to make someone laugh by increasing the shared context between two people,

one may find it useful to adopt a modified version of this approach in novel social

settings. One easy and natural way to do this is to seek out opportunities for "callbacks"

by internally alluding to messages in a conversation that have already been transmitted by

the other party. Ultimately, even if these low-surprisal jokes are low-hanging fruit, they

might make people laugh anyway, for a different reason: the simple delight of the proof

of a nascent intimacy with respect to the development of a shared language.

Conclusion

In this chapter, we propose that there is an intuitive connection between

information theory and humor. The *compression* of a joke is integral to its sense of

humor, giving an intuition behind why jokes aren't funny once they are explained (i.e. an

artificial lengthening of the compression scheme). An understanding of this principle

narrows our approach for increasing humor comprehension, allowing us to focus our attention on the possibility of updating the priors of the joke audience rather than changing the encoding scheme of the joke.

We also propose that the *surprisal* of a joke is integral, an observation that gives mathematical rigor to the commonly-held idea of humor as "subversion of expectation." We formalize two kinds of surprisal common in humor: *narrative surprisal*, defined as the low probability of a certain message being the punchline of a joke, and *delivery surprisal*, defined as the low probability of a certain sender being the courier of a joke. Within the realm of *low narrative surprisal*, we look to the open communication channel present in a live comedic performance as inspiration for an operational model that formalizes world-building in stand-up comedy as a dynamic updating of the audience's priors, with the potential to be applicable in problems of natural language understanding in industry.

CONCLUSION

A hundred cares, a tithe of troubles, and is there one who understands me?[145]

This thesis explored the role of miscommunication within a range of different communication systems. With respect to *Finnegans Wake*, we looked at a case in which miscommunication is generative, and with respect to stand-up comedy, we formally defined a method for its minimization. The tension between these two responses reflects in miniature the tension between the objectives of literary criticism and the objectives of computer science; at different times, both are valid approaches to thinking about communication. There are some cases — perhaps, for one, the wartime necessity out of which the field of information theory was partially borne — in which the accurate and efficient transmission of messages is key. There are other cases, as proposed in Chapter III, where it is possible to help someone overcome the threshold of context needed to partake in a joke (to fold them into an in-group of an artificial construction). There are yet other cases in which intimacy can only be achieved through a long history of paying close attention: some messages that are not legible to outsiders by design (a raised eyebrow, three taps on the back, an inside joke snuck into a larger conversation). For these messages, even if via some minimization of divergence or some alternate compression scheme we could possibly make them legible, we shouldn't want to.

In the case of *Finnegans Wake*, a few Easter eggs in the novel's ending reward the attention of knowing readers. According to Ellmann, the conclusion of Joyce's terminal work bears marked similarities to the endings of his previous ones: it is similar to Gabriel's contemplation of futility like the one at the end of "The Dead," on the precipice

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[145] Joyce, *Finnegans Wake*, 627.

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of a journey out into the Irish Sea like the one at the end of *Portrait*, and, perhaps most clearly, a striking feminine monologue like "Penelope" of *Ulysses*.[146] Like tributaries flowing into the River Liffey, the conclusion of the work shows one final recurrence of the Joycean stream (Chapter I), suggesting that *Finnegans Wake* was, in some ways, the dream of Joyce's previous works. Finally, hidden inside the last pages of *Finnegans Wake* is a reference to his own relationship with Nora Barnacle. "Is there one who understands me?" is the way Joyce asked the 19-year-old Barnacle to run away with him to Dublin in 1904.[147] A wayward proposal, to be sure — but, as we saw in Chapter II, there is a strong relationship between communication and love, and as we have defended with mathematical rigor in Chapter III, intimacy can be conceptualized as shared language that makes easier the possibility of being understood. Similar to his modernist attitude towards his potential readers, Joyce only wanted to be loved by one woman, but he wanted to be embraced materially, intellectually, totally: later he would write to Barnacle, "I want you to read over and over all I have written to you. Some of it is ugly, obscene and bestial, some of it is pure and holy and spiritual: all of it is myself."[148] On that evening with Jim in Merrion Square, Nora proved she was up for the task: despite the ambiguity of his request, she must have understood him, for she said Yes.

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[146] Ellmann, *James Joyce*, 726.
[147] Birmingham, *The Most Dangerous Book*, 33.
[148] Birmingham, *The Most Dangerous Book*, 17.

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