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Los Angeles

Memory Machines:
Mnemonics, Poetry, and Computing
in Nineteenth-Century Britain

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in English

by

Jessica Rose Cook

2024

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2024

ABSTRACT OF THE DISSERTATION

Memory Machines:

Mnemonics, Poetry, and Computing

in Nineteenth-Century Britain

by

Jessica Rose Cook

Doctor of Philosophy in English

University of California, Los Angeles, 2024

Professor Jonathan Hamilton Grossman, Chair

This study asserts that nineteenth-century mnemonics, known as 'artificial memory systems' until the twentieth century, served as one of the cornerstones for the invention of modern computing. Mnemonics systems rejected the associationist conceptualization of an intertwined mental hierarchy of ideas. As I show, Victorian mnemonics systems instead conceptualized a new form of memory akin to random access memory; they developed systems in print that perform as algorithms; and they invented universal and executable languages before programming. The roots of this project lie in my discovery that, unlike their predecessors, Victorian mnemonic systems were realized as autonomous memory machines. "Autonomy" here is defined not by physical externality from humans, but rather by a random-access recall process that consists in a printed system worked partly by the mind. The story that flows from this insight that Victorian mnemonics devised an

autonomous memory system revises the standard accounts of technology historians and digital scholars and challenges the consensus that mnemonics usage declined in the eighteenth century to reposition Victorian mnemonics as an exciting new dimension of the history of computing.

The dissertation of Jessica Rose Cook is approved.

Michael C. Cohen

Anahid J. Nersessian

Daniel Scott Snelson

Jonathan Hamilton Grossman, Committee Chair

University of California, Los Angeles

2024

DEDICATION

To my grandfather, who introduced me to the subject that would become my life's fullest passion.

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VITA

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Introduction

Most readers of this study will, almost certainly, be familiar with the concept of mnemonics: ROY G. BIV, Every Good Boy Does Fine, 'Thirty days hath September…'. Such memory aids are ubiquitously located today at the foundations of every discipline, from elementary mathematics to music to medicine. Employing aids to recall information is a well-worn ancient practice, a pillar of oral storytelling that prefigured the invention of writing. As Frances Yates's seminal history of mnemonic recall *The Art of Memory* (1966) details, the anonymous treatise *Rhetorica ad Herennium* (c. 86–82 BCE) first recorded the technique. Its author credited the sixth-century BCE poet Simonides of Ceos with the inventing the method of *loci* when he recreated a hall's seating arrangement after a divinely-retributed roof cave-in. This treatise set a crucial and enduring schematic for understanding the structure of human memory that persisted into the early twentieth century. *Rhetorica ad Herennium* distinguished between "two types of memory: one natural, and the other the product of art. The natural memory is that memory which is imbedded in our minds, born simultaneously with thought. The artificial memory is that memory which is strengthened by a kind of training and system of discipline."[1] For this reason, mnemonics were also commonly known as 'artificial memory systems' until the Cold War period, when that term began to take on its modern meaning of memories that are biochemically engineered or otherwise false.[2]

Major classical treatises like Aristotle's *De memoria et reminiscentia* (350 BCE), Cicero's *De oratore* (55 BCE), and Quintilian's *Institutio oratoria* (95 CE) all recommended the method of *loci* as a useful technique for training the memory, an important step in mastering the fourth component of

[1] *Rhetorica ad herennium*, trans. Harry Caplan (London: William Heinemann, 1954 [c. 86–82 BCE), sec. 3.16.28.

[2] Victorian scientists first investigated this phenomenon in the 1870s under the distinct term 'false memory.'

classical rhetoric, *memoria*. Aristotle's account in particular developed the understanding of the natural memory by suggesting that the mind remembered ideas according to three laws of association: similitude, contrast, and contiguity.[3] In the Middle Ages, Albertus Magnus's *De bono* (c. 1240–1244) and Thomas Aquinas's *Sententia de memoria et reminiscentia* (1268) recharacterized the method of *loci* as an ethical skill related to Prudence, one of the four cardinal virtues. As a result, using mnemonics to remember theological intricacies and divine truths became an important spiritual tool of the scholastic movement. Early modern treatises like Peter of Ravenna's *Phoenix, sive artificiosa memoria* (1491) and Johannes Romberch's *Congestorium artificiose memorie* (1520) popularized the technique with lay audiences, who applied it to both spiritual and secular uses.[4]

The traditional consensus from medieval and Renaissance scholars like Frances Yates, Ioan Couliano, and Mary Carruthers held that following this early-modern proliferation, mnemonics "fell into disuse in the seventeenth century" as the print revolution made Western cultures less reliant on oral communication.[5] Strikingly, however, recent research undertaken with the help of digital technology indicates that just the opposite is true: rather than being rendered obsolete by the advent of modern print culture, mnemonics became intertwined with it, undergoing a flourishing renaissance exactly when these systems were supposed to have become most redundant.[6] Until very recently, this eighteenth-century mnemonic revival has been all but invisible to scholars. Artificial memory systems are virtually absent from more commercially-enduring Victorian genres like novels

[3] Aristotle, *De memoria et reminiscentia*, in *Aristotle on Memory*, trans. Richard Sorabji (Providence: Brown UP, 1972 [350 BCE]), 451b16, 451b18.

[4] Frances Yates, *The Art of Memory* (Oxon: Routledge, 1966), 84.

[5] Ioan P. Couliano, *Eros and Magic in the Renaissance* (Chicago: University of Chicago Press, 1987), 181. Also see Mary J. Carruthers, *The Book of Memory: A Study of Memory in Medieval Culture*, 1st ed. (Cambridge: Cambridge UP, 1992).

[6] See Grace Rexroth, "Byron and the Problem with Memory Arts: Writing Don Juan for an Age of 'Uncertain Paper,'" *Nineteenth-Century Literature* 77, no. 1 (June 2022): 1–28.

and poetry, which have remained more continuously in print and were therefore more accessible outside of archives. Largely a facet of Victorian popular culture, mentions of mnemonics treatises and exhibitions overwhelmingly only appear in brief newspaper and periodical blurbs, performance-advertisement broadsides, and limited-run chapbooks (many of these now only exist as rare single copies in highly restricted collections like Oxford University's John Johnson Collection of Printed Ephemera and the British Library's Evanion Collection). But there, such mentions appear frequently. The recent large-scale digitization of large portions of library archive collections—which has made it possible to skim thousands of recently digitized periodical volumes, and in some cases to view physically inaccessible archive materials online—clearly indicates that the eighteenth and nineteenth centuries witnessed a remarkable resurgence in artificial memory systems.

But eighteenth-and nineteenth-century mnemonics were very different from both the ancient memory aids praised by the classical orators and from the well-known standalone acronyms cited above. Hampshire clergyman Richard Grey's *Memoria Technica* (1730), which revived public interest in the use of artificial memory systems, invented an intricate new form that was geared specifically toward the enciphering into poetic verse of numbers and their related facts. His successor, Gregor von Feinaigle, created a semi-related imagistic version of this system in the 1810s in Britain, and later figures like Bartlomiej Beniowski in England and Francis Fauvel-Gouraud in America likewise created their own adaptations during the 1840s. Each of these systems employed different text- and image-based encryption techniques and used distinct codices to encipher numbers and related concepts into phrases, poetic verse, and visual tableaux (both imagined and physical). These systems were very popular. At their height in the nineteenth-century, mnemonics attracted the creative attentions of luminaries like Edgar Allen Poe, Walt Whitman, Ralph Waldo Emerson, Mark Twain, and Lewis Carroll. Overall, it would be more appropriate to conceptualize

Victorian artificial memory discourse as constituted by a wonderous and complicated array of mnemonic dialects that were constantly evolving, drawing from one another, and competing for popular attention and usership.

Victorian mnemonics were also dangerous. London-based American writer Robert Barr's short story "A Memory Lesson" (1888) parodies the supposed mental destruction produced by mnemonic devices. As my study will explore, during the nineteenth century, the remembering produced by mnemonics was widely considered mechanical and artificial because artificial memory systems deliberately manufactured associations, to synthetically catalyze recall, rather than retracing the associative connections between ideas that were formed organically through personal experience and organized in an orderly, hierarchical mental structure. This unusual form of remembering is the subject of Barr's story. In this humorous tale, the narrator encounters a man reduced from a promising agent at "one of the best wholesale houses in this town" to a disreputable beggar.[7] Contrary to the narrator's assumption, the man is not an alcoholic, but an amnesiac marred by an artificial memory course that he took to help him learn French quickly to aid his career. But rather than helping him learn the language and earn his promotion, the course obliterates the man's natural retentive memory, transforming him from an industrious go-getter into a helpless "victim of [the] system." Once the memory system "gets a hold on you," he bemoans, "you can't remember anything unless you corral the words."

Eventually, his complete reliance on these mechanical associations caused him to lose everything. His boss fired him after a haltingly attempt to recall a customer's name led him to recite an increasingly impertinent string of insults: "'Ring—alderman—fool—idiot'—but before I got to 'prison' I was kicked into the street." Similarly, a mental wrong turn (remembering "needle" instead

[7] Robert Barr [Luke Sharp], "A Memory Lesson," *The Detroit Free Press*, May 6, 1888.

of "spool") leads him to call his beau "Josephine" instead of "Roberta"; she accuses him of infidelity and ends their relationship. Even now, he relates to the narrator, he cannot recall even his former lover's name without blindly reciting a long train of mechanical associations back and forth: "'Girl—dress—dressmaker—thread—spool—cotton—cotton-mill—spinner—bobbin—bob—Robert—Robert—Roberta. That's it—her name was Roberta.' 'What was her last name?' 'Her last name? Let me see. […] Roberta—Robert—Bob—bobbin—cotton—factory—mill—mills. That's it again. Mills is the name; Miss Mills. Let's see, what did I say her first name was? Girl—dress—dressmaker"—."

The unnamed recipient of "A Memory Lesson" thinks the mnemonics course will provide what the story's title seems to reference—lessons teaching mental shortcuts to help him store and recall information. But instead, the mnemonics system destroys the man's natural memory system and replaces it with an unwieldy artificial one that revolutionizes how he remembers. Clearly, the mnemonics course offers something very different than tips for remembering. It provides an entirely new memory technology altogether. In this instance—contrary to Marshall McLuhan's famous theorization of human-technology hybridity—this new mechanical remembering technology is neither supplemental nor prosthetic. The system replaces the man's natural memory mechanism, transforming him into an automaton. He is doomed to mechanically recite disconnected strings of words without ever arriving at the complete product. As the textile theme of the man's mnemonics and the industrial surname "Mills" mockingly gestures to, the man has become functionally akin to a cotton-weaving machine, endlessly repeating the same sequence back and forth.

The memory system's transformation of the man's memories into generalized strings of concepts also degrades the connections between ideas by transforming many of these links into mere mechanical sound-play. While some undoubtedly rely upon category relations—girls wear dresses and thread comes on a spool—others are less clear. Bobbins bob and dressmakers make

dresses (semantic connections), but "bobbin—bob" and "dress—dressmaker" are also first-syllable rhymes that simply mechanically echo the root sounds. The mnemonic chain for Roberta's last name, which reverses the first-name mnemonic but produces a different result, satirizes this breakdown of genuine semantic meaning into pure phonetic play. The workability of these mnemonic chains relies upon an *amnesiac* successfully remembering when to follow the semantic link between two words ("spinner—bobbin" for the first-name mnemonic) and when to attend to aural resonances instead (the half-rhyme "bobbin—cotton" for the surname mnemonic).

Even more strangely, part of this path-differentiation appears to operate visually in relation to the material text, which is of course not accessible to the characters, by differentiating between the homonyms *bob* and *Bob* typographically. In the first-name mnemonic, *bob*'s lower-case type identifies it as a verb that is auditorily connected to "Robert" through a first-syllable rhyme ("bob—Robert"); whereas the surname mnemonic's capitalization of "Bob" demarcates it as a nickname semantically connected to "Robert." And yet the story elides this precise typographical distinction through its aural narrative form, as the memory system comically requires the man to verbalize these mnemonic links aloud in the presence of the narrator. Even as the story attempts to enforce the distinction between natural semantic associations and artificial sonic connections on the written page, the spoken nature of the man's act of recall elides these niceties in the diegesis. In doing so, the story underscores a central paradox of Victorian artificial memory systems: at the same time as they demanded oral performance and relied upon aural sound-play between linked ideas, nineteenth-century mnemonics were fundamentally material entities.

Although the story humorously caricatures artificial memory systems, Barr's tale is ultimately a very earnest cautionary tale about the dangers of mechanization—but not in the sense one might expect. "A Memory Lesson" is not a conventional manifestation of general, well-worn industrial

tropes about the growing threat that machines and mechanicity posed to humanistic experience. Instead, I suggest, it is better understood as a story about the very specific threat posed by nineteenth-century mnemonic systems, conceived of as autonomous memory systems that act as destructive mental machines solely capable of producing recall through mechanical aural and visual sound-play. Although such a depiction might seem outlandish given the benignity of modern mnemonic aids, Barr's *fin de siècle* story comprehensively encapsulates the conceptualization of artificial memory systems that developed over the course of the nineteenth century.

My study traces the rise of artificial memory systems from the early eighteenth century to their decline in the 1930s. As I show, the proliferation and divergence of competing systems created a series of interlocking mnemonic dialects lauded by rival proprietors in Britain and America. As this industry developed, mnemonics systems transitioned from an intellectual fad of the British aristocratic elite in the 1810s, to phenomena showcased at Victorian technology institutions that sparked a mixture of genuine scientific interest and popular entertainment in the 1820s–1840s, to rowdy staples of popular working-class entertainment with connections to Chartism and American labor-reform movements from the 1840s onward. Artificial memory systems experienced a brief resurgence in the music halls of the Edwardian and inter-war periods before finally becoming all but extinguished with the decline of such venues in the late 1930s.[8]

Looking back on these complicated systems, it can be tempting to view them as an eccentric nineteenth-century curiosity—a laborious and rather esoteric pastime that could only be relished in a less hurried age. But this study proposes that Victorian mnemonics have a far greater import beyond the popular cultural history of the period, in that nineteenth-century mnemonics discourse was an

[8] Mnemonics reemerged as a competitive subculture after the World Memory Sports Council launched in 1991. Other major organizations include the International Association of Memory and the Memory League.

important Victorian site of theorization for many of the core concepts of modern computing. The roots of this project lie in my discovery that, unlike their predecessors, Victorian mnemonic systems were realized as autonomous memory machines. "Autonomy" here is defined not by physical externality from humans, but rather by a random-access recall process that consists in a printed system worked partly by the mind. As I argue, nineteenth-century mnemonics systems overturned the Aristotelian principles of associative memory, which emphasized the content of connections between ideas. As these systems developed, they conceptualized and performed random-access memory; they produced a form of mechanical symbol-play that paralleled the invention of Boolean logic; they enacted logarithmic computer encryption; and they ultimately became one form of source material for the twentieth-century conception of the computer as a wartime weapon. This new picture challenges the consensus that mnemonics usage declined in the eighteenth century and repositions Victorian systems of artificial memory as an exciting new alternative dimension of the history of computing.

In my first chapter, I tell the story of how artificial memory systems came to be understood as autonomous machines that produced random-access memory. The chapter traces debates about the dangers of mnemonics systems originating from eighteenth-century Scottish Common Sense philosophy. As philosophers like Dugald Stewart recognized, mnemonics eschewed natural remembering via organic connections between ideas, instead relying on artificial links to remember decontextualized information. I describe how Samuel Taylor Coleridge adapted these critiques in the early nineteenth century to conceptualize mnemonics as destroying the natural memory and replacing it with a separate machine, the mnemonic. Reacting to earlier eighteenth-century associationist debates while steeped in the context of the Industrial Revolution, nineteenth-century mnemonics systems came to conceptualize artificial memory systems as external machines partly

imbedded in the mind. These machine memories, as they were often described, stored and recalled information entirely through the mnemonic systems themselves, producing recall via references to their own illogical associative systems. Freed from the constraints of logical relations between ideas, they created a kind of memory that was virtually immediate, practically infinite, and readily purchasable. This discussion augments our current understanding of the Analytical Engine project by showing how the Scottish Common Sense tradition informed the simultaneous of random-access memory technology by Charles Babbage and by contemporaneous Victorian mnemonicians during the 1830s and 1840s. Recognizing this shared intellectual tradition contributes to the current conceptualization of the Analytical Engine project while also suggesting that it was not the sole innovation of mechanical random-access technology.

My second chapter shows how Victorian prosody debates about nonsensical sound, especially nonsense puns like those that mnemonics crafted, formed part of the intellectual movement in support of abstract symbolization that eventually led to George Boole's invention of Boolean logic. In the 1820s, Charles Babbage and John Herschel advocated for the usage of Leibniz's calculus notation and symbolic algebra more broadly. Although traditionalist English mathematicians considered symbolic mathematics 'nonsensical' because such methods enabled one to manipulate symbols in ways that had no direct connection to the physical world, Babbage and his fellow experimentalist mathematicians saw the abstract nature of this new notational form as a powerful means of mechanizing the processes of mental analysis and relieving the memory. Whereas Babbage explored these possibilities by inventing physical calculating machines, mathematician George Boole famously developed Babbage's early ideas about symbolic mathematics by applying the rules of algebra to logic, revolutionizing both fields in the process. His creation of Boolean logic laid the groundwork for many aspects of modern computing, from algorithms to digital circuitry. I

argue that this mathematical genealogy was only one side of a larger horseshoe-shaped continuum. Victorian nonsense poets and mnemonicians were also experimenting with the same ideas about abstract symbol manipulation in the realm of poetry, primarily with respect to sound-play. I trace the corollary side of this larger intellectual trend from the standpoint of literary debates from nineteenth-century artificial memory investigations of visual and aural symbol-play through Edward Lear's nonsense verse and drawings, and finally to the mnemonic poetry of Oxford mathematician and poet Lewis Carroll, which I argue follows the compositional structure of Boolean logic.

My third chapter focuses on how Victorian mnemonics operated as cryptographic algorithms by investigating the unexpected possibility that Lewis Carroll encoded a hidden mathematical code relating to maritime navigation in his famous nonsense epic poem *The Hunting of the Snark*. In my formulation, *The Hunting of the Snark* becomes a portmanteau play on 'The Hunting of the Sine-Arc.' I explain my discovery of a previously unacknowledged mnemonic cipher in Carroll's mathematical archive papers held in Princeton's Morris L. Parrish Collection of Victorian Novelists and examine examples of trigonometric and logarithmic mnemonic poetry written by Carroll at exactly the same time in which he was composing the *Snark* in the fall of 1875. Where, for instance, the Analytical Engine was designed as a physical machine to calculate logarithms, Charles Dodgson similarly used a mental machine, mnemonics, to compute them. I also discuss how the history of eighteenth- and nineteenth-century spherical geometry and trigonometry—specifically the applied field of maritime navigation in the context of the mathematical 'race to longitude'—offers an important mathematical context for understanding the poem's nonsense nautical quest. When interpreted alongside the *Snark*'s mathematical jokes and its pattern of textual anomalies that shares formal similarities with Carroll's contemporaneous mathematical mnemonic poems, I argue that

there is compelling evidence to suggest that Carroll used a mnemonic system that he personally adapted to encipher a series of logarithmic sine calculations for various Great Circle arcs.

In my final chapter, I show how the Victorian mnemonic literary history of computing as I have explained it eventually links up with the more familiar twentieth-century story that emphasizes the role of the military by examining the depiction of mnemonics as an espionage war machine in Alfred Hitchcock's 1935 film *The 39 Steps*. The film, a loose adaptation of John Buchan's Great War novel *The Thirty-Nine Steps*, depicts a German spy ring that attempts to steal state secrets by employing a famous mnemonist to memorize classified plans. Though this film's depiction of Victorian mnemonics culture—based on Hitchcock's childhood memories of a performance by Datas the Memory Man, the last great mnemonist of the nineteenth-century tradition—I chart mnemonics' transition from an Edwardian music-hall spectacle to a dangerous military technology vulnerable to German exploitation, arguing that Hitchcock's final scene represents the birth of a new cybernetic relationship between humans and computers.

As many scholars of computing have observed, the computer is the product of the intertwinement of many disparate mathematical and technological lineages. Most examinations tend to focus on one of two genealogies: the development of physical computing technology or the theoretical mathematical advances that underpinned the machinery. As Michael Mahoney observed in his famous 1988 article "The History of Computing in the History of Technology," throughout the latter half of the twentieth century, it was common for histories of computing to focus "in larger part on hardware and on the prehistory and early development of the computer. […] Biographies of men or machines—some heroic, some polemical, some both—are a prominent genre, and one reads

a lot about 'pioneers.'"[9] This more technical body of scholarship includes studies such as Maurice V. Wilke's, Alan Bromley's, and Doron Swade's manifold technical studies of Charles Babbage's calculating machines; Paul Cerruzi's *History of Computing*, which examines the development of computer technology from early machines like the ENIAC and the EDVAC to contemporary applications like iPhones and Teslas; *Computer: A History of the Information Machine* (ed. Martin Campbell-Kelly), which covers the history of computing technology from the *Nautical Almanac* to the rise of the personal computer.

This area also includes many broad historical surveys that trace the development of calculational technologies from the ancient world to today, including *Computing Before Computers* (ed. William Aspray), Michael R. Williams's *A History of Computing Technology*, and *The History of Mathematical Tables: From Sumer to Spreadsheets* (ed. Martin Campbell-Kelly). With respect to the nineteenth century, while nearly every study cites the Analytical Engine as an important forerunner of the computer, most historians generally characterize Industrial Revolution-era inventors as focused on expanding the possibilities of physical machinery while separate counterparts in the field of mathematics made discoveries of their own; later twentieth-century contributions intermingled the insights of these two disciplines to create the computer. Other studies from within the history of mathematics focus greater attention on the mathematical developments that enabled machinery to handle computational tasks. Prominent examples include Ivor Grattan-Guinness's excellent manifold studies of nineteenth-century mathematics, Mary Croarken's *Early Scientific Computing in Britain*, Michael Mahoney's *Histories of Computing*, Martin Davis's *The Universal Computer: The Road from Leibniz to Turing*, and Mark Priestley's *A Science of Operations: Machines, Logic and the Invention of*

[9] Michael S. Mahoney, "The History of Computing in the History of Technology," *IEEE Annals of the History of Computing* 10, no. 2 (April 1988): 114.

Programming. As Michael Mahoney argues, "Until the two strands come together in the computer, they belong to different histories, the electronic calculator to the history of technology, the logic machine to the history of mathematics."[10] Finally, within digital humanities, scholars of new media and critical software studies have augmented these histories by examining the gendered and racialized dynamics of the military development of computing, with special focus on the postwar period to today. Studies like N. Katherine Hayles's *My Mother Was a Computer: Digital Subjects and Literary Texts*, Wendy Chun's *Programmed Visions: Software and Memory*, and Lev Manovich's *Software Takes Command* have situated the emergence of the computer within its wider social context, theorizing and historicizing the social construction of this new technology.

My account is not an alternative retelling of nineteenth-century computing that attempts to reject or displace these other standard histories; rather, this study offers an unorthodox reconstellation of the essential elements of these various disciplinary narratives around Victorian artificial memory mnemonic discourse. Familiar computational touchstones like the *Nautical Almanac*, the Analytical Engine, and Boolean algebra emerge alongside peculiar ephemera like giant homunculus mnemonic globes sold at railway stations and Victorian mathematical code poetry. This account also offers an oppositional retrograde extension of the traditional digital humanities narrative of the exclusionary class and racial politics that produced the computer by illuminating that the nineteenth century mnemonic theorization of the computational concepts I examine was a bottom-up populist endeavor with ties to the Chartist and abolitionist movements.

Victorian mnemonics brought into focus for the first time, in a uniquely modern way, the electrifying and supremely disquieting possibility that true human remembering could occur without the human mind and may not actually require humans at all. This conceptual shift introduced serious

[10] Mahoney, 116.

psychological dangers as well as real sociopolitical, literary, and of course technological possibilities. Over the course of the century, many disparate discourses built upon one another's ideas; astonishingly, this decentralized collective exchange came to produce many of the fundamental concepts that would come to undergird the invention of the computer. My non-teleological examination of this history from within Victorian mnemonics and poetry posits that in addition to celebrating figures like Ada Lovelace and Charles Babbage, Alan Turing, and John von Neumann, we should also look to mnemonicians like Richard Gray, Gregor von Feinaigle, and Bartlomiej Beniowski; and to nineteenth-century poets like Samuel Taylor Coleridge, Edward Lear, and Lewis Carroll to appreciate the full extent of the messy synergism and unlikely creative insights that produced many of the core concepts of modern computing.

Chapter One: Victorian Mnemonics and Random-Access Memory

Although today all but unknown, Richard Grey's 1730 mnemonic treatise *Memoria Technica* garnered a widespread and devoted readership in the eighteenth and nineteenth centuries. No less than twenty-seven editions were published between 1730–1880; at its height, the system's students included literary luminaries like Edgar Allen Poe, Ralph Waldo Emerson, Walt Whitman, and Lewis Carroll. Somewhat surprisingly given the complexity of the eponymous *memoria technica* system—which created verse mnemonics by relating letters to numbers to recall information like dates and scientific figures—*Memoria Technica* became a "work of considerable celebrity" almost immediately after its publication.[11] Following the 1732 second edition, Grey was presented at court to Prince William, Duke of Cumberland (recently turned eleven), where he "had the Honour to kiss the Highness's Hand."[12] Roughly one hundred years later in the early nineteenth century, *Memoria Technica* had arguably become even more popular across a remarkably varied array of social spheres. In 1825, *The Ladies Monthly Museum* extolled: "Richard Grey's Memoria Technica is so well known, that it is unnecessary to expatriate on its value or utility, to the young student especially."[13] That same year, the *Monthly Magazine* likewise proclaimed, "The merits of Dr. Grey's celebrated and elaborate treatise are pretty universally allowed."[14]

Ancient and medieval societies held that the mind was composed of two innate kinds of memory: the natural memory, which contained innate knowledge, and the artificial memory, which

[11] Unsigned review of *Dr. Grey's Memoria Technica*, by J. H. Todd, *Literary Gazette*, no. 456 (October 15, 1825): 666.

[12] "London," *Daily Courant*, May 20, 1732.

[13] "Notices of New Publications," *Ladies' Monthly Museum* 22 (November 1825): 283.

[14] Unsigned review of *Dr. Grey's Memoria Technica*, by J. H. Todd, *Monthly Magazine: Or, British Register* 60, no. 416 (November 1, 1825): 347.

stored the information one acquired throughout life. Whereas the natural memory was static, one could improve the organic artificial memory by training it—for example, with mnemonics. The eighteenth-century Scottish Common Sense tradition expanded upon the classical distinction between the mind's innate natural and artificial memories by breaking down the latter into two complimentary subtypes, active memory and passive memory. The active memory was a willfully produced, logical form of remembering associated with genuine learning. The passive memory was responsible for a range of subconscious kinds of recall, from mechanical rote schoolhouse memorization to spontaneous flitting remembrances like Proust's famous madeleine episode. Whereas ancient and medieval writers had understood artificial memory systems as training the innate artificial memory, the Common Sense critics warned that *memoria technica* merely stimulated the passive memory. Rather than strengthening the active memory by expanding the mind's logical hierarchy of ideas, Richard Grey's system reproduced information through nonsensical strings of half-gibberish verses. Such recall was not true learning, but rote regurgitation, and should be avoided in all but very constrained circumstances. As a result of this philosophical tradition, the method by which one recalled information—not just the outward act of showcasing prowess—became all-important.

This debate resurfaced again with greater force in the first two decades of the nineteenth-century with the rise of Gregor von Feinaigle, an ostentatious mnemonist whose New Art of Memory merged elements of Grey's *memoria technica* with the classical 'memory palace' technique. Feinaigle's intermingling of memory and imagination enraged nineteenth-century philosophical inheritors of the Common Sense tradition like Samuel Taylor Coleridge, who passionately denounced the New Art of Memory in *Biographia Literaria* (1817). Although the eighteenth-century Common Sense philosophers had valued active and passive remembering differently, they had still

characterized them as two complementary components of the mind's innate artificial memory. Coleridge split passive remembrance into two further subtypes: the passive remembrance produced by the innate artificial memory—a salubrious creative form of recall he termed 'fancy'—and the degrading passive remembrance produced by external artificial memory systems. In making this denunciation of artificial memory systems the pinnacle of his broad refutation of the dehumanizing mechanicity of associationist models of mind, I suggest that Coleridge conceptualized mnemonics as external technology that was actively hostile to the organic memory—a mechanical foreign supplant rather than an ill-advised supplement. This argument was revolutionary. Following the *Biographia*, the term 'artificial memory' began to assume the connotation of a separate and unnatural interloper in the mind, as thinkers over the next two decades considered the key question that Coleridge's deeply unsettling new formulation had brought to the fore: if artificial memory systems destroyed the mind's innate memory, then *what*, exactly, was performing the remembering?

Computing historian Doron Swade emphasizes that the Industrial Revolution's mechanization of physical labor was accompanied by "another revolution […]—the mechanization of mental labour, specifically the mechanization of calculation and mathematics, and with it the extension of the model of industrial production from things to thought."[15] Although in Swade's estimation this mental revolution has "received less attention by historians, largely because it failed"—a conclusion based on the Analytical Engine's abortive construction—this essay posits that recognizing the influence of mnemonics discourse on both the Difference Engine and the Analytical Engine shows how the mental Industrial Revolution did influence the development of computational concepts, albeit in a more circuitous way than Swade envisions. Tracing this lineage

[15] Doron Swade, "Calculating Engines: Machines, Mathematics, and Misconceptions," in *Mathematics in Victorian Britain*, ed. Raymond Flood, Adrian Rice, and Robin Wilson (Oxford: Oxford UP, 2011), 241.

from mnemonics to the Analytical Engine, as I do, answers programming historian Mark Priestley's call for scholars to "think more generally of attempts to define the steps involved in computations and other information-processing activities in such a way that they could be performed by machines, or at least by humans mimicking the behavior of machines."[16] This wider framework therefore not only encompasses traditional histories of technology that focus on the invention of physical machines, but also examines the messy historical creation of the computer's theoretical framework.

In providing a more comprehensive examination of the nineteenth-century social and intellectual conditions that informed the conceptualization of Babbage and Lovelace's Analytical Engine, my account necessarily disrupts the historical trajectory and theoretical framework offered by new-media and critical software studies scholarship, which both emphasize the oppressive racial, gender, and class dimensions that underpinned the military development of computers during the twentieth century. In her new-media analysis of software's concretization in *Programmed Visions* (2011), Wendy Hui Kyong Chun analyzes the how the "hardening of programming into software and of memory into storage" caused (among other factors) by "computing's gendered and military history […] has made the computer, understood as networked software and hardware machines, both an instrument and a symptom of neoliberal governmental power." She emphasizes that the software's "externalization of information from the self, coincides with and embodies larger changes within what Michel Foucault has called *governmentality*."[17] Chun and likeminded critics understand the computer as arising from and still exemplary of the neoliberal consolidation of violent capitalist power. But, as I will argue, the earlier history of artificial memory discourse offers a very different story—one in which mnemonics, although conceptualized as commodified machine linked to the

[16] Mark Priestley, *A Science of Operations: Machines, Logic and the Invention of Programming* (London: Springer, 2011), v.

[17] Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge and London: MIT Press, 2011), xii, 6.

Industrial Revolution, were nonetheless embraced by working-class political movements in Britain and America as powerful democratizing technologies. As my final chapter on the militarization of artificial memory in Alfred Hitchcock's 1935 film *The Thirty-Nine Steps* shows, the history of mnemonics as a proto-computing technology does eventually link up with the militarized, top-down, twentieth-century history of computing that Chun and other new-media critics emphasize. But the earlier Victorian history of this technology offers an almost diametrically opposite vision of its possibilities. This chapter suggests a new origin story for the invention of modern computing that is neither grounded in gendered neoliberal military power nor characterized by the mythic contributions of individual geniuses like Charles Babbage operating outside of their own historical moment. Rather, the Victorian history of computing as told from within the history of nineteenth-century mnemonics is one of messy collective creation, where the discursive interplay between high philosophical debates and sensationalized popular entertainment produces a new kind of memory technology that vastly altered the scope of modern psychological and technological possibility.

I. *Memoria Technica* and the Eighteenth-Century Mnemonic Revival

The catalyst of this forgotten eighteenth-century mnemonic revival was a single book: Richard Grey's *Memoria Technica*. Unlike the ancient method of *loci*, Grey's *memoria technica* is a sound-based mnemonic system that produces encoded memory poetry to help one retain numbers. Based on the belief that remembering verses composed of words, even half-nonsensical ones, is easier than recalling strings of digits, Grey's method creates poetic strings of mnemonics by using a cipher to translate the numbers one wishes to remember into alphabetic letters. Then, one affixes these letters to an abridged version of the corresponding

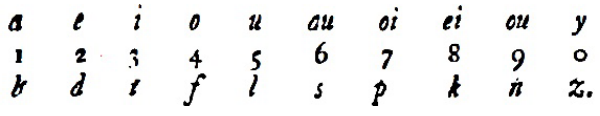


Figure 1: *Memoria Technica* cipher. Richard Grey, *Memoria Technica* (London: Charles King, 1730), 2.

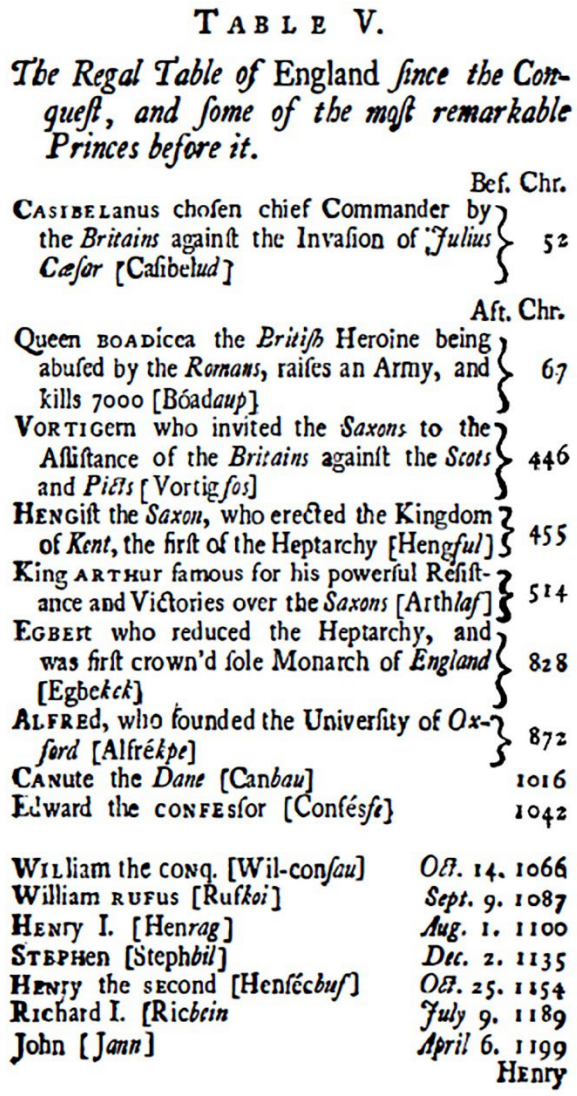


TABLE V.

The Regal Table of England *ſince the Conqueſt, and ſome of the moſt remarkable Princes before it.*

	Bef. Chr.	
CASIBELanus choſen chief Commander by the *Britains* againſt the Invaſion of *Julius Cæſar* [Caſibel*ud*]		52
	Aft. Chr.	
Queen BOADICEA the *Britiſh* Heroine being abuſed by the *Romans*, raiſes an Army, and kills 7000 [Bóad*aup*]		67
VORTIGERN who invited the *Saxons* to the Aſſiſtance of the *Britains* againſt the *Scots* and *Picts* [Vortig*fos*]		446
HENGIST the *Saxon*, who erected the Kingdom of *Kent*, the firſt of the Heptarchy [Heng*ful*]		455
King ARTHUR famous for his powerful Reſiſtance and Victories over the *Saxons* [Arth*laf*]		514
EGBERT who reduced the Heptarchy, and was firſt crown'd ſole Monarch of *England* [Egbe*kek*]		828
ALFRED, who founded the Univerſity of *Oxford* [Alfré*kpe*]		872
CANUTE the *Dane* [Can*bau*]		1016
Edward the CONFESSOR [Confés*ſe*]		1042
WILLIAM the CONQ. [Wil-con*ſau*]	*Oct.* 14.	1066
WILLIAM RUFUS [Ruſ*koi*]	*Sept.* 9.	1087
HENRY I. [Hen*rag*]	*Aug.* 1.	1100
STEPHEN [Steph*bil*]	*Dec.* 2.	1135
HENRY the SECOND [Henréc*buſ*]	*Oct.* 25.	1154
RICHARD I. [Ric*hein*	*July* 9.	1189
JOHN [*Jann*]	*April* 6.	1199
		HENRY

Figure 2: "Table V" (Regnal Table). Richard Grey, *Memoria Technica* (London: Charles King, 1730), 14.

English term. This method creates a portmanteau word where the prefix is a truncated English concept, and the suffix is a gibberish enciphered translation of numbers into letters. Traditionally, the user then strings together these 'technical words' and recites them *aloud* in dactylic hexameter, the classical epic verse form. As shown here, King Arthur's assumption to the throne becomes "Arth*laf*," where "laf" translates to 514. Depending on the context, implied numbers can be left unsignified in the chronogram, and multiple English words can be condensed into a single prefix. For example, the mnemonic for the 1727 assumption of George II, Gëo*doi* (727), implies the "1"; the technical word for the "Diameter of the Orbit of the earth in English Miles" is "Dorbtér*boid-áze-poul*" (172,102,795). One can recall seventeen hundred years-worth of rulers—from Casibelaunus to George II—simply by reciting "Casibel*ud*, Bóad*aup*, Vortig*fos*, Heng*ful* & Arth*laf*. / Egbe*kek*, Alfrékpe, Can*bau*, Confés*fe*." "Hundreds of them," as one devotee gleefully relished, "may be easily learnt by heart in order."[18]

[18] Edward Deacon Girdlestone, *Memory Helped* (London: Hamilton, Adams, and Co., 1866), 10–11.

But popular as it was, Grey's *memoria technica* system provoked strong disapprobation in eighteenth-century philosophical circles. Thinkers aligned with the Scottish Common Sense school—including Thomas Reid, James Beattie, Dugald Stewart, John Abercrombie, Sydney Smith, and Maria and Richard Edgeworth—stressed that *memoria technica* was of a very different stripe than the mental shortcuts lauded by the classical orators.[19] To them, Grey's mnemonics exemplified the pitfalls of associationism, the reigning materialist philosophical model of mind during the eighteenth and nineteenth centuries that saw all psychological processes as constituted by the interplay between linked mental ideas. Thirty years before the publication of *Memoria Technica*, John Locke had initiated the modern conception of associationism with the addition of his famous chapter "Of the Association of Ideas" to the 1700 fourth edition of the *Essay Concerning Human Understanding* (1689). Examining the Aristotelian notion that inherently independent ideas can become linked in the mind, Locke considered the role of improper mental associations in causing madness. As John Sutton explains, he argued that "The corporeal associative mechanism of imagination and memory […] introduce troublesome disorder, turning the mind away from contemplation of truth and reality (whether of religious and moral truths or simply of the external world and the real past) into dangerous realms of images unfettered by goodness."[20] David Hume's *Treatise of Human Nature* (1738) temporarily submerged this emphasis on the dangers of mental associations by significantly expanding and revising Aristotle and Locke's sketches into a comprehensive philosophy of mind that explained "*all* mental sequences, not just disordered and dangerous ones."[21] In Hume's

[19] The Scottish Common Sense school was a loose collection of thinkers. I employ the term broadly to both major proponents like Reid, Beattie, and Stewart; as well as to later British philosophers who supported their core tenants.

[20] John Sutton, *Philosophy and Memory Traces: Descartes to Connectionism* (Cambridge: Cambridge UP, 1998), 197. Also see Robert Hoeldtke, "The History of Associationism and British Medical Psychology," *Medical History* 11, no. 1 (January 1967): 46–65.

[21] Sutton, *Philosophy and Memory Traces*, 198.

formulation, the mind stores facts in an ever-growing hierarchical network of information by linking specific and abstract ideas. But rather than endorsing Aristotle's three fundamental principles of association—similitude, contrast, and contiguity—Hume instead proposed resemblance, continuity, and causation. As Jacqueline Taylor explains, within Hume's associationist theory

> the relation of causation is particularly important, as only by it can we draw conclusions that go beyond the immediate impressions of our senses, for example, in an anticipatory belief or prediction. Hume famously denies that we directly observe any causal connection between any particular cause and effect, but rather we find that in experience the mind moves beyond the observed constant conjunction of particular cause-effect pairs such that on the appearance of either the cause or effect, we infer the existence of the one not yet in evidence. It is "custom or a principle of association" that explains this inferential capacity on our part […].[22]

Hume emphasized the importance of the mind's ability to analyze the causational principle of associationism in the aggregate. This formulation sparked a lively discussion within the Scottish Common Sense tradition.[23] Thomas Reid, Dugald Stewart, William Hamilton, and Thomas Brown all proposed additional associative properties, but despite individual differences they all broadly accepted Hume's suggestion that linking thoughts by cause and effect was a fundamental mental principle. After coming to understand the mind's associative connections (learning), an individual can sequentially retrieve information by tracing adjacent links (remembering). Remembering can occur inductively by moving from individual observations to general principles (a particularly important concept within the Common Sense tradition); or deductively by applying abstract theories to specific instances. As Dugald Stewart clarified, cultivating these kinds of philosophical connections was important not simply because the practice improves "the strength of the memory,"

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[22] Jacqueline Taylor, "The Human Mind and Its Powers," in *The Cambridge Companion to the Scottish Enlightenment*, ed. Alexander Broadie and Craig Smith, 2nd ed. (Cambridge: Cambridge UP, 2019), 65.

[23] Although the Scottish Common Sense movement "began principally as a critical response to the philosophical writings of David Hume," earlier adherents "saw Hume as their principal teacher as well as their principal antagonist." Richard S. Olson, *Scottish Philosophy and British Physics, 1740-1870* (Princeton: Princeton UP, 1975), 28.

but ultimately because it necessitates "the exercise of judgment" in determining the logical relations between ideas. In this empiricist Enlightenment framework, fostering a causal understanding of the world through systematic inductive reasoning was all-important because it created the mental environment necessary for making profound new intellectual discoveries. Stewart's formulation makes these stakes clear: "Philosophic arrangement assists the memory by classing, under a few principles, a number of apparently dissimilar and unconnected rejected particulars. The habit, for instance of attending to the connexion of cause and effect, presents a multitude of interesting analogies to the minds of men of science, which escape other persons."[24]

The Common Sense school's emphasis on causality as a fundamental associative principle reaffirmed Locke's new emphasis on the memory's epistemological importance. One could only obtain systematized knowledge of the world by understanding the causal connections between ideas; to do so required a strictly disciplined memory underpinned by a sturdy hierarchy of associations. In investigating the psychological processes required to craft such a mental structure, Common Sense philosophers distinguished between the form of memory that created and utilized these kinds of logical connections, the active memory, and its free-association corollary, the passive memory. They employed different terminology for the two forms of remembering, referring to passive memory as remembrance and active memory as recollection. As James Beattie explained, "When we remember with little or no effort, it is called remembrance simply, or memory, and sometimes passive memory: when we endeavor to remember what does not immediately and (as it were) of itself occur, it is called active memory or Recollection."[25] Catherine Jones explains the significance of this difference: "Where active memory enables selection and self-construction and is dependent upon the influence

[24] Quoted in Maria Edgeworth and Richard Edgeworth, *Practical Education*, 1st ed. (London: J. Johnson, 1798), 561.

[25] "Remember," in *The Oxford English Dictionary* (Oxford: Oxford UP, 2009).

of the will, the trains of thought of passive memory present themselves spontaneously to the mind; the will is in abeyance."[26]

Like Aristotle, the Common Sense tradition conceptualized the active memory not just as an important epistemological tool, but also as a fundamental marker of humanity (the ability to actively recollect being supposedly unique to humans).[27] The active memory's cultivation was central to creating the ideal Enlightenment individual—not just from the standpoint of potential scientific triumphs, but also in terms of subjective selfhood. It was only through training the mind to generate robust logical associations that one could become strong-minded, rational, and ultimately free. As Andrew Baxter argued in 1779, because the active memory was responsible for the capacity to reason, it was the foundation for "the first and highest kind of liberty, that over the perceptions of the mind." He declared: "Since reason implies and supposes active memory, it follows that it implies or supposes liberty; this kind of memory being only the power of reflecting back, and applying voluntarily our attention to any past perception, and consequently to any part of our past consciousness within certain limits at least."[28] For the Common Sense tradition, the active memory demonstrated that the mind could be governed by the will, which had the ability to bring forth past perceptions and memories. In essence, the regulated exhibition of the active memory proved that an individual had the freedom and power to control his own mind. As James Beattie stated, developing this mental self-regulation enabled the active memory to access "the most important parts of human

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[26] Catherine Jones, *Literary Memory: Scott's Waverley Novels and the Psychology of Narrative* (London: Bucknell UP, 2003), 25. As Jones details, active and passive memory somewhat prefigure Freud's conceptualization of conscious and unconscious memory, but they are not analogs.

[27] Aristotle states: "of the other animals [as well as man] have memory, […] none, we venture to say, except man, shares in the faculty of recollection." Aristotle, *De memoria et reminiscentia*, in *The Basic Works of Aristotle*, trans. Richard McKeon (New York: Random House, 1941 [350 BCE]), 453a 5–9.

[28] Andrew Baxter, *The Evidence of Reason in Proof of the Immortality of the Soul*, ed. John Duncan, 1st ed. (London: T. Cadell, 1779), 10:97, 9:94.

knowledge," including "abstract notions in regard to truth and falsehood, virtue and vice, elegance and deformity, propositions in quantity and number, law, government, religion, commerce, and other sciences and arts."[29] Only by cultivating the active memory could individuals obtain the rational, disinterested understanding of the world requisite for true personal liberty.

Whereas the active memory created the mind's network of natural associations based on experiences guided by education and must be willfully accessed (actively remembered, as the name indicates), the passive memory consisted of a disorganized jumble of ideas floating around the mind. In this state, Catherine Jones explains, "the mind is at the mercy of the spontaneous progression of ideas." By generating impulsive recall where haphazard ideas jumped uncontrollably back into the mind, remembrance could spark droll fodder for witty conversation and artistic production. But if allowed to rule the mind, the passive memory would produce a litany of perilous outcomes, from irrational outbursts to full-blown insanity. When the mind becomes controlled by passive memory, "Identity fragments and madness results."[30] While the Common Sense tradition acknowledged some value for passive remembering in limited circumstances, its proponents asserted that the active memory must steadfastly rule the mind. Unless the passive memory was controlled and only allowed to manifest in constrained aesthetic circumstances, chaos would proliferate at every level of society.

While Aristotle had understood the capacity for active recollection as an inalienable human quality, the Common Sense tradition displayed significant anxiety about the seemingly increasing flimsiness of this boundary, especially with respect to how it might affect the larger class structure of eighteenth-century society. Reiterating earlier cautions raised by John Locke and Francis Hutcheson,

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[29] James Beattie, *Elements of Moral Science*, vol. 1 (Edinburgh: T. Cadell and William Creech, 1790), 102.

[30] Catherine Jones, "Scott's *The Heart of Midlothian* and the Disordered Memory," in *Memory and Memorials: From the French Revolution to World War One*, ed. Matthew J. B. Campbell, Jacqueline M. Labbe, and Sally Shuttleworth (New Brunswick, NJ: Transaction Publishers, 2004), 34.

these philosophers were particularly concerned about the dehumanizing and socially destabilizing effects of disordered memory on the lower classes, where unsystematic mental habits and injudicious remembrance were thought to be endemic. Widespread passive remembering on the part of the working classes threatened to muddy a key separation between the human mind and those of the lower species. Maria and Richard Edgeworth reprove: "A person who sets about to collect facts at random, is little better than a magpie, who picks up and lays by any odd bits of money he can light upon without knowing their use." The Edgeworths employ this metaphor to emphasize that the animalistic mental attitude produced by mnemonics was not just profoundly dehumanizing to individual users, but also threatening to the larger class structure of civilized society.

Whereas the educated classes' formative commitment to hierarchical mental structures inculcated respect for the class structure of eighteenth-century British society, the memory disorganization of the lower classes both reflected and contributed to their dangerous latent leveling tendencies. As after forming beliefs based on one coincidental event, *Practical Education* explains, "ill educated people continue through life to remember things by this single association; and consequently, there is an heterogeneous collection of ideas in their mind, which have no rational connexion with each other; crowds which have accidentally met, and are forced to live for ever together." This disarray permanently forecloses their ability to think logically: "no one can reason clearly, whose memory has these foolish habits; the ill matched ideas are inseparably joined, and they imagine there is some natural connexion between them. Hence arise those obstinate prejudices, which no arguments can vanquish."[31] Ideas within the uneducated mind form a jumbled crowd that resists hierarchical order, just like the masses when the appropriate constraints of civil society deteriorate (the political dimension of the Edgeworths' comments here seems especially rich given

[31] Edgeworth and Edgeworth, *Practical Education*, 86, 92–93, 94.

the timing: *Practical Education* was published in June 1798, one month after the advent of the Irish Rebellion, which eventually necessitated the family's evacuation from Edgeworthstown House a few months later).

The Common Sense philosophers viewed the rise of Grey's *memoria technica* as a troubling stimulant for the mental disorganization that had already become too pervasive within society. Whereas the classical and medieval writers had seen artificial memory systems as a methodical means of coaching one's active memory—recall *Rhetorica ad Herennium*'s assertion that "The artificial memory is that memory which is strengthened by a kind of training and system of discipline"—the Common Sense philosophers viewed Grey's *Memoria Technica* as only stimulating the passive memory.[32] Mnemonic recall was at best unhelpful; at worst, it inculcated inefficient mental habits that were laborious, if not impossible, to fully reverse. The *memoria technica* method intentionally eschewed philosophical connections to embrace the arbitrary, nurturing illogical associations to spur the haphazard recall of disconnected ideas. As John Abercrombie explained, artificial memory systems like Grey's created illogical associations that were synthetically "produced by a voluntary effort of the mind; and the facts associated are not connected by any relation except what arises out of this effort."[33] Sydney Smith likewise contrasted the "philosophical arrangement to memory" produced by "clustering numbers of" facts "together as illustrative of a simple principle" to the mental disorganization produced by artificial memory systems. As with too much uncontrolled passive remembering in general, mnemonics "accustom the mind to light and foolish associations, which have no foundation in nature," and allow ideas to become "promiscuously scattered through

[32] Rhetorica ad herennium, *Rhetorica ad herennium*, 3.16.28.

[33] John Abercrombie, *Inquiries Concerning the Intellectual Powers and the Investigation of Truth*, 1st ed. (Edinburgh: Waugh and Innes, 1830), 120.

the understanding without any such connecting tie."[34] Likewise, Samuel Bailey avowed that mnemonics "necessarily rendered all knowledge, acquired by its assistance, dependent on whimsical and preposterous associations, entangling every fact, every date, and every principle, with unnatural and absurd images, and thus depriving the taste and vitiating the imagination."[35]

But the single most troubling aspect about the growing popularity of mnemonics systems was the near impossibility of detecting their usage. Philosophers might harangue about the dangers of habitually engaging in such recall methods. But they recognized that the two were often functionally indistinguishable (transparent minds being the sole province of fiction). Nothing, save a high-minded commitment to philosophical principle, prevented one from employing such unsavory methods to imitate an Etonian education or even the indexical knowledge of a genius. Mnemonics showed that passive remembrance could produce the same quality of information—and significantly more of it—than the slow, labor-intensive processes of learning and active recollection could ever do. Maria and Richard Edgeworth address this disconnect between the internal act of recall and the external observable output:

> We judge by the effects frequently, that causes are the same, which sometimes are entirely different. Thus, we, in common conversation, should say, that two people had an equally good memory, who could repeat with equal exactness any thing which they had heard or read. But in their methods of remembering these persons might differ essentially; the one might have exerted much more judgment and ingenuity in the conduct of his memory than the other, and might thus have no only fatigued himself less, but might have improved his understanding, whilst the other learned merely by rote.[36]

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[34] Sydney Smith, "Lecture XV: On the Beautiful, Part III," in *Elementary Sketches of Moral Philosophy: Delivered at the Royal Institution in the Years 1804, 1805, and 1806*, 1st ed. (London: Spottiswoodes and Shaw, 1849), 85–86.

[35] Samuel Bailey, *Questions in Political Economy, Politics, Morals, Metaphysics, Polite Literature, and Other Branches of Knowledge* (London: R. Hunter, 1823), 385.

[36] Edgeworth and Edgeworth, *Practical Education*, 75–76.

It might be tempting to evaluate the quality of a person's memory—and by inference his intellect and judgment—via the ability to recall information. But as the Edgeworths point out, such approximations necessarily muddle the distinction between remembrance and recollection. Rejecting this functionalist mode of evaluation—a kind of proto-Turing test—Common Sense philosophy insisted upon the importance of recognizing the internal psychological distinctions between different forms of memory, even when they were invisible to the external observer. The means by which one stored and recalled information, rather than just one's ability to showcase it to the world, became all-important. Remembering became about the process, not the product.

At the same time, despite the Common Sense philosophers' ominous warnings about excessive mnemonics usage (especially for undereducated minds), most ultimately struck a tone of qualified, gloomy skepticism rather than all-out rejection. They expressed disapprobation towards Grey's artificial memory, but their desire to produce objective and comprehensive accounts of the mind's workings led to the begrudging concession that it was not impossible for such methods to have some potential value (for at least some people, in some limited circumstances). For example, after reiterating the "important objection" that artificial memory systems "accustom the mind to associate ideas by accidental and arbitrary connexions" and further an "ostentatious display of acquired knowledge" that merely furthers "the gratification of their [users'] vanity," Dugald Stewart tentatively grants that "to those, however, who are of a different opinion, such contrivances as Mr. Grey's may be extremely useful."[37] Maria and Richard Edgeworth quote a long passage from Stewart on the importance of logical hierarchical memory structures, followed by an sharp endorsement of Stewart's criticisms: "We agree entirely with Mr. Stewart in his observations upon technical helps to

[37] Dugald Stewart, *Elements of the Philosophy of the Human Mind*, 1st ed., vol. 1 (London: A. Strahan and T. Cadell, 1792), 455.

the memory; they are hurtful to the understanding." Ultimately, though, they too offer a realist acknowledgment of the potential usefulness of *memoria technica.* As "it may be advantageous in education to use such contrivances to assist our pupils in remembering those technical parts of knowledge, which are sometimes valued above their worth in society," they condescend, "the names and the dates of the reigns of a number of kinds and emperors, if they must be learned by children, should be learnt in the manner which may give them the least trouble."[38] Stewart and the Edgeworths both repeatedly employ the conditional tense (note the prevalence of "may") and disparage the kinds of knowledge that can be recalled using mnemonics. Although these acknowledgments of mnemonics' notional worth are clearly reluctant—born more out of a desire for argumentative completeness rather than genuine interest in their constrained utility—nonetheless it is noteworthy that the eighteenth-century Common Sense tradition did not view *memoria technica* as so dangerous as to be avoided entirely.

1	2	3	4	5	6	7	8	9	0
t	*n*	*m*	*r*	*l*	*d*	*k g q* & hard *c*	*b w v* *h*	*p f*	*s x z* & soft *c*

Figure 3: Gregor von Feinaigle's cipher. A. E. Middleton, *Memory Systems: Old and New* (New York: G. S. Fellows and Co., 1888), 29.

II. Feinaigle's New Art of Memory and the Creation of Random-Access Memory

The philosophical stakes of this debate intensified during the first decade of the nineteenth century after Richard Grey's successor Gregor von Feinaigle—a German Cistercian monk turned ostentatious mnemonic showman—created a new system called the New Art of Memory that spurred an industry boom. The New Art of Memory combined aspects of Grey's *memoria technica* with the classical method of *loci* to produce a method that relied on a combination of encoded number poetry and lurid visual symbols. Removing the vowels from Grey's original codex, Feinaigle

[38] Edgeworth and Edgeworth, *Practical Education*, 562–63.

rearranged his codex to link numbers with those consonants that physically resemble them—both visually and in terms of the number of strokes—and then associated other consonants according to a narrative framework. His encryption system relies upon a complicated patchwork of sonic resonances, linguistic qualities, and semantic links. For example, 1 and *l* become linked; as do 2 and *n* because they both have two prongs. But in the case of 7, the number's "slight curvature, may be made to resemble a crooked stick and as we shall remember this stick the better, if something be hung upon it, *cage* shall be suspended there. In the word cage we obtain the consonants *c* and *g*; k also is added to the number, for *c* is more frequently pronounced hard (*ka*) than it is soft (*se*); *q* being a guttural and a *crooked* letter, shall go along with the cage and the stick. For the figure 7 there are then *c*, *k*, *g*, and *q*."[39] Feinaigle's codex imaginatively transforms numbers into symbols embedded in a narrative tableau to initially relate figures alphabetically. After translating a string of numbers into consonant letters, one chooses vowels to create an English word that signifies a semantically unrelated concrete object (like a fish or an apple). Then one mentally places the object into a room in a memory palace, which also has its own assigned number and associated symbol. For example, the first room on the first wall of the first floor of Feinaigle's palace is the Tower of Babel room; the next is the swan room. The New Art of Memory was a highly significant development form Grey's

[39] John Millard, *The New Art of Memory*, 3rd ed. (London: R. Edwards, 1813), 47.

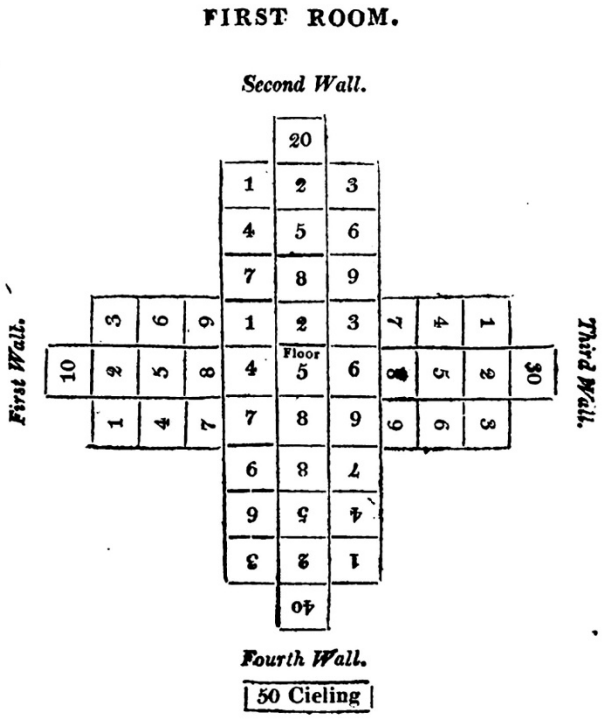


Figure 4: First room of Feinaigle's memory palace. [John Millard], *The New Art of Memory*, 3rd ed. (London: R. Edwards, 1813), 40.

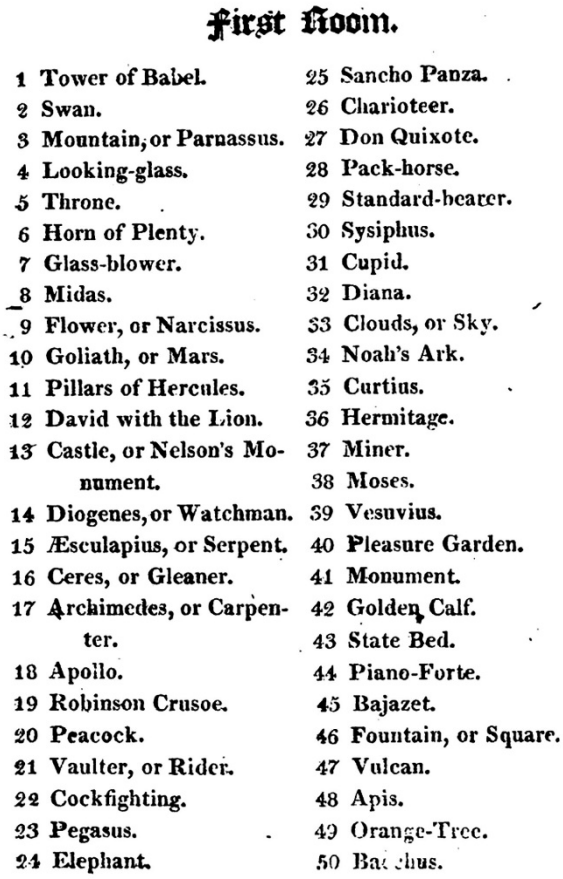


Figure 5: Symbols for the first room of Feinaigle's memory palace. [John Millard], *The New Art of Memory*, 3rd ed. (London: R. Edwards, 1813), 53.

system because it enabled one to not only recall the information by retranslating the code letters from English back into numbers (as with Grey's system), but also to precisely recall its pinpoint location in a longer sequence via the room's unique numerical identifier. Feinaigle explains how one might encode *William the Conqueror* and *1066*:

> A word must now be made from William; the first half *wil* is taken, and to this is added low, by which *willow* is obtained; this enables us to remember *William*. The willow is fixed upon the *Tower of Babel*, our first symbol; we have then *William I.* but another circumstance remains; he was the *conqueror*:—we hang some *laurel*, the reward of valour, and the crown of conquest, upon the willow tree. The *date* is yet wanting: w say the laurel is dead, in the word *dead*, are *d*, *d* for 66; the 1000 being understood through the whole series.[40]

[40] [Millard], 55–56.

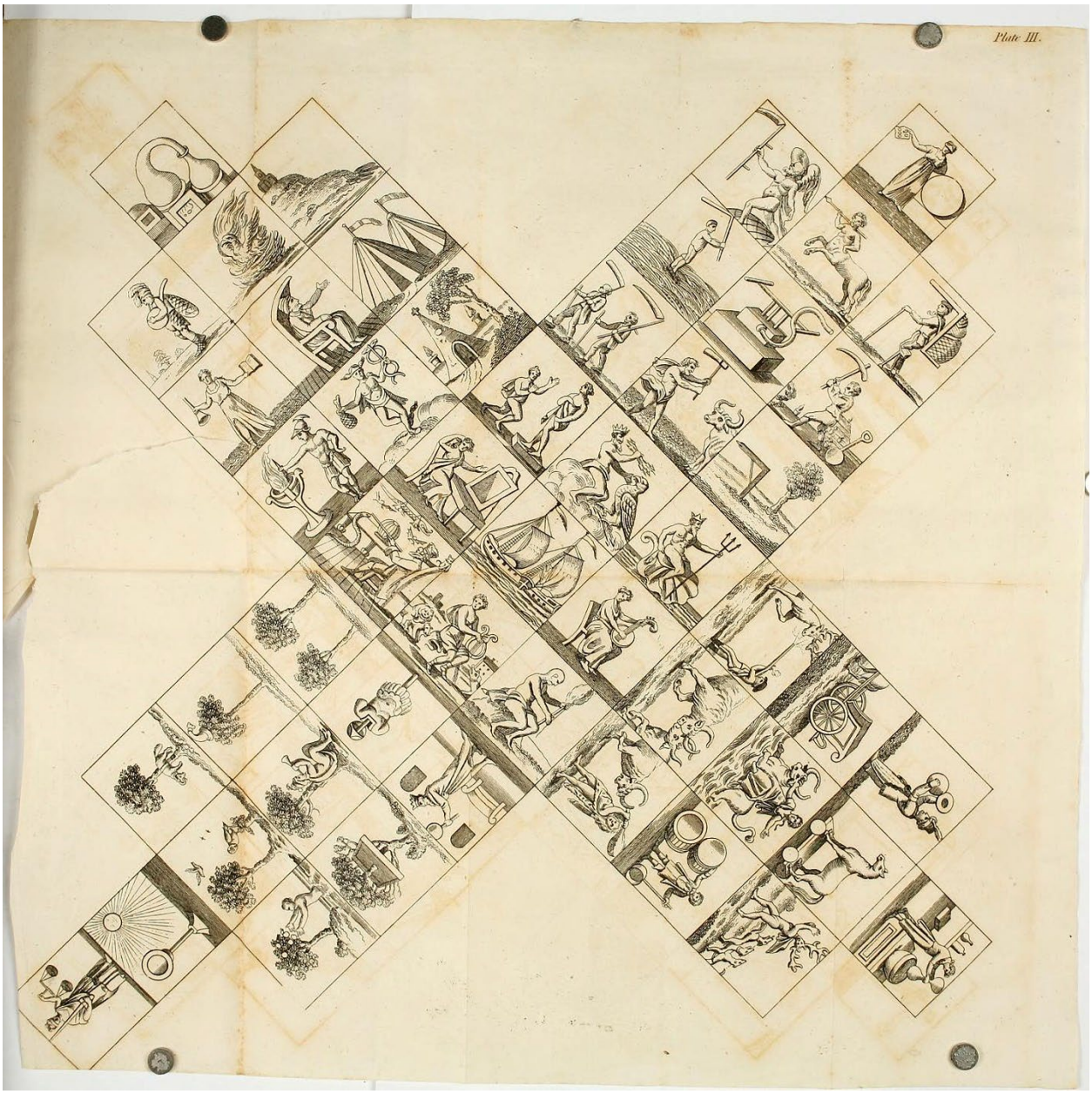


Figure 6: Feinaiglian mnemonic room. [John Millard], *The New Art of Memory*, 3rd ed. (London: R. Edwards, 1813), n.p.

Feinaigle became something of a lightning rod in early nineteenth-century European society. He quickly gained "a reputation as a mnemonical teacher of great celebrity throughout Europe,"[41] and his 1806 Parisian lectures attracted admiration from powerful figures like Klemens von

[41] "Artificial Memory," *The Dublin Review* 29, no. 57 (July 1877): 182.

Metternich, then Austrian minister to France and lover to Napoleon's sister Caroline.[42] After French dramatist Michel Dieulafoy's play *Les filles de mémoire, ou le Mnémoniste* (1807) satirized Feinaigle,[43] roughly two thousand people reportedly attended a rebuttal mnemonics exhibition organized by his students to showcase their extraordinary skills.[44] Before opening an elite Dublin school dedicated to mnemonic pedagogy under the patronage of the Duchess of Richmond in 1813, Feinaigle offered a series of public lectures at Britain's most respected learned institutions. He appeared in London at the Royal Institution (22 June 1811) and the Surrey Institution (6 April 1812); in Glasgow at the Andersonian Institution (30 January 1812); in Edinburgh; and in Liverpool (26 August 1812). He also gave a private lecture course at Spencer House, the London residence of Home Secretary Lord Spencer.[45] Daughter Sarah Spencer (later Lady of the Bedchamber to Queen Victoria) reported: "All London is wild, we among the rest, about a German professor, Feinagle [*sic*.] by name, who gives lectures on the art of memory."[46] But even as Feinaigle gained this powerful following, the New Art of Memory provoked an even more intense backlash from the early nineteenth-century inheritors of Scottish Common Sense philosophy than Grey's *memoria technica* had. At issue was the strangely nightmarish quality of its images, which revived John Locke's concerns about the role of improper

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[42] Scientist Leopold Fichtel reported: "the Count of Metternich, the Austrian ambassador, […] followed, with all his secretaries, the whole course of lectures: they all spoke very advantageously of it, [as did] several other persons of the first rank I met." Fichtel, "Mnemonica, or New Method of Assisting the Memory," *The Philosophical Magazine*, 1807, 93.

[43] Michael Quane, "The Feinaiglian Institution, Dublin," *Dublin Historical Record* 19, no. 2 (1964): 31.

[44] Fichtel, "Mnemonica, or New Method of Assisting the Memory." The event took place on 22 February 1807; it has been mistakenly reported as 27 February 1807 in the *Oxford Dictionary of National Biography* and elsewhere.

[45] Peter Galliver, "The Early Ampleforth College," *Recusant History* 28, no. 4 (October 2007): 526. The Royal Institution events stirred controversy because Feinaigle refused to submit to the requirement that speakers publicly disclose their methods. The General Managers ultimately agreed to let him present his mnemonic experiments but declined to endorse the system due to his methodological secrecy. See *Minutes of Managers' Meetings, 1799-1900: In Facsimile*, vol. 5 (London: Scolar Press, 1971), 226.

[46] Sarah Spencer, "Letter to the Hon. Robert Spencer, 14 May 1811," in *The Correspondence of Sarah Spencer, Lady Lyttleton, 1787-1870*, ed. Mady Mary Wyndham (London: John Murray, 1912), 122.

associations in causing madness. Although *memoria technica*'s promotion of rote passive remembrance over true learning was undesirable, the New Art of Memory's fabrication of fantastical visions akin to nightmares or insanity was much worse. As one commentator put it, practicing the New Art of Memory was like a "feverish dream" characterized by "nonsensical stringings together of bulls, charcoal-tins, spiders, virgins, bows and arrows, tin-cans, rattlesnakes, goats, rams, fishponds, feeble lions and diseased females […]."[47]

Often explicitly invoking the Common Sense tradition in their rebuttals, early nineteenth-century critics focused on the new dangers posed by the imagistic nature of Feinaigle's. For example, journal founder Richard Phillips signed his anonymous 1807 *Monthly Magazine* article on Feinaigle's system as "Common Sense." Phillips's article sardonically compares the "new and mysterious art of Mnemonics" captivating Parisian audiences to the "famous phantasmagoria, a piece of optical conjuring of French invention."[48] The phantasmagoria (Greek for 'assembly of phantasms')[49]—an "exhibition of optical illusions produced chiefly by the use of a magic lantern […] in which preternatural phenomena are represented using artificial light"[50]—drew Gothic inspiration from the French Revolution and the Terror. Created in France during the 1790s by Etienne-Gaspard Robertson before coming to Britain, the show presented "unstable, internal hallucinations, seething with idiosyncratic monsters extruded from the overheated brain by the force of the vehement

[47] James Pierson Downs, *The Accretive System of Developing Memory and Thought* (New York: E.H. Libby, 1890), 20.

[48] Common Sense [Richard Phillips], "To the Editor of the Monthly Magazine," *The Monthly Magazine: Or, British Register* 24, no. 161 (September 1, 1807): 105. The connection between artificial memory systems and magic shows is still evident in the former's prevalence in major Victorian magic collections like the British Library's Evanion Collection.

[49] Marina Warner, *Phantasmagoria: Spirit Visions, Metaphors, and Media Into the Twenty-First Century* (Oxford: Oxford UP, 2006), 147.

[50] "Phantasmagoria," in *The Oxford English Dictionary* (Cambridge: Oxford UP, March 2022).

imagination."[51] In comparing Feinaigle's system to the politically-tinged Gothic horror shows of Robertson and his successors, Phillips intimates that the deliberate creation of similarly lurid mnemonic imagery coaxes the mind into a dangerously altered state that allows nightmarish fantasies and raw political energies to proliferate. Characterizing the New Art of Memory as exemplary of the "quackery and charlatanry, political, religious, and scientific" that had descended upon Paris since the Terror, he urges his readers to adopt an alternative recall method that links to-be-remembered information with memories of real places. In doing so, he firmly rejects the creative illogic of Feinaigle's artificial memory system—which he dismisses as merely the newest French "means of picking the pockets of our countrymen,"[52] for the firmer ground of actively remembered reality.

Phillip's Common Sense criticism of the New Art of Memory is most important for its probable influence on Samuel Taylor Coleridge, who enters my story here as the most consequential computing theorist of the early nineteenth century. An associate of Phillips's and a longtime supporter and literary contributor to the *Monthly Magazine*, it is almost certain that Coleridge was familiar with this piece given that it circulated widely through republication in many publications in the ensuing years; all the moreso given in his interest in the subject. In *Biographia Literaria* (1817), Coleridge takes up the mantle of Scottish Common Sense to explore the philosophical and poetic implications of the similarities that Phillips highlighted between Feinaigle's New Art of Memory and the phantasmagoric technology that disrupted the mind with its production of hallucinatory nightmare images. It might seem surprising that Coleridge, often cast as an ardent (if erratic) critic of the Scottish Common Sense philosophers, served as the intellectual inheritor to the school's ideas

[51] Warner, *Phantasmagoria*, 148.

[52] Common Sense [Richard Phillips], "To the Editor of the Monthly Magazine," 105. Phillips was known as a political radical and a supporter of the French Revolution, but he did not support the Terror.

about artificial memory systems and the dangers of excess passive remembering. Notwithstanding important distinctions, however, recent scholarship has underscored his place as an important interlocutor—if not a key progeny—of this tradition. Gavin Budge argues that although "Coleridge has often been regarded as a precursor of British Idealism" because he "anticipated J. F. Ferrier in showing how these ideas might be employed to critique the Common Sense tradition," at the same time "it would not be altogether unconvincing to characterize Coleridge as a Common Sense philosopher himself" due to major areas of agreement with contemporaries like Dugald Stewart and the overall "nature of Coleridge's philosophical interests."[53]

Drawing upon traditional Common Sense warnings about artificial memory systems as disruptive to the mind's organic hierarchy of ideas, Coleridge focuses specifically on mnemonics' debilitating effect on the fancy, the part of the mind responsible for making foundational connections between ideas with the overseeing influence of the will. In a sharp passage at the close of Chapter VII, he acerbically proclaims:

> the true practical general law of association is this: that whatever makes certain parts of a total impression more vivid or distinct than the rest, will determine the mind to recall these in preference to others equally linked together by the common condition of contemporaneity, or (what I deem a more appropriate and philosophical term) of continuity. But the will itself by confining and intensifying the attention may arbitrarily give vividness or distinctness to any object whatsoever; and from hence we may deduce the uselessness if not the absurdity of certain recent schemes which promise an artificial memory, but which in reality can only produce a confusion and debasement of the fancy. Sound logic, as the habitual subordination of the individual to the species, and of the species to the genus; philosophical knowledge of facts under the relation of cause and effect; a chearful and communicative temper that disposes us to notice the similarities and contrasts of things, that we may be able to illustrate the one by the other; a quiet conscience; a condition free from

[53] Gavin Budge, introduction to *Romantic Empiricism: Poetics and the Philosophy of Common Sense, 1780-1830*, ed. Gavin Budge (Lewisburg: Bucknell UP, 2007), 24.

> anxieties, sound health, and above all (as far as relates to passive remembrance) a healthy digestion; these are the best, these are the only ARTS OF MEMORY.[54]

Coleridge indicates his support for the general associationist idea that the mind recalls the aspects of an entity that are the most intrinsically vivid over its more mundane elements—like recalling a sweater's redness rather than its length. But because the will can enhance the retentive powers of the memory by artificially enhancing some qualities over others for the purpose of aiding recall, then there is no need for another outside entity to perform this duty. He arrives at this view through meta-philosophical conciliation in which he endorses an amalgamation of views on the principles of association—Aristotle's contrast and Hume's cause and effect and similitude—while simultaneously echoing the Common Sense dismissal of mnemonic systems and their indictment of associationist mechanical models of mind more broadly.[55] In discussing this passage, Cairns Craig underscores that "Coleridge's denigration of 'the arts of memory' in this passage is an implicit attack on associationist theory" since that "'[t]he arts of memory […] are precisely those that associationist theories promote."[56] But it seems to me that this explanation does not fully reflect Gavin Budge's observation that "the Common Sense tradition represents a 'meta-philosophy' that finds no difficulty in accommodating associationist analyses of experience."[57] As many scholars including M. H. Abrams, Trevor H. Levere, and Gavin Budge have underscored, Coleridge's commitment to

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[54] Samuel Taylor Coleridge, *Biographia Literaria, Or, Biographical Sketches of My Literary Life and Opinions*, 1st ed., vol. 1, 2 vols. (London: Rest Fenner, 1817), 127.

[55] In a related passage from chapter 4 of the *Biographia* drawn heavily from Johan Maass, Coleridge attributes five major principles of association solely to Aristotle: time, space, cause and effect, likeness, and contrast. James Engell's footnote relates that Maass attributes everything but cause and effect to Aristotle; Coleridge's inclusion of the latter seems to be drawn silently from Hume. Samuel Taylor Coleridge, *Biographia Literaria*, ed. James Engell and W. Jackson Bate, vol. 1, Bollingen, LXXV (Princeton: Princeton UP, 1983), 103.

[56] Cairns Craig, "'Kant Has Not Answered Hume': Empiricism and the Romantic Imagination," in *Romantic Empiricism: Poetics and the Philosophy of Common Sense, 1780-1830*, ed. Gavin Budge (Lewisburg: Bucknell UP, 2007), 54. Ironically, Budge makes this observation when summarizing Craig's central thesis.

[57] Budge, introduction to *Romantic Empiricism*, 13.

achieving what Abrams called a "metascientific" conceptualization of the universe via dialectical synthesis serves as the foundation for his all-important system of organic unity.[58]

In what follows, I will argue that this passage represents a pivotal moment within the history of computing, understood here in Mark Priestley's terms as a series of broad "attempts to define the steps involved in computations and other information-processing activities in such a way that they could be performed by machines, or at least by humans mimicking the behavior of machines."[59] I contend that Coleridge, through his rejection of the new kind of memory offered by Feinaigle's artificial memory system, offers the first modern theorization of random-access machine memory. On its face, the paradigm-shifting nature of this passage might be difficult to grasp at first because Coleridge's theorization here comes in the form of a negative construction, the stakes of which only become clear by carefully following multiple threads of major Coleridgean concepts theorized throughout his oeuvre—including the fancy, organic unity, digestion, visual perception, and associationism—to one central nexus. Foundationally, because Coleridge's critical formulation is centered around his claim that Feinaigle's New Art "produces a confusion and debasement of the *fancy*," understanding this passage's immense computational significance first necessitates understanding precisely what that charge means. As such, I will begin by taking a few steps back to establish what, for Coleridge, the fancy is, how it operates under normal circumstances, and what occurs when the fancy becomes deranged.

Forming a key element of the Romantic theory of organic poetic creation, Coleridge's conceptualization of the fancy is, of course, one of the most comprehensively studied concepts in

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[58] M. H. Abrams, "Coleridge and the Romantic Vision of the World," in *Coleridge's Variety: Bicentenary Studies*, ed. John Beer (Pittsburgh: University of Pittsburgh Press, 1975), 101–33. Also see Trevor H. Levere, *Poetry Realized in Nature: Samuel Taylor Coleridge and Early Nineteenth-Century Science* (Cambridge: Cambridge UP, 1981); Gavin Budge, *Romanticism, Medicine and the Natural Supernatural* (Basingstoke: Palgrave Macmillan, 2012).

[59] Priestley, *A Science of Operations*, v.

literary criticism. Since the heyday of the New Criticism,[60] interest in Coleridge's understanding of the fancy and imagination has only expanded, as demonstrated by their centrality to many recent studies on topics as varied as madness, slavery, female authorship, and even Romantic optics.[61] As the classic accounts of W. Jackson Bate, James Engell, and M. H. Abrams established, Coleridge's famous distinction between the fancy and the imagination in the *Biographia* was not so much a lone epiphany as the crystallization of a terminological reversal in terms that had been ongoing since the late eighteenth century.[62] Classical and medieval thinkers had conceptualized the fancy as the higher aesthetic power. In this "older distinction, the Greek *phantasia*, with its suggestion of a free play of mind, was the higher or more creative power," while the "Latin *imaginatio*, with its stress on the concrete and sensory (from the root-word 'image'), was the inferior power."

During the Enlightenment, however, the tide began to turn. Due to fancy's playfulness, writers increasingly began to view it as a potentially dangerous mental faculty. As James Engell explains, "At the height of seventeenth century rationalism, *phantasia* with its related words, because of the freer play of mind connoted, was especially an object of rationalistic distrust. It became associated with chimeras, unrealistic fantasies."[63] The period from 1780–1820 saw this shift consolidate. The imagination definitively took on the superior role of the higher creative faculty,

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[60] Major works include I. A. Richards, *Coleridge On Imagination* (London: Routledge and Kegan Paul, 1922); John Bullitt and W. Jackson Bate, "Distinctions between Fancy and Imagination in Eighteenth-Century English Criticism," *Modern Language Notes* 60, no. 1 (1945): 8–15; M. H. Abrams, *The Mirror And The Lamp*, 1st ed. (New York: Oxford UP, 1953); James Engell, *The Creative Imagination* (Cambridge: Harvard UP, 1981). See Engell, "Imagination," in *The Princeton Encyclopedia of Poetry and Poetics*, ed. Stephen Cushman et al. (Princeton: Princeton UP, 2012) for a fuller bibliography.

[61] See, for example, Frederick Burwick, *Poetic Madness and the Romantic Imagination* (University Park, PA: Pennsylvania State UP, 1996); Deborah Jean Lee, *Slavery and the Romantic Imagination* (Philadelphia: University of Pennsylvania Press, 2002); Maura Smyth, *Women Writing Fancy* (Cham: Springer, 2017); Terry F. Robinson and John Savarese, "Introduction: Romanticism and Vision," *European Romantic Review* 33, no. 4 (July 4, 2022): 451–60.

[62] W. Jackson Bate and James Engell, introduction to *Biographia Literaria*, by Samuel Taylor Coleridge, ed. James Engell and W. Jackson Bate, vol. 7, Bollingen, LXXV (Princeton: Princeton UP, 1983 [1819]), xcvii.

[63] Bate and Engell, xcvii.

transforming into a transcendent and divine "cosmic power" with the capacity to "[govern] the interrelated activities of perception, experience, aesthetic appreciation, and the crown of all, artistic creativity."[64] Significantly, this connective element made the imagination responsible for informing the reason, since it "enable[d] the seeing of relationality" so important for abstract analysis.[65] Fancy, in contrast, became reconceptualized as the inferior aesthetic entity. Taking in ideas from the senses and passive memory, it provided the raw materials for the imagination, guided by the will, to develop and improve. Alexander Gerard's influential *Essay on Genius* (1774) describes this process: "Fancy forms the plan in a sort of mechanical or instinctive manner: judgment, on reviewing it, perceives its rectitude or its errors […]."[66] As Gerard's account indicates, eighteenth-century commentators characterized the fancy as a mechanical mental faculty because, in contrast to the intrinsic relationality of the rational imagination, the fancy could only offer playful combinations arising from the arbitrary free-play of perceptual ideas.

In contrast to the imagination's intrinsic unifying relationality, fancy was, if anything, an inherently schismatic associative power. Rather than rationally unifying concepts, it associatively linked them but preserved their independence, in order to suggest arbitrary juxtapositions between unlike ideas (for this reason, the fancy was responsible for producing wit, puns, and nonsense—subjects I shall return to in chapter 3). "Fancy operates," Engell summarizes, "without a unifying design and does not meld, transform, or newly create images or ideas. Rather, it juxtaposes or connects them in a more mechanical fashion, appealing to novelty of sense impression instead of

[64] Engell, *The Creative Imagination*, viii.

[65] Richard C. Sha, *Imagination and Science in Romanticism* (Baltimore: JHU Press, 2018), 148.

[66] Alexander Gerard, *An Essay on Genius*, 1st ed. (London: W. Strahan and T. Cadell, 1774), 84–85.

strength or grandeur of intellectual conception and power."[67] John Bullitt and W. Jackson Bate argue for the direct influence of Dugald Stewart's conceptualization of Fancy as an associative faculty on Coleridge's formulation. They state: "With one possible exception, […] the essentially 'associative' character of 'fancy,' upon which […] Stewart dwelt, is not mentioned before Coleridge's letter of 1802 or even before his second delineation of the two terms to Crabb Robinson (1810); this may perhaps furnish some small additional support to the probability of Stewart's direct influence."[68]

Although the fancy was an arbitrary and 'mechanical' associative power that preserved the separation of ideas rather than assimilating them into the mind's rational hierarchy, it nonetheless provided an important foundation for the higher imaginative powers. Yet these qualities did suggest a strong kinship between the fancy and the passive memory—so much so that Coleridge actually categorizes fancy *as* a memory phenomenon: "The Fancy is indeed no other than a mode of Memory emancipated from the order of time and space; and blended with, and modified by that empirical phenomenon of the will, which we express by the word CHOICE. But equally with the ordinary memory it must receive all its materials ready made from the law of association."[69]

This emergent understanding of the fancy was central to Coleridge's organic theory of poetic unity, a vitalist formulation of artistic creation that emphasized the immense aesthetic power that arose from the imaginative assimilation of parts into wholes. Coleridge's account stresses the importance of balance and harmony between the mind's faculties: passive and active imagination;

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[67] James Engell, "Fancy," in *The Princeton Encyclopedia of Poetry and Poetics*, ed. Stephen Cushman et al. (Princeton: Princeton UP, 2012).

[68] Bullitt and Bate, "Distinctions between Fancy and Imagination in Eighteenth-Century English Criticism," 14.

[69] Coleridge, *Biographia Literaria*, 1:305.

fancy and imagination. He metaphorically compares the psychological processes of writing and remembering to the movements of a gliding water-bug:

> Now let a man watch his mind while he is composing; or, to take a still more common case, while he is trying to recollect a name; and he will find the process completely analogous. Most of my readers will have observed a small water-insect on the surface of rivulets, which throws a cinque-spotted shadow fringed with prismatic colours on the sunny bottom of the brook; and will have noticed, how the little animal wins its way up against the stream, by alternate pulses of active and passive motion, now resisting the current, and now yielding to it in order to gather strength and a momentary fulcrum for a further propulsion. This is no unapt emblem of the mind's self-experience in the act of thinking. There are evidently two powers at work, which relatively to each other are active and passive; and this is not possible without an intermediate faculty, which is at once both active and passive.[70]

Examining the central organicist metaphor of the growing plant—famously the crux of New Critical accounts of Romantic poetic creation—in *The Mirror and the Lamp* (1953), M. H. Abrams explains Coleridge's influential formulation: "In Coleridge's organic theory, images of sense become merely materials on which the mind feeds—materials which quite lose their identity in being assimilated to new whole. 'From the first, or initiative Idea, as from a seed, successive Ideas germinate.'"[71] Ideas entering the mind were acted upon by the fancy, which—guided by the will—offered ready suggestions for the higher mental faculties, namely the primary and secondary imagination, to act upon and develop. Writing in 1833, James Stuart Mill provided a succinct description of this process: "All the combinations which the mind puts together, all the pictures which it paints, the wholes which Imagination constructs out of the materials supplied by Fancy, will be indebted to some dominant *feeling*, not as in other natures to a dominant *thought*, for their unity and consistency of character—for what distinguishes them from incoherencies."[72] Coleridge

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[70] Coleridge, 1:124.

[71] Abrams, *The Mirror And The Lamp*, 172. Abrams is quoting from Coleridge's "Treatise on Method" (1817).

[72] John Stuart Mill, "Thoughts on Poetry and Its Varieties," *The Crayon* 7, no. 5 (1860): 124.

described the fancy's role in this process as such: "Fancy is the arbitrarily bringing together of things that lie remote, and forming them into a unity. The materials lie ready for the fancy, which acts by a sort of juxtaposition."[73] It is important to note that fancy's production of unity is not an assimilative or rational unity like that created by the imagination: it is merely an uneasy conjoining of disparate ideas such that the effect is mildly surprising or whimsically delightful.

Although the fancy's functions are arbitrary and mechanical, the will guides its selection and juxtaposition of sense impressions, providing fertile ground for the primary and secondary imagination. This process of upward growth constitutes "an organic unity: a self-evolved system, constituted by a living interdependence of parts, whose identity cannot survive their removal from the whole." Coleridge emphasizes that the vitalist interconnectedness of the organic artwork borne of this imaginative process definitively separates it from that which is mechanical. As Abrams explains, for Coleridge "The achieved structure of a plant is an organic unity. In contradistinction to the combination of discrete elements in a machine, the parts of a plant, from the simplest unit, in its tightest integration, interchange, and interdependence with its neighbors, through the larger and more complex structures, are related to each other, and to the plant as a whole, in a complex and peculiarly intimate way."[74] Coleridge's stress on the importance of organic interconnectedness distinguishes his formulation of mechanicity from contemporaries like Hume and Hartley, who had followed Descartes in stressing the deterministic element of the mechanical. Rejecting this Cartesian framework, Coleridge saw machines as decentralized collections of isolated parts that lacked the relational unity only found in organic creation.

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[73] Henry Crabb Robinson, *Diary, Reminiscences, and Correspondence of Henry Crabb Robinson, Barrister-at-Law, F.S.A.*, ed. Thomas Sadler, vol. 1 (London: Macmillan and Co., 1869), 304. Coleridge made these remarks during a conversation at Charles Lamb's house on 15 November 1810.

[74] Abrams, *The Mirror And The Lamp*, 174–75.

More recent historicist studies by scholars like Gavin Budge, Jennifer Ford, and Richard Sha have also examined Coleridge's theory of poetic creation but have emphasized its indebtedness to Coleridge's interest in contemporary medical discourse rather than philosophical organicism.[75] For them, the central model for artistic creation is not the metaphor of a growing plant, but the mental and physical experience of digestion. Coleridge was, without putting too fine a point on it, obsessed with digestion—and its discontents. He conceived of digestion not just as a physical experience involving that stomach and gut, but also as a conceptual framework for analyzing an array of mental phenomena, including dreams, sensation and perception, imagination, and—although it has received less critical attention—memory (indeed, he characterized "a healthy state of the digestive powers, mental and bodily," as "the best [aid] of the Memory").[76] In this paradigm, the mind digests sense impressions and then reconstitutes them to form a living whole greater than the sum of its parts. Gavin Budge explains that Coleridge held that "the imagination of men of genius performs the function of digesting their perceptions so that they can be assimilated into their mental constitution. […] Imagination for Coleridge enables the assimilation of perceptions into the living whole which is the mind. In these terms, genius can be equated to a superior power of mental digestion […]."[77]As with the plant-based conceptualization of artistic production emphasized by the New Critics, this digestive formulation likewise emphasizes the assimilative and relational nature of this process and its end result.

[75] See Budge, *Romanticism, Medicine and the Natural Supernatural*; Jennifer Ford, *Coleridge on Dreaming: Romanticism, Dreams, and the Medical Imagination* (Cambridge: Cambridge UP, 1998); Sha, *Imagination and Science in Romanticism*.

[76] Samuel Taylor Coleridge, *The Philosophical Lectures of Samuel Taylor Coleridge*, ed. Kathleen Coburn, The Pilot Press Limited (London, 1949), 396.

[77] Budge, *Romanticism, Medicine and the Natural Supernatural*, 81–82.

Compared with the New Critical assessments of Coleridge's aesthetic philosophy, this body of recent digestive scholarship has also paid more attention to Coleridge's interest in the darker side of these mental processes. A lifelong sufferer of severe alimentary concerns, Coleridge was highly attuned to "the close relationship posited in early nineteenth-century medical discourse between mental and digestive derangement."[78] He utilized digestion's dreaded corollary—indigestion, physical and mental—as a conceptual framework for examining a host of psychological aberrations including nightmares, hallucinations, mania, and delirium. Although they affected different mental faculties, one major commonality between these abnormal mental states was that they were all instances of mental indigestion in which certain sense impressions—predominantly highly vivid images—refused to break down in the mind. In general prone to suspicion about the danger posed by images (a position he drew from the Common Sense tradition, especially the work of Thomas Reid), Coleridge referred to the visual senses as the "despotism of the eye" and expressed concern that the heightened stimulation it produced made visual imagery particularly susceptible to generating detached pieces of mental iconography.[79] Coleridge was extremely wary of the strange isolationist power that made these sensations resistant to mental assimilation because, as Richard Sha explains, he held that "anytime images have an agency of their own, they risk idolatry."[80]

The proliferation of isolated 'idolatrous' mental images occurs with all the afore-mentioned mental phenomena, but it is arguably most destructive to the mind in the case of delirium. Delirium, Coleridge held, was a psychological disorder caused by the "excess of fancy."[81] As the mental faculty

[78] Budge, 80.

[79] Coleridge, *Biographia Literaria*, 1:107.

[80] Sha, *Imagination and Science in Romanticism*, 162.

[81] Robinson, *Diary, Reminiscences, and Correspondence of Henry Crabb Robinson, Barrister-at-Law, F.S.A.*, 1:304.

most closely associated with isolated images unlinked by reason, the fancy was primed for idolatrous corruption. Coleridge's discussion of the dangers posed by visual images registers his concern over the fancy's special vulnerability: "Slavery <of the Mind> to the Eye and <the> visual Imagination (or Fancy), <under the influence of> which <the Reasoner> must have a picture and mistakes surface for substance."[82] He styles the powerful visual image's dominance over the fancy as a kind of arbitrary tyranny—connoted through terms like "despotism" and "slavery"—which in turn leads the fancy to rule capriciously over the mind. This arbitrary dominance of the lowest creative faculty runs dangerously counter to the psychological balance and willful deliberation that occur under the normative governance of the rational imagination. "Often described as 'aimless' or 'sportive,'" James Engell relates, even under normal circumstances "fancy suggests a phantasmagoria of passing, fixed images, whose mingling does not mutually transform or resolve or unify them into larger patterns."[83] This phantasmagoric effect becomes even more pronounced when the fancy degrades into delirium. Instead of producing witty fodder for the rational imagination to enhance, the debased fancy mechanically spews out delirious sequences of disconnected, horribly phantasmal imagery. These hauntingly vivid images refuse to digest or assimilate, instead filling the mind with luridly powerful isolated symbols.

Over the years, Coleridge explored the aesthetic implications of delirium through poetry, consistently citing two paradigmatic examples from Thomas Otway's *Venice Preserved* (1682) and Samuel Butler's *Hudibras* (1663). As Henry Crabb Robinson relates, during a dinner discussion on the subject at Charles Lamb's house in 1810, Coleridge presented a line from the former: "The 'seas

[82] Samuel Taylor Coleridge, *The Collected Works of Samuel Taylor Coleridge: Marginalia*, ed. George Whalley and H. J. Jackson, vol. 12 Part 3, Bollingen, LXXV (London: Routledge and K. Paul, 1969). Qtd. in *Biographia Literaria*, 1:107 n. 5. Engell's footnote records that Coleridge wrote this comment "On the back flyleaf of his copy of Joannes Scotus Erigena's *De divisione naturae* (Oxford 1681)." The <> symbols indicate words that Coleridge later added.

[83] Engell, "Fancy."

of milk and ships of amber' he quoted as a fanciful delirium."[84] Roughly twenty-five years later in *Table Talk* (1834), Coleridge made the same point via an example from the latter:

> You may conceive the difference in kind between the Fancy and the Imagination in this way,—that if the check of the senses and the reason were withdrawn, the first would become delirium, and the last mania. The Fancy brings together images which have no connexion natural or moral, but are yoked together by the poet by means of some accidental coincidence; as in the well-known passage in Hudibras:— The sun has long since in the lap/Of Thesis taken out his nap,/And like a lobster boyl'd, the morn/From black to red began to turn."[85]

The "accidental coincidence" that artificially conjoins this string of innately disconnected and unlike terms into their strained union is the poetic line. Coleridge's choice of two verses replete with vivid gustatory imagery—the element he amplifies in his hybrid verse—presents the improper association of unlike entities as a form of poetic indigestion. In both lines, the use of concrete consumptive nouns like "milk" and "lobster" to describe concrete non-consumptive objects like "sea" and "morning" produces an unpleasant mismatch rooted in the clash between two competing factions of imagery. In a properly constructed poetic line, the descriptors presented by the Fancy melt into the main concepts, creating an assimilative compound that offers more than the imagistic sum of its parts. But in these examples, the gustatory descriptors jar; each concept remains inappropriately vivid. Failing to coalesce into their referents, they persist as isolated indigestible images.

For Coleridge this degradation of the Fancy, manifested in poetry by indigestible images, offered an apt description of David Hartley's associationist model of mind, the consequences of which he characterized as delirium. He describes associationism as "the whole mechanism of the reproduction of impressions […]. It is the universal law of the *passive* fancy and *mechanical* memory"

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[84] Robinson, *Diary, Reminiscences, and Correspondence of Henry Crabb Robinson, Barrister-at-Law, F.S.A.*, 1:304.

[85] Samuel Taylor Coleridge, *Specimens of the Table Talk of the Late Samuel Taylor Coleridge*, ed. Henry Nelson Coleridge, 1st ed., vol. 1 (London: John Murray, 1835), 167.

and referred to David Hartley's system specifically as a "delusion of the fancy." His central argument against associationism is that it put too much weight on the predominance of connections between ideas that happen to become linked to one another, rather than on the 'philosophical' links between logically associated ideas in the mind's comprehensive hierarchy. If Hartley's theory were correct, he propounds, "the consequence would have been, our whole life would be divided between the despotism of outward impressions, and that of senseless and passive memory." He again invokes the political language of tyranny to describe the totalizing power of isolated images, whether they stem from mechanical perception or mechanical passive memory without the rationalizing influence of the will. Coleridge expands on his position by taking on Hartley's contention that "every partial representation recalls the total representation of which it was a part." Propounding that "[i]n practice it would indeed be mere lawlessness," Coleridge counters:

> If therefore we suppose the absence of all interference of the will, reason, and judgment, one or other of two consequences must result. Either the ideas (or relicts of such impression) will exactly imitate the order of the impression itself, which would be absolute delirium: or any one part of that impression might recal [*sic.*] any other part, and (as from the law of continuity, there must exist in every total impression some one or more parts, which are components of some other following total impression, and so on ad infinitum) any part of any impression might recal any part of any other, without a cause present to determine what it should be.[86]

Examining Hartley's system in the context of delirium and powerful indigestible mental images, Coleridge was the first critic to see that the model of memory offered by the associationist mind was completely multidirectional. When the eighteenth-century Scottish Common Sense philosopher had decried the randomness of the remembrance enacted by the passive memory, they had discussed the concept 'random' in the traditional sense of "Having no definite aim or purpose; not sent or guided in a particular direction; made, done, occurring, etc., without method or

[86] Coleridge, *Biographia Literaria*, 1:104, 107, 111–12.

conscious choice; haphazard."[87] Their criticism of Grey's *memoria technica* had emphasized the chaos of the remembering process—the lack of structured mental steps—which was responsible for such disjointed recall. This dearth of organization was a central element distinguishing remembrance from active remembering, which occurred by willfully accessing the all-important hierarchy of mental connections between associated ideas. In contrast, Coleridge's likening of associationism and delirium enables him to recognize that—liberated from the constraints of logical connection (as he repeats twice in this passage)—"any part of any impression might recal *any* part of any *other*." In emphasizing that associationism actually altered the memory's fundamental retrieval process, Coleridge's critique describes a kind of recall that I want to suggest is 'random' in the modern computing sense of the term: the ability to access any piece of information directly rather than sequentially through a logical chain of hierarchical ideas. Forging associative links between adjacent ideas through the mnemonic system freed one from tracing long hierarchies (in other words, of undertaking the processes of induction and deduction) that were normally required for recall.

That the process of random-access recall was widely conceptualized long before the modern computing term "random-access memory" was coined in the 1950s is evident in the work of many nineteenth-century commentators on artificial memory systems, who were working in the wake of Coleridge's epiphanic insight. Like Coleridge, the majority were clearly disturbed by the inception of this new form of remembering, and their criticisms of mnemonics systems are clearly premised upon a post-Coleridgean understanding of random-access recall. The common view asserted that a mnemonic "takes the occurrences, characters, and actions out of their logical association[s] […] and encloses them separately in an envelope of heterogeneous ideas, with which they have only an imaginary affinity; thus breaking the connection of cause and effect; ignoring the higher abstract

[87] "Random," in *The Oxford English Dictionary* (Oxford: Oxford UP, September 2021), n. A. 1.

relations, and destroying the very philosophy of the narrative." In doing so, artificial memory "converts history into a broken jumble of isolated ideas." Far from advancing the memory's recall capacity, shifting to random-access mnemonic recall condemns one to follow an endless chain of signifiers: "we must have a second mnemonical contrivance to recall the first, and a third to recall the second—mnemonics upon mnemonics *ad infinitum*; and when the whole creation had been exhausted, we should only have reduced to chaos and confusion that which was beautiful and ordinary in its first arrangement."[88] American philosopher Noah Porter—a noted "keen student of the Scottish [Common Sense] philosophers"[89] and of Coleridge—likewise argued that the "new set of arrangements" that "artificial memory proposes to substitute for the natural and necessary relations under which all objects must present and arrange themselves […] are purely arbitrary and mechanical."[90]

Consider, for example, this parodic 1891 chart by James Pierson Down offering possible artificial associations for *white*. While ideas are all connected, there is no inherent reason why *ivory* should recall an elephant and not a chess piece or piano keys or the Ivory coast; or why *elephant* should recall Barnum's white elephant and not India or Africa. While ivory and elephants have the potential to be logically related in the right context, here the connection is illogical because the associations that connect ideas in the larger

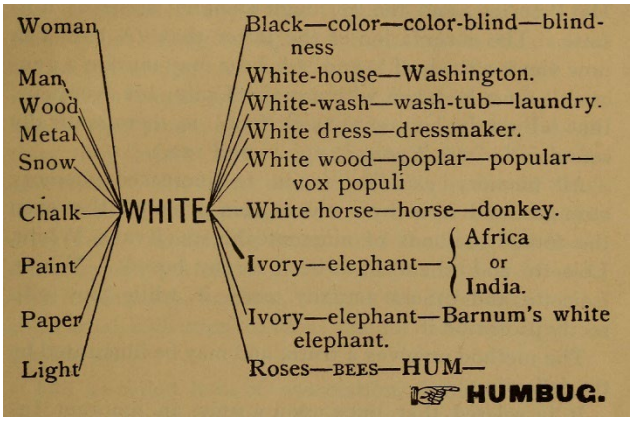


Figure 7: Associations for "White." James Pierson Downs, *The Accretive System of Developing Memory and Thought* (New York: E.H. Libby, 1890), 23.

[88] review of *Education as a Science and an Art*, by M.A. Garvey, *Journal of the Society of Arts* 2 (1854): 165.

[89] David Ballin Klein, *A History of Scientific Psychology* (New York and London: Basic Books, 1970), 640.

[90] Noah Porter, *The Elements of Intellectual Science* (New York: Charles Scribner's Sons, 1890), 275.

chain are decontextualized and therefore arbitrary. There is no cohesive hierarchical structure that connects all ideas in the sequence; the links are mercenary connections of convenience. This "unnatural" form of association "produces precisely the sort of disorder which would be produced in dress if a man were insane enough to tie, let us say, a frying-pan to one of his coat-tails and a child's kite to the other."[91] As Down's image not-so-subtly remarks, such arbitrary associative chains should be regarded as mere "HUMBUG." Although Down's protestations are somewhat hyperbolic, other commentators seriously noted the likenesses between mnemonic random-access recall and madness. For example, American professor William Mathews warned, "The great objection to such systems is that they are founded upon incongruous or superficial associations of ideas, such as we observe in the common forms of insanity."[92]

Returning now to Coleridge's critique on Gregor von Feinaigle, I want to lay out how Coleridge's distrust of the random-access recall offered by the associationist model of memory shaped his view on artificial memory systems, which I have cast as a pivotal moment in the conceptualization of random-access mechanical memory. Within this context, the resemblance between Coleridge's description of delirium and the New Art of Memory's production of inchoate phantasmagoric images appears unmistakable. In both cases, the mind becomes deranged by the uncontrollable proliferation of unassimilated, indigestible images brought forth by a degraded, completely mechanical fancy. Coleridge decries

> the uselessness if not the absurdity of certain recent schemes which promise an artificial memory, but which in reality can only produce a confusion and debasement of the fancy. Sound logic, as the habitual subordination of the individual to the species, and of the species to the genus; philosophical knowledge of facts under the relation of cause and effect; a chearful and communicative temper that disposes us to notice the similarities and contrasts of things, that we may be able to illustrate the one by the other; a quiet conscience; a

[91] Philip Gilbert Hamerton, "Letter X," in *The Intellectual Life* (Boston: Roberts Brothers, 1887), 128.

[92] William Mathews, "Memory and Its Marvels," in *Literary Style: And Other Essays* (Toronto: Rose-Belford, 1881), 151.

> condition free from anxieties, sound health, and above all (as far as relates to passive remembrance) a healthy digestion; these are the best, these are the only ARTS OF MEMORY.[93]

Reaffirming the balanced and hierarchical model of mind advanced by the Scottish Common Sense tradition, Coleridge describes the ideal memory as one of regulated harmony between the active memory and passive memory. He asserts that the 'philosophical' hierarchy of the active memory must be systematically developed, just as the bodily conditions that allow for the temperate exercise of passive remembrance must be carefully cultivated through the restraint of gluttonous urges. His description combines the two major psychological frameworks that modern literary critics have highlighted—the organicist metaphor of the germinating plant stressed by the New Critics and the digestive model highlighted by recent medical historicism—to describe the healthy workings of the innate passive and active memory. He describes this structure as the subversion of the "genus" to the "species," terms that dually invoke their original philosophical context (as two of the five predicables in Aristotelian logic) and the more familiar botanical and zoological connotation that aligns with the *Biographia*'s organicist rhetoric. At the same time, Coleridge emphasizes corporeality by maintaining the importance of various subconscious bodily elements that facilitate passive remembering—temper, conscience, mental equanimity, physical health, and digestion. Notably, he places special emphasis on a vigorous gut, which he describes as the prime indicator of a strong capability for "passive remembrance."

Coleridge's comments likewise register the Common Sense emphasis on the importance of process over product, and it is here that his implicational development of this line of thinking precipitates a crucial theoretical break. This distinction becomes clear when one parses the seemingly

[93] Samuel Taylor Coleridge, *Biographia Literaria, Or, Biographical Sketches of My Literary Life and Opinions*, 1st ed., vol. 1, 2 vols. (London: Rest Fenner, 1817), 127.

contradictory logic of Coleridge's mnemonic critique. At first glance, his comments seem circular: he effusively rejects passive remembering as harmful (when it is produced by mnemonics systems), only to immediately re-embrace passive remembering (that arising from salubrious corporeal conditions) in the very next sentence. In the Common Sense formulation of the memory, such a distinction does not make sense. There could be no meaningful distinction between mnemonically and corporeally produced passive recall because they had understood *memoria technica* to work by activating the mind's innate passive memory (albeit to an inappropriately high degree). When the Scottish Common Sense philosophers had emphasized the importance of the remembering process, they had discussed it in the context of distinguishing between active recall and passive recall. Within this framework, one could only adjudicate whether the *amount* of passive remembering that the mind produced was sufficiently balanced with its active powers. Discriminating on the basis of origin between different 'types' of passive remembering was a non-sequitur. Coleridge, extending this logic, introduces a new core distinction between different types of passive remembering based on their source. He envisions two totally separate forms of passive memory: an organic and psychologically necessary kind of passive recall that arises from salubrious bodily conditions, and a destructive and anathematic form of passive remembering produced by the artificial memory system. This distinction is paramount: through it, Coleridge suggests that artificial memory systems are not unsavory because they overstimulate the organic passive memory, thereby inducing too much passive remembrance. Artificial memory systems are harmful because they destroy the mind's innate organ responsible for producing passive memory, the fancy. The result is a truly artificial form of recall produced by an external supplant—the artificial memory system itself. In this new formulation, the passive memory borne of artificial memory systems is truly of a different piece than that arising from bodily conditions. In this context, what at first seems like Coleridge's unjustifiably

impassioned rejection of a silly society fad becomes much more comprehensible when one appreciates that, in destroying the mind's natural fancy, artificial memory systems actually struck at the heart of the individual's capacity for artistic creation within his theory of organic poetic unity.

That Coleridge saw Feinaigle's imagistic artificial memory system as representative of the mental destruction wrought by associationism is evident in the placement of his denunciation, which—far from existing as a throwaway aside at the end of the chapter—serves as the capstone to his critique of Hartley's vibrational theory. It is clear that Coleridge and the Common Sense thinkers shared a deep ontological, moral, and theological revulsion for the psychological determinism that for them formed the logical conclusion of associationism, first as articulated by David Hume and then in a more extreme form by David Hartley. Coleridge followed the Common Sense philosophers in believing that it was "obvious that associationism leads to the elimination of the will, of rationality, the soul and the self, art and agency, and to the destruction of the foundations of morality and religion."[94] The root of this destruction was the supreme mechanicity of the associationist mind. No longer was the mind ruled by the higher faculties benevolently provided by God. In their place, all that remained was a series of random encounters between ideas behaving according to set physical laws. Such a conclusion was equally untenable for the Common Sense thinkers, for whom the preservation of traditional moral and theological values was a key philosophical objective; and for Coleridge, who characterized associationism as an "all-annihilating system" because it foreclosed, as Jerome Christensen puts it, the existence of "an authority in the free will that cannot be traduced by the associationist's philosophical machinery."[95] Coleridge

[94] Sutton, *Philosophy and Memory Traces*, 270. The Common Sense tradition also opposed associationism because there could be no inherent 'common sense' if the mind were constructed by associations arising from chance.

[95] Jerome Christensen, *Coleridge's Blessed Machine of Language* (Ithaca: Cornell UP, 1981), 17–18.

endorses the Common Sense argument that such devices allow the passive memory to reign, producing wildly illogical associations that proliferate in the mind. As John Sutton states, Coleridge argued that "The law of association ('if law it may be called, which would itself be a slave of chances') makes will, reason, judgement, and understanding mere creatures of association, subordinating our lives to the despotisms of sensation and passive memory, and reducing us all to the level of the light-headed."[96] Discussing the line that Sutton cites, James Engell adds: "The law is the one [Coleridge] cited and criticised for its automatic, universal despotism of mechanical association, over which the will or self has no active control."[97]

Crucially, the Common Sense philosophers and Coleridge denounced associationism not because it offered a mechanical model of memory that was too flat, too bereft of agency per se; but paradoxically because, as a result of its mechanicity, it offered *too much* independence. A mechanical memory was uncontrollable by the higher mental faculties. Describing the critiques of the Common Sense tradition and Coleridge as "deriv[ing] from the same horror," John Sutton stresses this important point: "Their fear was not the modern one that associationist models of memory and mind are too mechanistic, too passive, to catch the rich personal complexity of cognition: rather, they complain, such models attribute too much activity to memory traces, activity which cannot be controlled by reason, will, or unified self."[98] Far from offering—as one critic recently put it—a "lifeless and lame Fancy overshadowed by the powerful, eternal Imagination […] in which Fancy sits passively on the bottommost rung of this ladder of creativity" and "has no agency of its own,"[99]

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[96] Sutton, *Philosophy and Memory Traces*, 270.

[97] Coleridge, *Biographia Literaria*, 1:116 ft. 1.

[98] Sutton, *Philosophy and Memory Traces*, 260.

[99] Smyth, *Women Writing Fancy*, 1–2.

Coleridge's apprehension about the degraded Fancy is a Promethean fear of an isolated automaton memory technology asserting too much arbitrary power over the mind.

By conceptualizing the mnemonic system as a separate, passive, mechanical recall apparatus located inside the mind but not within the innate organic memory, Coleridge's formulation extends Plato's formulation of external memory from his Socratic dialogue *Phaedrus* (c. 360 BCE). After the Egyptian god Thamus contests a pronouncement by Theuth, the inventor of letters, that writing "will make the Egyptians wiser and give them better memories," Thamus warns that writing will

> create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves. The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth; they will be hearers of many things and will have learned nothing; they will appear to be omniscient and will generally know nothing; they will be tiresome company, having the show of wisdom without the reality.[100]

Through Thamus, Plato makes a crucial distinction between remembering, or retrieving ideas stored in the mind, and reminiscence, recalling information from any source. Rather than relying upon the memory, the mind's natural 'information storehouse,' the reader continually retrieves information directly from written texts, which function as ancillary facilities located outside of the body. Reminiscence succeeds remembering; and rendered superfluous by outside storage space, the embodied memory remains untouched, lies fallow, and deteriorates. Overall, Plato suggests that writing weakens the natural memory by removing it from the equation entirely.

While for Plato this alternate memory facility is physically external, artificial memory discourse radically extended this argument by conceptualizing the external replacement technology as located within the mind. This replacement system is not external in the sense of existing physically

[100] Plato, "Phaedrus," in *The Dialogues of Plato*, ed. Benjamin Jowett, 1st ed., vol. 1 (Oxford: Clarendon Press, 1871 [c. 360 BCE]), 610. Jacques Derrida's "Plato's Pharmacy" (1981) examines this dialogue in discussing Plato's representation of writing as a *pharmakon* (drug).

separate from the body, but because it is a functionally self-contained technology that nonetheless interacts with the mind. The focus is not on location, but once again on process. The new "recent schemes" of mnemonics did not train the memory, as the ancient method of *loci* did, nor did they simply induce the mind to perform passive remembering, as the Common Sense philosophers had argued. Coleridge conceptualizes mnemonics systems as external memory devices that replace the innate memory altogether, producing a form of truly mindless and mechanical random-access recall.

The reports of Feinaigle's mnemonics exhibitions at the Royal Institution and the Surrey Institute published by the *Morning Post* during the period in which Coleridge was a contributor to the newspaper illustrate this formulation of mnemonics as random-access recall machines in practice. One boy "repeated Goldsmith's *Hermit* backward, and forward, and repeated the stanza, the line, and the order of any remarkable word required of him"; likewise, "Miss P.K. (11 years of age) recited fifty stanzas of four lines each, from the second part of Mrs. More's 'St. Eldred of the Bower.' These she repeated consecutively, and in any order desired."[101] In this episode, the children demonstrate their ability to use artificial memory systems to switch back and forth between two competing types of remembering, sequential memory and random-access recall. The opening episodes of their recitals imitate active remembering. Both performances first gesture to the long history of mnemonics by invoking the ancient oral practice of oral storytelling (poetic verse being the first mnemonic device, in the broader sense of that term. The children both recite ballads that themselves seem to recall a long-ago medieval past. At first, the first expressions of their recall—forward, backward, consecutively—indicate that the children's memories may have been expertly trained, in the way offered by the classical art of memory. The sequential and logical order of the ideas that they recall would seem to indicate, from the outside observer's perspective, that the

[101] review of *The New Art of Memory*, by [John Millard], *The Monthly Review* 71 (May 1813): 37.

children are actively remembering the poetic lines by making use of developed mental hierarchies. But in the second half of the performances, their mode of remembering shifts. Rather than calling up each line or word sequentially according to the logic set by the narrative, the children use the mnemonic system to miraculously retrieve words entirely outside of any larger structural context. Miss P.K. retrieves words "in any order desired." The unnamed boy goes one step further, fully turning Goldsmith's poem on its head by repeating (it seems to me) the mnemonic *numbers*—meaning the concepts' numerical assignation in the Feinaiglian memory palace, like floor one, room nine—that are associated with "the stanza, the line, and the order of any remarkable word."

It quickly becomes clear that this performance represents the most extreme iteration of the scenario that Maria and Richard Edgeworth had presciently warned about. The children can perfectly perform the skilled recitation of a poem according to the normal narrative sequence—in doing so, replicating the same end product that active remembering would have produced. Observed from the outside, this recitation is indistinguishable from normal recollection. And yet it is clear that the children have become, in essence, mnemonic automatons. Using the mnemonic system, they randomly access an immense number of ideas and recall any bit of information equally quickly. The boy's ability to induct poetic lines and return what is effectively a kind of mnemonic machine language—strings of numerical locations within a mechanical memory storage facility—emphasizes the stark difference between mnemonic recall and natural remembering.

II. Collective Creation: The Rise of Random-Access Memory Machines

Traditional histories of modern computing—the nineteenth-century peak of which is Charles Babbage's Analytical Engine, the machine that encapsulated the first random-access memory—typically begin not with the eighteenth-century philosophical and mnemonic lineage I

have just laid out, but with the history of the *Nautical Almanac*. Briefly: in 1765, the Board of Longitude authorized the Royal Observatory at Greenwich to produce a nautical almanac containing logarithmic tables and other calculations of heavenly bodies requisite for maritime exploration. Assembling a network of human computers and checkers, fifth Astronomer Royal Nevil Maskelyne oversaw the publication of the first annual edition in 1767, and the issue seemed successfully resolved. But while Maskelyne's skilled management enabled his team to produce highly accurate tables, the calculations' quality rapidly declined after John Pond succeeded him as Astronomer Royal in 1811.[102] Within a decade, the inability to access reliable figures had resurfaced as a major scientific problem. In 1821, Charles Babbage was spurred to create the Difference Engine, a single-purpose calculating machine for calculating logarithms, after reviewing one such series of error-riddled calculations destined for the *Nautical Almanac* alongside John Herschel, Babbage's intimate friend and the son and nephew (respectively) of famed astronomers William and Caroline Herschel—and. Babbage recalled:

> My friend Herschel calling upon me, brought with him the calculations of the computers, and we commenced the tedious process of verification. After a time many discrepancies occurred, and at one point these discordances were so numerous that I exclaimed, "I wish to God these calculations had been executed by steam," to which Herschel replied "It is quite possible." We continued our tedious comparison without further comment. The labor and uncertainty of reducing formulae to numbers, and then of calculating tables by means of differences, had however been strongly impressed on my mind, and the uncertainty in the result of such computation with the pen, induced me to enquire whether one part, at least, namely, that depending on the method of differences, might not be accomplished by mechanism.[103]

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[102] Mary Croarken, "Tabulating the Heavens: Computing the Nautical Almanac in 18th-Century England," *IEEE Annals of the History of Computing* 25, no. 3 (July 2003): 48–61.

[103] Harry Wilmot Buxton, *Memoir of the Life and Labours of the Late Charles Babbage Esq., F.R.S.*, ed. Anthony Hyman, vol. 13 (Cambridge and London: MIT Press and Tomash Publishers, 1988), 46.

As Babbage describes, the Difference Engine mechanized the method of finite differences, a mathematical process that allows one to extrapolate additional solutions for a given polynomial equation using only addition. As addition is a mathematically simpler operation than multiplication, it is much faster to use the method of finite differences to calculate an array of solutions for a polynomial equation than it is to plug a sequence of specific xs—for example x=125, 126, 127, etc.—directly into the formula. Broadly speaking, since "any section of a well-behaved continuous function can be approximated by a polynomial," once one finds a suitably accurate approximating equation, "the method of differences can then be used to tabulate the function throughout the interval"—a process called "sub-tabulation."[104] With respect to Babbage's specific goal of improving the *Nautical Almanac*'s calculations, because logarithmic functions can be approximated using polynomial equations, the Difference Engine could calculate logarithms much faster and more accurately than a human computer. Without delving too fully into mathematical specifics, Babbage designed the Difference Engine to solve a given polynomial equation for a wide array of values—in general terms, something like $f(x) = ax^2 + bx + c$ for all $x \in \mathbb{N}$ ($\mathbb{N}$ as it could not store decimals). The machine would first compute the equation for a small range of values—say $f(x)$ for $x = (x_1, x_2, x_3, x_4)$—by directly plugging in those values. Then, the Engine would take the difference between adjacent solutions to find a set of values known as first differences. It would then repeat that step again to calculate the differences between those differences. The result, called the second difference, is always a constant number (similar to how the second calculus derivative of a polynomial is always a constant). Therefore, the machine could add that constant value of the second difference to the first difference of the next number to extrapolate the next first difference in the sequence. By

[104] William Aspray, ed., *Computing Before Computers* (Ames, IA: Iowa State UP, 1990), 64.

repeating this process again, it could work backwards all the way to find the equation solution for the next adjacent value—$f(x+1)$—entirely through addition.

Mechanically, the Difference Engine represented numbers on a vertical 'axis' strung with horizonal wheels that each represented a numerical place value (units, tens, hundreds, etc.). Babbage referred to the place where a particular decimal digit was momentarily stored on a wheel before being acted upon as the 'cage.'[105] For our purposes, there are two important takeaways with respect to this process: firstly, due to the nature of the method of finite differences, the Difference Engine's calculations build upon one another sequentially in a process that Babbage referred to as 'consecutive carriage'; and secondly, the numbers produced by any given difference calculation are only momentarily stored locally in the cages before being used in the very next step. Despite the exciting opportunities that the Difference Engine offered, the project stalled in 1833 after a quarrel with the project's engineer. Babbage conceptualized several versions of the Difference Engine over a forty-year period—notably Difference Engine No. 1 (1821–1832) and Difference Engine No. 2 (1847–1849)[106]—but they only existed as partial models and small-scale prototypes during his lifetime.[107] The main reason for this state of prolonged incompleteness is that Babbage moved on to a more intriguing project in the interim: the creation of the Analytical Engine.

In contrast to the single-purpose Difference Engine, the raison d'être, functionality, and technical structure of the Analytical Engine were all much grander in scope. Whereas Babbage

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[105] Allan G. Bromley, "The Evolution of Babbage's Calculating Engines," *Annals of the History of Computing* 9, no. 2 (April 1987): 116.

[106] Although computing historians Allan Bromley and Doron Swade have both illuminated important differences between Babbage's evolving Difference Engines, for our purposes it is sufficient to treat the Difference Engine as a singular concept. See Bromley, "The Evolution of Babbage's Calculating Engines"; Swade, "Calculating Engines: Machines, Mathematics, and Misconceptions."

[107] In 2002, a team lead by Doron Swade at the Science Museum in London produced the first full-size version of Difference Engine No. 2 using Babbage's original plans.

designed the Difference Engine to address a specific problem within the field of nautical mathematics, the Analytical Engine was a general-purpose computing machine. Never built despite many protracted attempts by Babbage to secure government funding for the project, the Engine exists most completely as a text: mathematician Ada Lovelace's 1843 *Sketches of the Analytical Engine Invented by Charles Babbage, Esq*. In close collaboration with Babbage, Lovelace translated a French treatise by Italian engineer (and later prime minister) Luigi Menabrea that had summarized an 1840 lecture that Babbage had given in Turin on the Engine.[108] Although Babbage was undoubtedly the primary inventor of the Analytical Engine, Lovelace's translator's notes—an extensive running commentary that more than doubles the size of Menabrea's original text—clarify and expand important aspects of Babbage's project and offer key theoretical additions. Most notably, modern scholars credit Lovelace with the conceptualization of the first computing algorithm due to her famous Note G, which offers a step-by-step delineation of the Engine's steps for calculating Bernoulli numbers. Computer scientist Aharon Yadin summarizes the overall significance of the Analytical Engine within the history of computing: "the principles expressed (a processing unit, a control unit, memory, input and output devices) are the cornerstones of modern computers." [109]

Unlike the Difference Engine, whose numbers were stored locally in the same area that the calculations took place in, the Analytical Engine included physically separate areas for these two components. The Engine "had a processing unit, which Babbage called the *mill*, and a memory unit for data, which was known as the *store*." [110] One can of course see the influence of the factory model on Babbage's choice of terms (which were still used in British computing terminology into the

[108] Luigi Menabrea, *Sketch of the Analytical Engine Invented by Charles Babbage, Esq.*, ed. Ada Lovelace, 1st ed. (London: Richard and John E. Taylor, 1843).

[109] Aharon Yadin, *Computer Systems Architecture* (Boca Raton, London, and New York: CRC Press, 2016), 5.

[110] David J. Eck, *The Most Complex Machine: A Survey of Computers and Computing* (Wellesley, MA: A K Peters, 2018), 142.

twentieth century). Yet it is also important to recognize that given the prevalence of metaphor depicting memory as a storehouse for intellectual wealth, 'store' is equally a memory term. The Analytical Engine's store was composed of axes, each of which consisted of "a set of wheels mounted on a vertical shaft, there being one wheel for each decimal digit. Each wheel would have ten distinguishable positions, corresponding to the digits 0 to 9."[111] It was connected to the mill by long racks of pinions that created two paths (in modern terminology, data buses) for exchanging data: the ingress axis for data coming into the mill from the store and the egress axis for data returning from the mill to the store.

The Analytical Engine also included separate cards for use in each location: "Fundamental to Babbage's user programming is the separation, into individual strings, of the cards that specify the operation to be carried out from the cards that specify which store axes hold the operands and results. Babbage called them, respectively, the 'operation cards' and the 'variable cards.'" As Maurice Wilkes explains, "If the operation required one of the axes of the store to *give off*, that is to transmit a number to some other part of the engine, or to *receive* a number from another part, then the appropriate axis would be selected by a suitably punched variable card."[112] Although Babbage adopted the idea of punch cards from the Jacquard loom in June 1836, the Analytical Engine "was not limited, like the Jacquard loom, to following a sequence of instructions from beginning to end. Like a modern computer, it was designed to perform loops, conditional jumps and subroutines. These were executed by physically moving the ribbon of cards back and forth through the card reading mechanism, under the control of the program instructions."[113] However there were two

[111] M. V. Wilkes, "Babbage as a Computer Pioneer," *Historia Mathematica* 4, no. 4 (November 1, 1977): 419–20.

[112] Wilkes, 422–23.

[113] Eck, *The Most Complex Machine*, 142.

different systems of cards, and since only the variable cards denoted where the numbers were stored, the store simply had "direct memory addressing (the machine had no facility to modify the address specified by a variable card)."[114]

Babbage's addition of variable cards and the creation of a separate store to retain numbers was momentous because it meant that unlike the Difference Engine, whose calculations were entirely sequential, the Analytical Engine's memory operations were inherently random access. As Allan Bromley explains, "Babbage's designs do not provide any residual storage in the mill between operations. Each operand is read from the store, and all results are returned there. A chain of additions therefore involves writing every intermediate result to the store and immediately rereading it." In practice, this set-up means that "the store is accessed to fetch an operand or store a result for every cycle of the machine." As Babbage's designs evolved, so did his goals for the Engine's storage capacity: Discussing Plan 13, which Babbage completed in January 1837, Allan Bromley explains, "Each axis stores a 30-digit decimal number. There are 25 axes with four sets of interspersed figure wheels on each axis, so the total storage capacity of the machine is one hundred 30-digit numbers (although some axes are restricted to specialized usages)." Plan 16 of 1838 included even more storage capacity, which would have expanded the store to about 3 meters in length. In this version, Bromley states, "All axes accommodate 40-digit numbers. The store racks extend an indefinite distance to the right and can therefore provide for an indefinite number of store axes. Up to 1000 axes are mentioned, but more than 100 could probably not have been usefully employed. The

[114] Bromley, "The Evolution of Babbage's Calculating Engines," 127. Bromley notes that the computer's ability to modify addresses only arose the design of the EDVAC.

separation of the store racks from the central wheels eliminates the fixed limit on the store size implicit in the earlier circular designs."[115]

Although there are many technical and operational differences between the Analytical Engine and the various Difference Engines, the Analytical Engine's ability to compute a variety of operations—a feat only made possible by its novel capacity for memory, which could hold roughly 675 bytes in today's terms—is a central reason why historians of technology recognize it as the first modern computing machine.[116] As Vered Maimon explains, the Analytical Engine "differed from the Difference Engine in that it was designed to perform a broader set of operations, and because it possessed both memory and foresight, it was capable of changing its operations to anticipate needs arising in the process of computation."[117] Underscoring the importance of these new features, Simon Schaffer adds that "the crucial aspects of the new Analytical Engine, its capacity for memory and anticipation, were profound resources for Babbage's metaphysics and his political economy."[118] These two qualities were all-important: Babbage held that since "intelligence was comprised of memory and foresight, and the analytical engine possessed both," therefore "the engine embodied the concept of intelligence itself."[119]

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[115] Bromley, 130, 126, 129. Babbage considered but rejected binary notation in favor of base ten.

[116] "Babbage Analytical Engine Designs to Be Digitised," *BBC News*, September 21, 2011, Web edition, sec. Technology, https://www.bbc.com/news/technology-15001514. This calculation was performed by programmer John Graham-Cumming, who founded the Plan 28 project, a collaboration with the London Science Museum to build the Analytical Engine.

[117] Vered Maimon, *Singular Images, Failed Copies: William Henry Fox Talbot and the Early Photograph* (Minneapolis: University of Minnesota Press, 2015), 33.

[118] Simon Schaffer, "Babbage's Intelligence: Calculating Engines and the Factory System," *Critical Inquiry* 21, no. 1 (1994): 207.

[119] Peter J. Bowler and Iwan Rhys Morus, *Making Modern Science*, 2nd ed. (University of Chicago Press, 2020), 289.

It is clear from the discourse surrounding the earlier Difference Engine project that the mechanical creation of human intellect had always been one of Babbage's ultimate goals. Discussing the Difference Engine in 1825, for example, Astronomical Society president Henry Thomas Colebrooke stated: "In other cases, mechanical devices have substituted machines for simpler tools or bodily labor. […] But the invention, to which I am adverting, comes in place of mental exertion: it substitutes mechanical performance for an intellectual process: and that performance is effected with celerity and exactness unattainable in ordinary methods, even by incessant practice and undiverted attention."[120] But it was not until the conceptualization of the mechanisms for mechanical memory and foresight in the Analytical Engine project that such ideals actually became a realistic possibility (according to Babbage's definition). Babbage's descriptions of the Engine clearly shows that he intentionally sought to create an intelligent machine by replicating a mechanical version of the human memory according to the model of the optimized factory system. Describing the Engine's constituent structure in *Passages from the Life of a Philosopher*, Babbage writes: "The mechanical means I employed to make these carriages bears some slight analogy to the operation of the faculty of memory." Later on, he reiterates this claim to mechanical memory even more boldly, declaring: "in the Analytical Engine I had devised a mechanical means equivalent to memory, also that I had provided other means equivalent to foresight, and that the Engine itself could act on this foresight."[121]

Many studies investigating the intellectual genesis behind the Difference and Analytical Engines have examined Babbage's interest in creating a machine that would harness the insights of

[120] Henry Thomas Colebrooke, "On Presenting the Gold Medal to Charles Babbage, Esq. F. R. S.," in *Memoirs of the Astronomical Society of London*, 1st ed., vol. 1 Part 2 (London: Baldwin, Cradock and Joy, 1825), 509.

[121] Charles Babbage, *Passages from the Life of a Philosopher*, 1st ed. (London: Longman, Green, Longman, Roberts, & Green, 1864), 62, 467.

Industrial-era manufacturing to more efficiently perform tasks once solely under the province of the human mind. Characterizing Babbage and his associate John Herschel as "intellectual industrialists" because "they viewed knowledge as wealth," William J. Ashworth describes how the two men's youthful visits to Britain's famous factories shaped their view "that the manufacturing changes that had taken place at the vanguard of British industry could also be applied to intellectual output." Just as they studied factory systems, Babbage and Herschel thoroughly understood the importance of understanding the workings of the mind. Just as with manufacturing technology, it was only by gaining an intimate understanding of the mechanics that one could improve and optimize their processes in order to secure the greatest maximum output: "a better knowledge of the mind's operations would enable them to be refined, quickened, and thus made even more industrious—just as observing the processes involved in manufacturing a material product in a factory could lead to their improvement."[122] Yet quite surprisingly given the centrality of this topic to Babbage's magnum opus, and given the polymath nature of his interests more generally, he did not dedicate any serious energy to the scientific study of the brain. Laura Otis puts it bluntly: "Babbage knew little or nothing about anatomy or physiology, and before the articulation of cell theory in the late 1830s, the organization of the nervous system was poorly understood."

This apparent lack of interest becomes all the more curious when one considers that his intellectual circle was composed of the period's scientific vanguards on a variety of subjects, including biology, evolution, physics, chemistry, and other relevant subfields of natural philosophy. He visited Alexander von Helmholtz in Berlin during the 1820s; was an associate of figures like Michael Faraday, Charles Darwin, Joseph Hooker, and Charles Wheatstone; and even played the

[122] William J. Ashworth, "Memory, Efficiency, and Symbolic Analysis: Charles Babbage, John Herschel, and the Industrial Mind," *Isis* 87, no. 4 (1996): 658, 638.

central role in connecting Ada Lovelace with Faraday to help her fulfill her goal of studying electrophysiology under him. Laura Otis attempts to square this circle by contextualizing Babbage's Engines within the larger discourse of nineteenth-century physiology and mental science. Despite Babbage's lack of scientific knowledge about the brain, she claims, the Engines' "basic organization reflected the nervous system's structure as revealed by anatomists of the 1830s" and should be viewed as precursors to the later electrophysiological discoveries of Hermann von Helmholtz and Emil du Bois-Reymond.[123]

In contrast to this discourse-level contextualization, I propose an alternative: perhaps Babbage did not feel it necessary to undertake an intensive materialist study of the brain from an anatomical and electrophysiological perspective for his Engine projects because he already had another model of mind—that arising from Scottish Common Sense philosophy—which provided him with all the requisite information about the mind's structural hierarchy. The influence of this philosophical tradition on Babbage has been remarkably undervalued, perhaps in part due to an overly siloed focus on the technical aspects of his work. Yet biography and writings both suggest its deep and sustained influence on his thought. Babbage was highly enthusiastic about Dugald Stewart from the time he was a young man. In his autobiography *Passages from the Life of a Philosopher* (the very title of which signals his desire to be considered as a peer to those working in that branch of intellectual inquiry), Babbage exuberantly describes meeting Stewart in 1819 in Edinburgh. Afterwards he "spent a delightful week at Kinneil with Dugald Stewart. The second volume of his 'Philosophy of the Human Mind' had fortunately fallen into my hands at an early period during my

[123] Laura Otis, *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (University of Michigan Press, 2001), 33.

residence at Cambridge, and I had derived much instruction from the valuable work."[124] From that time, Babbage regularly corresponded with Stewart and his wife Helen. In 1823 he again visited them with his wife Georgiana on a trip to Scotland and Northern England.[125] He even named two of his sons—his fourth child, Edward Stewart Babbage (1819–1821) and his sixth child, Dugald Bromhead Babbage (1823–1901)—jointly after Dugald Stewart and fellow Cambridge Analytical Society founder Edward Bromhead.[126]

In addition to his reverent relationship with Dugald Stewart, Babbage's close friend John Herschel was one of the main nineteenth-century inheritors of the Scottish Common Sense tradition. Out of his contemporaries, Herschel was certainly the most influential with respect to philosophy of science topics like the nature of causation and the principle of induction. His 1830 *Preliminary Discourse on the Study of Natural Philosophy* was the first treatise to make "the basic tenets of Common Sense methodology available to a much wider segment of the scientific community." Richard Olson notes that "Herschel's ideas were so similar to those of the Scottish school that there is little doubt of a direct relation"—indeed, the resemblance is so strong that "even his illustrative materials often came directly from Thomas Brown's *Lectures on the Philosophy of the Human Mind*."[127]

Given Babbage's deep personal relationship with Stewart and Herschel, it might appear deeply contradictory that the lodestar of Babbage's life was an invention that, among other capabilities, contained the first physical random-access memory. Such a project might instinctively

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[124] Babbage, *Passages from the Life of a Philosopher*, 474.

[125] Anthony Hyman, *Charles Babbage: Pioneer of the Computer* (Princeton: Princeton UP, 1985), 55.

[126] Given that Bromhead would later become a close mentor of George Boole, the inventor of symbolic algebra (the subject of chapter 3), Babbage's children's names are an extraordinarily encapsulation of what I suggest are the two main intellectual springs of modern computing: Scottish Common Sense philosophy symbolic algebra.

[127] Olson, *Scottish Philosophy and British Physics, 1740-1870*, 252–53.

seem to reject the concerns about memory mechanization that first arose in the work of Stewart and his contemporaries. The difference between the line of thought running from Stewart, Reid, and the Edgeworths to Coleridge; and that motivating the work of Babbage's Engine projects, stems from the latter's economic grounding. Like Coleridge, Herschel and Babbage focused on Scottish Common Sense philosophy's emphasis on proper mental hierarchies; yet they were industriophiles in a way that would have been abhorrent to their intellectual predecessor. Unlike Coleridge—for whom this model of mind lead back to organicism—Babbage and Herschel drew the conclusion that the "efficient and correct mental operations" which led to the most efficient outputs "depended completely on the organization of the mind." Bringing their observations of factory systems to bear on the question of how technology could optimize human memory, the two men

> held that the mind, much like a mill or a factory, had to be correctly organized to retrieve ideas or data (like stored goods or materials) efficiently, without wasting human memory. In a factory, the speed and precision of production depended on its organization. Through a combination of well-arranged memory and analysis, the mind, too, could become more efficient at processing information and better at intellectual production.

Before Babbage's work began on the Difference Engine, in the 1810s and 1820s Babbage and Herschel had considered a several solutions—both technological and natural—for optimizing the memory. As undergraduates they founded the Cambridge Analytical Society, a mathematical club out of which they created a pre-Boolean symbolic algebra. As William Ashworth explains, they explicitly conceptualized their symbolic language as "a mental technology that was universal, efficient, visible, and, consequently, immune to ambiguity and corruption." This "algebraic language was precise, economical, and efficient in the storage and production of knowledge. In short, […] it provided the means to industrialize the human mind."[128]Aside from the mathematical advantages this new notation afforded (a subject I consider in my third chapter), Babbage and Herschel believed

[128] Ashworth, "Memory, Efficiency, and Symbolic Analysis," 635, 631, 636, 653.

that their universal analytical language would streamline the memory's recall process. Reducing qualitative details to abstract mathematical symbols enabled the mind to work faster and was much less labor-intensive. Just as mnemonists conceptualized artificial memory systems—also symbolic languages—as mental technologies that made recall more efficient and precise, Babbage and Herschel characterized their symbolic algebra as "a mental labor-saving technique assisting the memory and as a technology that taught the mind efficient intellectual production." Relatedly, in early works like *Memoirs of the Analytical Society* (1813) and "On the Influence of Signs in Mathematical Reasoning" (1826), Babbage considers how to optimize the mind by improving its inherent mechanisms. Drawing upon his manufacturing knowledge, he proposes optimizing variables such as mental quickness by creating strong associations that aid the natural memory's speed and mitigating the memory's innate space-capacity limitations by reducing the storage and recall of unnecessary information. As his knowledge of the potential horizons of industrial technology deepened in the 1830s, however, he focused increasingly on the early question he and Herschel had considered: how "the supposed operations of intelligence could be artificially built into a machine."[129]

I suggest that Babbage's ability to ground the conceptual design of the Analytical Engine's mechanical random-access memory in the principles of Scottish Common Sense philosophy of mind—an application that would have seemed ludicrously antithetical to Coleridge—was made possible by John Herschel's work developing the concept of induction, a major topic of Scottish Common Sense philosophy of mind. Herschel's conceptualization led to a much more positive view of mechanical abstraction than the gloomy one voiced by Coleridge. Although Babbage does not seem to have commented on artificial memory systems except in passing, John Herschel affords them a central role in his formulation of these concepts in his influential *Preliminary Discourse*. In his

[129] Ashworth, 629, 638.

discussion of the methodology and ultimate reach of philosophical investigations of causal relations, Herschel describes general truths as artificial memory devices. He presents two equivalent definitions of a law of nature (which he describes as a tautological human-defined principle, like a triangle's angles adding to 180°, in contrast to an immutable physical principle like gravity). He states: "We may therefore regard a law of nature either, 1st, as a general proposition, announcing, in abstract terms, a whole group of particular facts relating to the behavior of natural agents in proposed circumstances; or 2dly, as a proposition announcing that a whole class of individuals agreeing in one character also agree in another." Herschel goes on to characterize the first definition—that a law of nature is a statement describing the behavior of a class in a given circumstance—as "little more than an artificial memory" because it merely provides a mental shortcut for predicting observational outcomes for members of a class, rather than encouraging investigation into a phenomenon's proximate and ultimate causes.[130]

This seemingly condescending analogy is actually a very positive characterization since Common Sense philosophy held that the laws of nature were objectively true; although unproveable, the innate principles of common sense dictated that they must be unqualifiedly accepted in the same way that geometric axioms were. As Vered Maimon explains, Herschel "defines laws of nature as the outcome of processes of analysis and classification of phenomena that are based on resemblance between attributes or on analogy in the relations between attributes. Laws are general propositions that are discovered by grouping together particular facts or individual objects under 'points of agreement.'" Although grounded in Common Sense philosophy, his formulation also draws on Francis Bacon's characterization of this process as mechanical in nature: Herschel's "main interest

[130] John Herschel, *A Preliminary Discourse on the Study of Natural Philosophy*, 1st ed., vol. 1 (London: Longman, Rees, Orme, Brown, and Green, 1830), 100–101.

lies in Bacon's formulation of scientific method as a mechanistic system that regulates the operations of the mind and the senses." Maimon explains: "in Herschel's and Babbage's formulations, Bacon's "ladder of reasoning" is extended to the gradual accumulation of scientific discoveries by the means of (mathematical) analysis, which, through the application of a system of abstract signs, makes the operations of the mind much more efficient and thus facilitates the accumulation of scientific 'capital.'"[131] The kind of inductive generalization that Herschel describes as leading to the illumination of the laws of nature here is exactly the sort of abstraction that Babbage and Herschel believed to be necessary for mechanizing the mind. Recognizing the influence of Scottish Common Sense philosophy, especially that of Dugald Stewart and John Herschel, on the conceptualization of the Analytical Engine's mechanical random-access memory illuminates the links between Babbage's invention and the mnemonic random-access technologies that proliferated in parallel with it, underscoring how this philosophical tradition generated a variety of random-access technologies conceived in response to the questions it raised.

III. The Mental Industrial Revolution

As I have alluded to, the Analytical Engine's mechanical random-access memory was only one such technology that existed in the 1840s. Despite Coleridge's best efforts, the popularity of mnemonics systems had soared in the decades following *Biographia Literaria*. Although Feinaigle passed away in 1819 (leading Dublin's Feinaiglian Institution to flounder and close shortly thereafter), a series of successors quickly appeared in his wake. The industry swelled to include a throng of competing mnemonists—the key players include Aime Paris, Francis Fauvel-Gouraud, Bartłomiej Beniowski,

[131] Maimon, *Singular Images, Failed Copies*, 12, 7, 31.

Pliny Miles, Alphonse Loisette—each of whom produced a unique new system. As the mnemonics industry grew in the two decades following the publication of *Biographia Literaria*, artificial memory systems also became universally understood explicitly as a mechanical technology. Mnemonics had been imbued with a somewhat scientific aura since Feinaigle showcased his system at Britain's fledgling scientific institutions in the 1810s. But due to a combination of forces—including Coleridge's formulation of artificial memory systems as machines and the growing cultural intensity of the industrialist mindset—this link intensified in the 1830s and 1840s. Mnemonics exhibitions became standard fare at the preeminent Victorian institutions showcasing new Industrial Revolution technologies, such as London's Royal Adelaide Gallery of Practical Science and Royal Polytechnic Institution. In these venues, immaterial random-access mechanical memory technology in the form of mnemonic systems was showcased alongside Babbage's various calculating machines and other cutting-edge glittering machines that filled the halls of Britain's industrial galleries. Simon Schaffer records that "In early 1834 two models of the Difference Engine itself were made by the instrument designer Francis Watkins, who plied his trade as electrician and showman at the Adelaide Gallery, the leading London showcase for new engineering."[132] Likewise, Ada Lovelace recommends that those "who may desire to study the principles of the Jacquard-loom in the most effectual manner, viz. that of practical observation, have only to step into the Adelaide Gallery or the Royal Polytechnic Institution."[133] The overlap between these two worlds was so acute that mnemonist Beniowski gave artificial memory demonstrations directly before John Herschel's lectures on chrysotype photography in 1841.

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[132] Schaffer, "Babbage's Intelligence," 211.

[133] Menabrea, *Sketch of the Analytical Engine Invented by Charles Babbage ... with Notes by the Translator. Extracted from the "Scientific Memoirs," Etc. [The Translator's Notes Signed*, 706.

Based on the existing source material, it is impossible to know if Babbage, Herschel, and Lovelace attended these lectures or if they had heard of Beniowski (or vice versa). However, Babbage was a radical sympathizer who hosted Napoleon's brother Lucian at his house in the 1810s; his various disputes with the British government were well covered by Chartist papers like the *Northern Star*. And given that Beniowski was also a highly devoted inventor of novel printing technology, it seems quite possible that he was familiar with Charles Babbage's work on the self-printing Engines. Beniowski's Phrenotypic system, which he seems to have developed around 1841, shares so many key similarities with Babbage's calculating engines that it seems entirely possible that Beniowski modeled his artificial memory machine in part directly upon Babbage's machines. Beniowski described his mnemonic system as a self-printing mental machine, calling it ""The PHRENOTYPING or BRAIN-PRINTING method,' on account of its direct and rapid working upon the sheets of the brain." Updating and literalizing Plato's wax tablet memory metaphor for the Industrial Age, he claimed that his Phrenotypic method enabled one to "engrave upon the brain," so that those who followed his method would "soon find their morasses covered with rail-roads; and their tired horses metamorphosed into powerful steam-engines."[134] He used this 'brain-printing method' not simply to recall numerical information (as had been done since the eighteenth century with Grey's *memoria technica* system) but also to perform an entirely new mnemonic function: the calculation of logarithms. A 20 November 1841 account of Beniowski's lecture records:

> His most wonderful feat, however, was the calculation of logarithms, from one to one hundred: this he did on the instant; that is, so soon as he had written down the number uttered by an auditor, he followed it by writing the logarithm on the same line on the board, so that the person who had put the question might compare the result with the table in his hands; he performed the same series of difficult operations by inversion; that is, when the

[134] Bartlomiej Beniowski, *Major Beniowski's Phrenotypics* (London: Foale, 1841), 7, 26.

> logarithm was given, he instantly wrote down the original, or radical number. We believe this to be the greatest effort of the human mind that has ever been attempted."[135]

These kinds of calculations could be undertaken by a mnemonic machine, he explained, because "Mathematical studies are all easily reducible […] to a series of problems, each problem being a series of minor operations to be recollected."[136] This insight—that the calculation of logarithms could be broken down into an algorithm of simple operations that a machine could repeat—is notably also the central gambit that drove Charles Babbage's creation of the Difference Engine. Beniowski not only demonstrates his ability to calculate logarithms in sequence, but also to produce them in any order as cued by the audience, as well as to reverse this process in only some random instances by taking any given logarithm's exponent. Therefore, Beniowski's Phrenotypic demonstrations in the early 1840s exhibited two of the central features of the Difference Engine and the Analytical Engine, respectively: the mechanical calculation of logarithms and random-access machine memory. Irrespective of whether Beniowski and Babbage knew of one another's work—a question that is, as far as I am aware, unknowable based on existing documentation—the similitude between their technologies suggests that the invention of mechanical random-access memory is more precisely described as a form of creative cross-lighting arising from the two men's immersion in similar influences and discourses, rather than a linear instance of direct cause and effect.

Continuing debates over mnemonics during this period solidified Coleridge's original conceptualization of artificial memory systems as external machines in the mind that provided random-access (meaning non-sequential, access-time-independent) recall. They also expanded upon

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[135] "PHRENOTYPICS," *The Presbyterian*, November 20, 1841, 188.

[136] Beniowski, *Major Beniowski's Phrenotypics*, 24.

several important elements of this new form of memory that hold significance for the modern version of physical RAM: its commoditization as a result of the ballooning mnemonics industry, and its expanded storage capacity compared to the innate memory. Although proponents and critics of mnemonics vehemently debated whether the effects of these new memory machines were ultimately detrimental or constructive, by the mid-1840s both sides nonetheless broadly concurred that mnemonics systems offered a new, commoditized, mechanical form of memory that could traverse the boundaries of idea sequence, speed, and space capacity. The specificity of these features further demonstrate that nineteenth-century commentators truly conceptualized artificial memory systems as a literal memory technology, rather than merely employing the well-worn rhetoric of industrialization to metaphorically describe the mind as a machine.

The mid-century detractors of artificial memory systems were generally educated middle-class individuals and some educational reformers who followed Coleridge in lamenting mnemonics' active destruction of the organic human mind and distrusted the educational value of rote memorization. These commentators often echoed Coleridge's suggestion that mnemonics systems actively destroyed the innate memory and replaced it with a mechanical system, but in much more explicit and industrial terms. For example, one commentator asserted that a person cannot use mnemonics "without enfeebling the faculties relieved, destroying our reliance upon them, and inducing a helpless dependency upon artificial expedients; nor can the natural order of the mental operations be inverted without producing imperfection and confusion in the knowledge we may acquire."[137] Some of the most explicit theorization of artificial memory systems as machine substitutes for the memory came from American phrenologist Orson Squire Fowler, a major opponent of the new "Mnemonic quackery" and a dedicated critic of Feinaigle's mid-successor, the

[137] "Education as a Science and an Art," 166.

French-born mnemonist Francis Fauvel-Gouraud. Twenty-seven years after Coleridge's circuitous conceptualization of artificial memory systems as machines, Fowler argued unmistakably that mnemonic systems like that of Fauvel-Gouraud were machine substitutes for the innate memory:

> If he claimed that his system *aided* the natural memory, *worked with* it, and tended to *strengthen* it, then it might merit attention; but when he *pits it against* natural memory—tramples natural memory into the very dust, and then crowns his magnificent system and places it on the *ruins* of natural memory—[…] no gift in the universe could tempt me to adopt his system—that is, to exchange my *natural* memory for his purely *artificial* system.[138]

Fowler represents mnemonic systems as dangerous replacement machines for the natural memory, bluntly stating that the artificial memory system "supercedes memory. It is a substitute. A mechanical memory, much superior to that which is natural."[139] Describing the mnemonic as a self-contained mental system that produces "*artificial, man-made* memory," Fowler warned that artificial memory systems make "the memory a perfect *machine*, and the things produced, mere mechanical results." He rails against the idea that the memory can be improved by "introducing within it '*Professor-Francis-Fauvel-Gouraud's-Phreno-Mnemotechnic-System*' machine, just as you would put a grain-cleaner or a bolt into a grist-mill, or […] a cotton factory!" Such an action would

> do no little damage to the remembering apparatus invented by the great Architect of the Universe, and furnished to every human being 'without money and without price.' As if Professor Gouraud, or Robert Fulton, or some great inventor, had actually invented a *machine to eat with*, or to walk with, or with which to digest, or propel the blood, or breathe, or love, or reason, or worship, better than the organs and faculties invented for these respective purposes by the God that made us! so that, by *laying aside* our mouths, stomachs, muscles, eyes, lungs, […] and using his *new, superior, magnifique*, and *all-powerful eater, digester, mover, lover, worshipper, mnemonizer*, &c., &c., to the whole of man's powers, we could attain results 'infinitely superior to those we now attain'!

The fever-pitch tenor of Fowler's denunciations—which echoes the vigor of Coleridge's denunciations of David Hartley's random-access associationist recall and Feinaigle's New Art of

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[138] Orson Squire Fowler, *Education and Self-Improvement*, 2nd ed. (New York: O.S. and L.N. Fowler, 1844), 116–17.

[139] Thomas Hallworth, *Rational Mnemonics*, vol. 1 (New York: Alexander V. Blake and O. O. Wickham, 1845), ix.

Memory—seems to stem from a kind of denialism at the sheer supremacy of these new technological systems. For example, according to Fowler, mnemonist Francis Fauvel-Gouraud "asserts and re-asserts a hundred times in his course, that *natural* memory *cannot possibly* retain a hundredth or a thousandth part as much as can his *machine* memory, and that, therefore, his system is inconceivably superior to natural memory." The powers of his mnemonic system are supposedly "*illimitable*, and its capacity adequate to recalling *whatever* facts, dates, names, numbers, *any thing and every thing* with which it can possibly be charged—that its power might be so augmented as to be able, at any time, to recall *any* thing and *every* thing that ever entered it."[140] As with Coleridge's negative theorization of artificial memory systems, Fowler's criticisms develop the conceptualization of random-access machine memory by explicitly recognizing that such a recall system has a much greater storage capacity than one that uses direct-access memory, as the mind does when it accesses its innate hierarchy of ideas.

In contrast, advocates of artificial memory systems perversely embraced the Coleridgean suggestion that mnemonics systems were mechanical replacements for the organic mind, viewing them as a revolutionary mechanical invention of the Industrial Age. For them, artificial memory systems paralleled other vanguard achievements like the creation of the steam engine, the steam boat, and the telegraph, and they proudly compared the creators of the major artificial memory systems to inventors like James Watt and Robert Fulton. One praised Richard Grey in 1845 for having "originated a complete revolution in the mnemonic art, as that brought about by the invention of the steam-engine in mechanics."[141] Another positioned Francis Fauvel-Gouraud's Phreno-mnemotechnic system as one of the greatest advancements in the history of science more

[140] Fowler, *Education and Self-Improvement*, 112–13, 115, 116.

[141] Francis Fauvel-Gouraud, *Phreno-Mnemotechny* (New York and London: Wiley and Putnam, 1845), 63.

broadly: "What steam is in the physical world, Phreno-mnemotechny is in the intellectual. […] What Bishop Butler did for the science of morals—what Sir Isaac Newton did for Astronomy—what James Watt did for the Mechanical Arts—Professor Francis Fauvel Gouraud has done for Mnemonics."[142] The Loisettian system promised "INSTANTANEOUS MEMORY" and advertised mnemonics as the "Greatest labour-saving, time-saving invention"—"one perusal masters any book."[143] For proponents of mnemonics, artificial memory systems represented an electrifying extension of the mechanical revolution to the formerly impenetrable confines of the human mind. That new technologies could be attained relatively cheaply was even more exciting, as many people—applying what they saw as the larger democratizing trends of the Industrial Revolution—believed that mnemonics could offer a new technological means of democratizing knowledge in ways that far outstripped the rise of mass education.

The biggest jump in the popularity of artificial memory systems occurred in the 1840s alongside the intensification of two trans-Atlantic liberation movements—the abolitionist movement in America and the rise of the Chartist movement in Britain—wherein reformers emphasized the radical democratizing potential of mnemonic technology. In the United States, abolitionist Lydia Maria Child cast artificial memory systems as a technological tool for racial equity that could quickly raze social and racial distinctions. Covering Francis Fauvel-Gouraud's mnemonics lecture series for her weekly column in the *National Anti-Slavery Standard* newspaper, she characterized artificial memory systems as "some rail-road to learning, some machine for the manufacture of intellect." Child emphasized the significance of mnemonics for the advancement of democracy:

> As Phrenology is the democracy of metaphysics, and Daguerreotype, the democracy of drawing, so Mnemonics appears to be, emphatically, the democracy of learning. It levels all

[142] "Phreno-Mnemotechny," *The New World*, February 24, 1844.

[143] "Advertisement," *The Era Almanack*, January 1883, [172].

> distinctions. The ignorant slave, or the child of eight years old, can tell all about the planets, as accurately as the best astronomer and mathematician; though they know nothing of the laws by which the answer was obtained.[144]

A similar push occurred in Britain in the context of class liberation, where the overlap between Chartism and mnemonics was literalized in the person of Bartłomiej Beniowski, an early Chartist leader and the most successful British mnemonist of the 1840s. Beniowski was a former Polish general who fled to England during the Great Emigration of the 1830s, when a wave of radicals escaped a Russian crack-down in Poland. Beniowski—a self-described "cosmopolitical Chartist"[145] who was a member of the London Working Men's Association (LWMA), secretary of the East London Democratic Association, and an elected Chartist convention delegate for the Borough of the Tower Hamlets in east London—was a key point of connection between Polish and English radicals. He regularly participated in Chartist meetings, wrote bellicose military articles on the necessity of revolution for the Chartist newspaper *The London Democrat*, and gave a speech at a Democratic Supper in 1845.[146] Peter Brock records that by "the middle of 1839" Beniowski was known as a man "'whose name has for some time been inseparable from every political row and disturbance.'"[147]

His connections to prominent figures like John Frost, William Lovett, Henry Vincent, Feargus O'Connor, and Julian Harney had led the British government, under the advice of Home Secretary Lord John Russell, to strip him of the £40 yearly assistance allocated to Polish exiles in

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[144] Lydia Maria Francis Child, "Letter VI (26 January 1844)," in *Letters from New-York: Second Series* (New York: C. S. Francis and Co., 1845), 57, 64.

[145] Bartłomiej Beniowski, "To the Editor of the Northern Liberator and Champion," *Northern Liberator*, November 21, 1840, 7.

[146] "Marylebone," *Working Men. Reform.*, December 1839.

[147] Peter Brock, "Polish Democrats and English Radicals, 1832–1862," *The Journal of Modern History* 25, no. 2 (1953): 146.

September 1839. The Chartist press heartily decried this response, fashioning Beniowski into a symbol of the British government's tyranny. The West London Democratic Association sent out a national collection call to its sister organizations to aid "the unfortunate, the persecuted Beniowski—[…] esteemed, wherever known, as a patriot, and honoured by the confidence of thousands of Chartists in the metropolis, equally as by that of many members of the Convention."[148]

Beniowski gained widespread notoriety for his supposed role as a military leader in the failed November 1839 Newport Rising in Wales, the last large-scale violent insurrection in Britain. Two weeks after the incident, the mayor of Newport received an anonymous letter claiming that "a man is sent by the Convention of London to Newport, Major Beniowski of a Polish Regiment – He has taken with him 138 lbs of Ball carterage [*sic.*] in a type Box, marked type, and they are sending ammunition stores and they are to be in readiness to march upon Monmouth as soon as the Major sends further orders."[149] Hawkins forwarded the anonymous letter to Home Secretary Lord Normanby, informing him of Beniowski's suspected leadership in the plot: "I believe from information that a Box [of ammunition] was brought by the Steam Packet last night […] I would respectfully suggest to Your Lordship the prospects of sending down here two or three active intelligent officers who would be able to recognize the person of the Polish Major Beniowski."[150]

Government informers such as double-agent William Cardo affirmed Beniowski's guilt in the aftermath of the Rising, a claim that became further publicized when eccentric Scottish Tory MP David Urquhart accused Beniowski of leading the insurrection in his supposed capacity as a Russian

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[148] G. Godwin, "The West London Democratic Association, Marylebone, to the Associations of Great Britain, for the Obtainment of Universal Suffrage," *Northern Liberator*, September 15, 1839, MS Radical Politics and the Working Man in England: Part Two, Set 66, British Library.

[149] "Letter to Thomas Hawkins," November 17, 1839, H.O. 40/45_4, UK National Archives.

[150] Thomas Hawkins, "Letter to Lord Normanby," November 19, 1839, H.O. 40/45_4, UK National Archives.

spy (Urquhart mistakenly believed the Newport Rising to be the start of a coordinated Russian invasion of England). Although the true nature of Beniowski's involvement remains murky—unsurprisingly, he denied any involvement after its failure—most historians agree with Peter Brock that at base it seems "probable that he visited the area beforehand and helped to drill the conspirators and that, at least on the military side, he had a definite connection with its organization."[151]

Whatever Beniowksi's role in the Newport Rising really was, his suspected involvement to the violence clearly afforded him a reputation as a militant Chartist that persisted into the mid-1840s. Given his widespread public notoriety as a bellicose radical, it is significant that less than two years after the Newport Rising, he also became well-known as a famous mnemonics lecturer who gave regular shows at the Royal Adelaide Gallery. His political agitating efforts and career as a successful mnemonics lecturer were not separate pursuits but rather two sides of the same coin. The Chartist newspaper *The Northern Star and Leeds General Advertiser* made this connection explicit in 1843 when it promoted Beniowski's upcoming mnemonics lecture at the City of London Institution as one of the "Forthcoming Chartist Meetings."[152] James Gregory states that this notice describes a lecture that Beniowski gave to "members of Branch A1 of the Owenites," referring to the followers of socialist Robert Owen.[153] The nature of this event suggests that some of Beniowski's mnemonics lectures doubled as Chartist meetings where working-class radicals organized while—or perhaps by—

[151] Brock, "Polish Democrats and English Radicals 1832-1862," 146.

[152] "Forthcoming Chartist Meetings," *The Northern Star*, July 15, 1843.

[153] James Gregory, *The Poetry and the Politics: Radical Reform in Victorian England* (and New York: I. B. Tauris, 2014), 281.

learning artificial memory systems. This context is particularly suggestive given Beniowski's regular lectures at working-class institutions like the London Mechanics' Institution.[154]

Proponents explicitly celebrated the transformation of memory from an inborn psychological faculty to a purchasable commodity. One skeptical commentator summarized this view by ventriloquizing a stereotypical mnemonician: "these memories are for sale by the manufacturer."[155] In the 1870s, Victorian mnemonist William Stokes built his entire brand around this new commoditization. Whereas other mnemonists had simply sold admission to their courses, Stokes created a line of physical mnemonic products to accompany his intangible mnemonic memory machines. He punningly named "Stokes's Capital Mnemonic Globes" for their ability to earn him capital, relation to the head (*caput* in Latin), and 'capital' novelty. He hopes that "I may not find that I have simply made an investment of capital, but a capital investment. Look at the globe, consider its workmanship, its simplicity, its power […]. Then please go to work immediately, and get twenty of your friends to write to me for a copy."[156]



Figure 8: *Stokes's Capital Mnemonical Globe.* William Stokes (London: Houlston & Sons, [1868]). Courtesy of Bonhams.

The working-class embrace of the automized recall that these new commodified memory machines offered marks a significant departure from the familiar Marxist histories of Industrial-

[154] "Artificial Memory," *The Sun*, October 8, 1842.

[155] Hallworth, *Rational Mnemonics*, 1:ix.

[156] William Stokes, *Companion to Stokes's Capital Mnemonical Globe*, 19th ed. (London: Houlston & Sons, 1879), 4. Stokes was a professor of memory at City of London College who gave lectures at the Royal Polytechnic Institution, Oxford, Cambridge, and the Crystal Palace School, among other institutions. His globes were sold at railway stations.

Revolution technology and new-media accounts of twentieth-century computing, which both position technological innovation and increased automation as antithetical to workers' interests. As Simon Schaffer put it in his Foucauldian account of reformist opposition to the Industrial Revolution, "Critics reiterated their suspicion that automatic machinery and factory discipline mechanized the proletariat." Likewise, he argues that Babbage was politically and economically invested in creating machines that would displace the human computers that formerly performed that work: "The machinery of the factory and the calculating engines precisely embodied the intelligence of theory and abrogated the individual intelligence of the worker."[157] There is of course historical support for this narrative in many major events like the Luddite protests and the Swing Riots with respect to the former; and with respect to the military development of modern computers during and after World War II. While many nineteenth-century working-class mnemonic users would undoubtably have broadly agreed with the Marxist critique that capitalist modes of production developed during the Industrial Revolution treated people as akin to machines to maximize efficiency and profit, in the case of mnemonics they whole-heartedly embraced commoditized artificial memory systems as a beneficial mechanical technology whose automation of the memory could be wielded to produce populist freedom.

IV. Conclusion

In this chapter, I have offered an intellectual genealogy of mechanical random-access memory that intersects the traditional history of modern computing at key moments while also broadening and reframing the standard narrative. Tracing the philosophical objections of the Scottish Common

[157] Schaffer, "Babbage's Intelligence," 222, 210.

Sense school to the eighteenth-century popular revival of mnemonics sparked by Richard Grey's *Memoria Technica* revealed how the post-Lockean associationist emphasis on creating an organized mental hierarchy of ideas rendered the classical tradition of remembering via systems of artificial memory unacceptable within an Enlightenment educational framework. Highly influenced by this line of thinking, Samuel Taylor Coleridge momentously developed the Scottish Common Sense wariness about mnemonics into a broader indictment of the mechanical's degrading effects on the human mind by retheorizing their critiques through his influential conception of the fancy and the larger framework of Romanic organicism. His formulation was the first to explicitly characterize systems of artificial memory as mechanical technologies that existed within, but were entirely separate from and destructive to, the mind's innate workings. Following Coleridge's formulation, in the 1830s and 1840s commentators in Britain and America very explicitly conceptualized mnemonics systems as Industrial Revolution technologies. Some, like Lydia Maria Child and Bartlomiej Beniowski, lauded the radical racial and political possibilities of this new technology; others followed Coleridge in decrying the degrading effects of mnemonics systems in ways that parallel many modern concerns with the use of artificial-intelligence technology. Understanding how nineteenth-century society understood mnemonics as isolated mental machines reveals previously unacknowledged links between artificial memory systems and Charles Babbage's revolutionary computing machines; specifically here with respect to the shared development and exhibition of random-access memory technology in the 1840s, in both Victorian mnemonics lectures through the Analytical Engine project. Reconceiving random-access machine memory as the product of a multidirectional influx of intellectual and popular forces pushes against the accepted history of computing, which often emphasizes the exploitative, top-down, and increasingly militaristic context in which these technologies were developed. Working against the grain of this traditional narrative

offers a fresh origin story that illuminates the messiness of the diffuse forces that shaped with development of random-access memory within the world of Victorian computing.

Chapter Two: Sonic Nonsense and the Invention of Boolean Algebra

Just what, exactly, did computing pioneer George Boole mean when he claimed that "a real mathematician […] must be something more than a *mere* mathematician, he must be also something of a poet"? [158] The complicated answer to that deceptively simple question can be glimpsed, I suggest, in the self-described "wicked pun" that Boole's fellow traveler Charles Babbage employed to articulate the ideals of the new symbolical turn in British mathematics, a movement that Babbage helped initiate and Boole brought to its zenith in his creation of Boolean algebra. Babbage described this tradition as advocating for "The Principles of pure D-ism in opposition to the Dot-age of the University." "Dot-age" refers to Isaac Newton's fluxional calculus notation, which was then standard in Britain despite its severe limitations; "D-ism" to Gottfried Wilhelm Leibniz's rival notation, widely used by French and German mathematicians because its abstract symbolic nature made it much more conducive to experimental mathematics. Babbage describes the pun as "wicked" because he conceived of the Society as a parody of the dueling Bible societies then in vogue at Cambridge; the witticism's secondary satirical sense revolves around the double religious meaning of 'dotage' and 'Deism.'[159]

As undergraduates in 1811, Babbage and John Herschel founded the Cambridge Analytical Society to promote the spread of this Continental mathematical framework in Britain. They recognized that Leibnizian notation and related symbolic notations enabled one to condense complicated linguistic concepts into a formal language of mathematical symbols that could be mechanically manipulated, thus relieving the memory and intellect of any functions. While Babbage

[158] Mary Everest Boole, "Home-Side of a Scientific Mind," *The University Magazine* 1 (January 1878): 106.

[159] Babbage, *Passages from the Life of a Philosopher*, 28–29.

eventually pursued his early goal of creating a mechanical means that would lessen the intellectual strain of analysis by designing a physical machine that could perform the calculational work of the human mind, Boole sought a mathematical solution to this same problem. His theorization of Boolean algebra in his 1847 *Mathematical Analysis of Logic* and 1854 *Laws of Thought* fully realized the object that Babbage and Herschel's advocacy had put in motion roughly four decades earlier.

Embracing symbolic notation despite its perceived mathematical nonsensicality enabled George Boole to recognize that the formal principles of syllogistic logic could be represented as equations using algebraic symbols, which could then be manipulated through a heterodox application of normative mathematical rules to reproduce the correct Aristotelian syllogistic conclusions. Boole's creation of this symbolic algebra employed a playful methodology that transformed concepts into pure symbols with no worldly referentiality, then creatively applied mathematical rules that ordinarily would not be considered appropriate in that context in order to achieve his desired philosophical conclusions, and finally reconciled those results mathematically by limiting the equations to just two binary cases, 0 and 1. From within logic, the crucial insight that any class of entity, irrespective of its qualitative content, could be formally represented within this system of binary logic and operated on using the primary logical operators 'AND,' 'OR,' and NOT' became foundational to many physical and theoretical aspects of computer science, from the design of electrical circuits and relays to the form of the programming algorithm.

As historians of mathematics like Joan L. Richards and Ivor Grattan-Guinness have established, Boole's breakthrough discoveries arose out of the fierce series of debates that Babbage and Herschel's push to spread abstract mathematics in Britain sparked, which considered the treatment of purely symbolic concepts that had no material referentiality. Traditionalist mathematicians, led by the department at Cambridge, argued that it was 'nonsensical' to employ

Leibniz's abstract symbolic notation or, relatedly, to apply mathematical language to any concept that did not have a clear physical referent, such as negative, irrational, and imaginary numbers. In contrast, defenders of the new Continental methods supported the expansion of mathematical symbolic language and deemphasized the importance of tying every concept or operational step back to a physically observable phenomenon, instead focusing on the experimental gains such methods produced. In his recent examination of how Romantic philosophy of language and poetry informed the creation of computing algorithms, Jeffrey Binder suggests that the traditionalist view that symbolical algebra was nonsensical was merely a "side effect of the adoption of algorithmic methods"[160]; a vestigial resistance that melted away as the use of abstract mathematical language became more widely accepted in Britain. He partially grounds his assessment in the Romantic poetic and philological commitment to organicism, which features prominently in the verse and writings of Wordsworth and Coleridge.

In contrast to this view, I propose that tracing a different contemporaneous literary discourse—prosody debates about poetic nonsense that arose alongside the emergence of Victorian nonsense poetry as a popular genre—reveals these two contemporaneous debates about nonsense to have mutually informed one another. This realization allows us to see that the traditional computational history of nineteenth-century mathematics is only one half of an intellectual genealogy that extends along a continuum in both directions, rather than a single direct line of influence. I suggest that the computational history that arises from Victorian mathematical and literary investigations of symbolic nonsense is best conceptualized through a model borrowed from political science: the horseshoe theory, which describes how a shared set of beliefs transforms in

[160] Jeffrey M. Binder, "Romantic Disciplinarity and the Rise of the Algorithm," *Critical Inquiry* 46, no. 4 (June 1, 2020): 829.

opposite directions according to different ideological pressures until the continuum's two extremes eventually bend back towards one another.

As my first section rehearses, one side of this spectrum traces the standard intellectual history of computing from within mathematics that I have summarized above: the movement away from rudimentary literalist mathematical methods to Continental symbolic analysis as a result of the Cambridge Analytical Society circle, which made possible George's Boole abstract symbolical algebra and the corresponding branch of logic that became foundational to computer science. I suggest that Babbage's and Boole's recognition of the theoretical and methodological parity between the work of experimental symbolic mathematics and the writerly effort of producing poetic verse—as shown by Babbage's "D-ism" and "Dot-age" pun and Boole's likening of experimental mathematics to writing poetry—sit at the central juncture between the two sides of the continuum, and indeed help illuminate the very existence of a corollary to their mathematical investigations. Yet this alternative line of sound-based inquiry was not pursued further by either man, and this tradition therefore shifts away from Babbage and Boole.

The other half of this continuum, my second section suggests, offers an alternative nineteenth-century literary history of computing centered around concurrent sonic experimentation with nonsense. The stakes of these debates become clear by examining their place within the broader theocratization of the proper relationship between sound and sense, which first arose from the eighteenth-century neoclassical aesthetic ideals of Alexander Pope, Joesph Addison, and Samuel Johnson; through Coleridge (whose concerns about the poetical destruction caused by debased fancy were also discussed in Chapter 1). This context illuminates the aims of nonsense experimentations with sound, both aural and visual, which occurred in the realms of Victorian nonsense poetry, especially in Edward Lear's sound-based experimentation with nonsense song-

poem-drawings, and in Victorian mnemonics discourse through the poetry produced using artificial memory systems. These forms of poetic play deliberately emptied language of semantic meaning by recycling abstract symbols and sounds through sing-song verse, doggerel, and puns. The mechanical manipulation of sound enabled abstract, structural reconfigurations of the relations between symbols, an action that catalyzed passive recall. Lear's repetitious sing-song rhymes and puns mechanically manipulate language by playing upon unmeaning phonetic resonances to create easily memoizable, childlike verse that parodies the traditional structures of both narrative and sense. Mnemonics systems likewise produced a form of poetry written in abstract symbol-language that leveraged the homophonic associative illogic of puns and sing-song rhyme to produce mechanical remembrance. Following the horseshoe model, I argue that Lewis Carroll's *memoria technica* nonsense verse—in which he creatively encodes the 'nonsensical' irrational number π in a manner that I suggest applies the logic of Boolean algebra—exemplifies the eventual cleaving together of these nonsensical sonic and mathematical lines of inquiry.

This essay posits that the central key to understanding how these sonic literary and mnemonic nonsense inquiries parallel concurrent mathematical investigations by figures like Babbage and Boole is the realization that, in an abstract morphological sense, all three of these discourses embraced nonsense play to create mechanical ways of manipulating generalized symbolic languages in ways that aided the memory; this method refocuses attention on the metareferential relations between the symbols rather than the literal subject matter (whether a specific number, a word or image acting as a mnemonic 'link,' or the direct diegetic narrative of a nonsense poem). The central breakthroughs of Boolean logic, nineteenth-century mnemonic systems, and Victorian nonsense poetry are premised upon the same crucial insight: that dissociating language from its original context and recycling it erases the terms' original meanings (whether semantic or

mathematical) and symbolizes them; this process of abstraction enables their mechanical manipulation, which in turn inherently unburdens the organic memory. Mathematically, Boolean logic's symbolization of analytical relations made it possible to mechanically operate on abstract classes irrespective of their particular qualities, a metareferential turn outwards that made Boolean expressions programmable in binary code. Likewise, mnemonic systems, also a formal symbolic language that encodes numbers (although in base ten), mechanically manipulated symbols that were related by nonsense phonetic associations rather than semantic meanings in order to produce artificial recall. Victorian nonsense poetry's sing-song recirculation of nonsense sounds likewise plays with these same mechanical relations of associative sonic play, thereby symbolizing certain expressions and concepts, to produce a metareferential fictional environment that examines and often parodies the abstract relations of genuine sense. Rediscovering a richer historical definition of nonsense by tracing this continuum of nineteenth-century mathematical and sonic debates—which were notably both sparked by the takeover of mechanical symbol-play in their respective discourses—reveals a much broader and intertwined conceptualization of nineteenth-century nonsense than has previously been recognized by Victorian literary scholars, historians of mathematics, or scholars of the history of computing.

I. Mathematical Nonsense

To begin, it is necessary to briefly explain the mathematical context out of which the nineteenth-century disagreements about nonsense arose. In the seventeenth century, the independent invention of calculus by Isaac Newton in England and Gottfried Wilhelm Leibniz in Germany created a rift between British and Continental mathematics that would only reach its breaking point in the early nineteenth century. Newton's 'fluxion' notation was a geometric representation of calculus concepts

that used dots to signify derivatives ($\dot{x}$, $\ddot{x}$, etc.) and included several notations for 'antiderivatives' (such as x' and $\square\, \dot{x}$). Because "geometric expression has more direct physical correspondence to the material world," Dometa Brothers explains, the steps of Newtonian calculus could be more easily correlated and verified with respect to observable worldly phenomena.[161] In contrast, Leibniz's terminology, which used dx and $\int dx$ for the derivative of x and its integral, was a more abstract notational system that "placed great reliance on the power of symbols."[162] By stressing the "algorithmic nature" of the expressions represented, Leibnizian calculus enabled "a more complex and subtle degree of expression."[163] Unlike the geometrical foundation that kept Newtonian notation tethered to reality, the high degree of abstract symbolic play inherent in Leibniz's system meant that, as Jeffrey Binder elucidates, "one could apparently produce real knowledge about the world by arranging symbols on a paper or slate according to mechanical rules."[164] The intellectual payoff of this new symbolical ethos was astounding: it "enabled people to produce correct results even in cases so complex as to be virtually impossible to reason about without symbolic notation."[165] Freeing mathematics from the stifling tethers of both the physical world and the inevitable boundaries of human memory and analytical intellect led to advancements in virtually every scientific field.

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[161] Dometa Wiegand Brothers, *The Romantic Imagination and Astronomy: On All Sides Infinity* (Basingstoke: Palgrave Macmillan, 2015), 77.

[162] Judith V. Grabiner, "Is Mathematical Truth Time-Dependent?," *The American Mathematical Monthly* 81, no. 4 (April 1, 1974): 356.

[163] Brothers, *The Romantic Imagination and Astronomy*, 76–77.

[164] Binder, "Romantic Disciplinarity and the Rise of the Algorithm," 813.

[165] Binder, 820.

At the same time, however, it was apparent that Leibnizian calculus offered something of a Faustian bargain. Because "moving out of Euclidean geometrics removes some visual ties to the empirical world," the mechanical symbol-play that made this notation so generative also clouded the relationship between mathematics and reality.[166] Although the scientific breakthroughs that Leibnizian calculus enabled ultimately rendered it "more effective as a tool of *mathematical* demystification" than Newtonian calculus, the obfuscation produced by its notational abstraction paradoxically made the task of independently confirming the veracity of one's mathematical conclusions much more difficult (if not impossible). As Brothers puts it, "Leibniz's vision of differentials in the new world of abstract mathematics […] allowed for a penetrating gaze that saw further than ever before, but which was also a penetration of the *invisible*."[167] One could, for example, use Leibnizian notation to "produce results that were evidently false," such as "that 1=2."[168] Such examples suggested that relying too blithely abstract symbolical methods in less-established realms of scientific inquiry could have disastrous consequences.

Allured by the potential watershed of new scientific discoveries, eighteenth-century Continental mathematicians had mostly overlooked (or at least been willing to conveniently ignore) Leibnizian notation's equivocal relationship to material reality and embraced his symbolic methodology.[169] In contrast, their British counterparts—motivated by a combination of nationalistic pride for Newton's achievements and allegiance to the hegemonic orthodoxy of the Cambridge mathematics department, which fiercely rejected these innovations—had refused to follow suit.

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[166] Brothers, *The Romantic Imagination and Astronomy*, 77.

[167] Brothers, 76–77.

[168] Binder, "Romantic Disciplinarity and the Rise of the Algorithm," 820.

[169] For a discussion of some of the Continental mathematicians' misgivings, see Binder, *Language and the Rise of the Algorithm* (Chicago: University of Chicago Press, 2022), 98–100.

They expressed deep antipathy toward the use of any mathematical symbols (in all areas, not just calculus) that could not be linked back to the physical world. As a result, British mathematics fell way behind during the eighteenth century, as French and German thinkers made important advances in algebra by applying abstract symbolical methods. By the early nineteenth century, the English mathematical tradition's isolation from the cutting-edge developments in Europe had produced a profound intellectual stagnation. However, this malaise was halted in the 1810s when undergraduates George Peacock, John Hershel, and Charles Babbage formed the Cambridge Analytical Society, a group dedicated to promoting Continental symbolical mathematics (including, but not limited to, Leibnizian calculus notation) in Britain. They began by translating French mathematician Sylvestre Lacroix's textbook *Differential and Integral Calculus*. The formation of this short-lived society nonetheless opened the door for what would become a major, century-long debate that split nineteenth-century British mathematicians into two competing factions.

Led by the faculty at Cambridge, the majority of nineteenth-century professional mathematicians were traditionalists who remained committed to the idea that all mathematical concepts must directly refer back to physical phenomena. As Jeffrey Binder explains, they "only accepted the validity of symbolic methods that were backed up with clear physical interpretations. This emphasis on conceptual clarity inspired endless debates about the status of algebraic entities whose relation to physical reality was difficult to articulate, such as negative or imaginary numbers." This group held that "algorithms"—series of mechanically computable steps—"were only acceptable for instrumental purposes; within the realm of mathematical theory they seemed, at best, engines for producing intelligible nonsense, and at worst, a tyrannical imposition or arbitrary rules onto natural reason."[170] William Ashworth describes their aversion to such mechanical methods in

[170] Binder, "Romantic Disciplinarity and the Rise of the Algorithm," 815.

terms that recall the Coleridge's objections to the deranged fancy, which the last chapter argued was the larger significance behind his critique of artificial memory systems. Ashworth explains that symbolic notation was "associated with the mentality accompanying the French Revolution, which in turn was seen as a product of human fantasy cut loose from philosophy, tradition, and reality. The abstract nature of a pure algebraic calculus seemingly allowed the mind to wander in fantasy through the meaningless manipulation of symbols. […] [T]he new calculus [also] confronted an established order that feared that the industry newly penetrating that landscape was also impinging on the realm of the mind."[171] These criticisms strikingly parallel the objections raised to mnemonics systems: both were considered to be destructive, anarchistic mental machines that unleashed nonsensical symbols.

The traditionalist resistance to Leibnizian calculus and symbolical notation was tied to the outsized psychological and theological role that mathematics played in early nineteenth-century society, and to the reactionary climate in Britain produced by the Napoleonic Wars, in which the injection of this new mechanical 'French' method was politically suspect. Mathematical education served as the primary intellectual foundation for all learned occupations in Britain: "The knowledge of mathematics was not claimed to be useful in itself," Tony Crilly explains, but "it was believed that the study of mathematics would develop and strengthen the faculties of the mind."[172] As Daniel J. Cohen's *Equations from God: Pure Mathematics and Victorian Faith* (2007) highlights, many Victorian mathematicians considered it to be "so sublime that it transcends the profane realm of humanity and ascends into the pure realm of the divine."[173] Yet Leibnizian notation had showed that mathematics, formerly a reliable bedrock of psychological and Christian truth, could be adulterated and perverted.

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[171] Ashworth, "Memory, Efficiency, and Symbolic Analysis," 634.

[172] Tony Crilly, "Cambridge: The Rise and Fall of the Mathematical Tripos," in *Mathematics in Victorian Britain*, ed. Raymond Flood, Adrian Rice, and Robin Wilson (Oxford: Oxford UP, 2011), 19.

[173] Daniel J. Cohen, *Equations from God: Pure Mathematics and Victorian Faith* (Baltimore: JHU Press, 2007), 8.

For the traditionalists, William Ashworth explains, "Modern algebraic analysis was a symbol of the unnatural events in France, the 'dreadful energy' of human intellect set free from all social restraints. Moreover, it was increasingly associated with a mechanized culture. There was no room or need for such 'unnatural' products in the curriculum of the sacred order of Cambridge."[174] The traditionalists asserted that the fundamental unverifiability of such nonsense mechanical symbolic methods would cause destabilizing effects far beyond the realm of mathematics, threating the very bedrock of several key pillars of British society.

In contrast to the British mathematical establishment, experimentalists like George Peacock, Charles Babbage, John Herschel, Edward Ffrench Bromhead, Augustus De Morgan, and George Boole wanted to widen the purview of algebraic language to enable inquiry into purely abstract concepts that had no direct connection to the physical world. The new form of abstract algebra this circle was invested in developing, Mark Priestley explains,

> used arbitrary symbols to represent both quantities and operations, and it appeared to many observers that this enabled reason to somehow outstrip or come adrift from its subject matter. […] In particular, unrestrained algebraic manipulation introduced and made extensive use of negative and imaginary numbers such as $\sqrt{-1}$. Such numbers did not conform to existing notions of quantity: for example, they could not be thought of as representable by the length of a line segment. As a result, they were frequently referred to as impossible quantities. Expressions for impossible quantities were therefore often taken to be meaningless, because they denoted nothing: this in turn raised the question of what sense could be made of formulae in which they occurred.[175]

Priestley notes these thinkers offered a "new view of algebra" that reconceptualized it as "the study of the operations that were defined on numbers," a focus that emphasized algebra's abstract algorithmic nature. By examining how operations could be "captured by rules for the symbolic manipulating of formulae" and analyzing how "these rules could then be applied independently of

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[174] Ashworth, "Memory, Efficiency, and Symbolic Analysis," 633.

[175] Priestley, *A Science of Operations*, 8.

the meaning of the symbols," the experimentalist tradition linked logic and computation, with the overarching goal of developing "a calculus of reasoning so that deductions [could] be made or verified by algorithmic methods."[176] Martin Davis underscores that out of this movement arose the realization that "the power of algebra comes from the fact that the symbols representing quantities and operations obeyed a small number of basic rules or laws. This implied that this same power could be applied to objects and operations of the most varied kind so long as they obeyed some of these same laws."[177] This tradition generated the fundamental insight that abstract nature of algebra—the fact that it is of no consequence what number x represents—theoretically enables one to employ this symbolic mathematical language to represent any other applicable phenomena.

Charles Babbage and John Herschel initially pursued the possibility of creating a mechanical means of abstract analysis that did not require strong exertions of the memory or intellect in the creation of a symbolic algebra, before Babbage turned towards a different type of machine alternative through his calculating engine projects. William Ashworth has demonstrated that Babbage and Herschel advanced the "philosophy of algebraic analysis […] as a mental-saving technique assisting the memory and as a technology that taught the mind efficient intellectual production. […] They held that an algebraic symbolic language provided a means to condense language and ideas into symbols."[178] Babbage's investment in symbolic algebra was motivated by the analytical limitations of the mind, which he saw as fundamentally a problem of the human memory. He explains in his 1813 *Memoirs of the Analytical Society:*

> Were an Analytical operation of any complexity converted into common language, in all its detail, the mind, after acquiring a clear conception of one part o the related ideas, must

[176] Priestley, 68.

[177] Martin Davis, *The Universal Computer: The Road from Leibniz to Turing* (London and New York: W. W. Norton, 2018), 26.

[178] Ashworth, "Memory, Efficiency, and Symbolic Analysis," 629.

> suspend its decision until it would obtain an equally [perspicuous one of the remainder of the proposition; and in so long an interval as thus must occupy, the impression of the formers ideas would necessarily have faded in some degree from the memory, unless fixed by an expense of time and attention, sufficient to deter any one from the employment of such means of discovery. It is the spirit pf this symbolic language, by that mechanical tact, (so much in unison with all our facilities,) which carries the eye at one glance through the most intricate modifications of quantity, to condense pages into lines, and volumes into pages; shortening the road to discovery, and preserving the mind unfatigued by continued efforts of attention to minors parts, that it may exert its whole vigor on those which are more important.[179]

Babbage reiterated similar sentiments in his 1826 treatise *On the Influence of Signs in Mathematical Reasoning*: "The more complicated the enquiries on which we enter, and the more numerous the quantities which it becomes necessary to represent symbolically, the more essentially necessary it will be found to assist the memory by contriving such signs as may immediately recall the thing they are intended to represent."[180]

Babbage's development of this symbolic algebraic system ultimately had a utopic universalist aim. As William Ashworth explains, he wanted to "find the essence of the grammar of a universal symbolic language and to make visible the foundations of nature and mind. […] The analyticals were on a quest to find a mental technology that was universal, efficient, visible, and, consequently, immune to ambiguity and corruption."[181] Babbage eventually realized his goal of fully removing human memory from its role in abstract analysis by fully mechanizing this process—not via the creation of a universalist symbolical language, but by outsourcing it to a physical machine, the Analytical Engine (and as I argued in chapter one, the Engine's random-access memory technology paralleled the mechanical processes and outputs of the nineteenth-century mnemonic 'machines').

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[179] Charles Babbage and John Herschel, *Memoirs of the Analytical Society*, 1st ed. (Cambridge: J. Smith, 1813), i–ii.

[180] Charles Babbage, *On the Influence of Signs in Mathematical Reasoning* (Cambridge: J. Smith, 1826), 47.

[181] Ashworth, "Memory, Efficiency, and Symbolic Analysis," 636.

Four years after Charles Babbage and Ada Lovelace published *Sketches of the Analytical Engine* (1843), George Boole's *Mathematical Analysis of Logic* outlined his mathematical creation of a universal symbolic language of analysis, realizing the project that had so intrigued Babbage and John Herschel in earlier years. Building on the symbolist tradition developed by the Analytical Society circle, Boole recognized that the language and principles of algebra could be applied to formal logic. By representing classes of syllogisms rather than mathematical quantities using algebraic symbols, he was able to show that classes of entities could be manipulated using mathematical operations to produce the correct conclusions of Aristotelian logic. Boole's method relied upon a new symbolic application of the operation of multiplication. As Martin David explains:

> If the letters x and y stand for two particular classes, then Boole wrote xy for the class of things that are both in x and y. […] Boole thought of this operation applied to classes as being in some ways like the operation of multiplication applied to numbers. However, he noticed a crucial difference: If once again y is the class of sheep, what is yy? It must be the class of things that are sheep and are also…sheep. But this is the very same thing as the class of sheep; so $yy = y$. It is only a small exaggeration to say that Boole based his entire system of logic on the fact that when x stands for a class, the equation $xx = x$ is always true.[182]

For purposes, the most important points to understand here are that Boole creatively applied the rules of multiplication to a new context (philosophy), and the end result of that alternative discourse—the knowledge that the correct resolution of xx was not x^2, but x because of the operations of logic—guided his use of this mathematical operation in a mathematically heterodox way. Mathematically, Boole then reconciled this apparently nonsensical application of multiplication with his logical conclusions by restricting the range to 0 and 1 (the only numbers for whom $xx = x$).

This symbolical abstraction also placed ultimately emphasis on the logical relations between equational terms, irrespective of what was represented in the given syllogistic classes. As Davis explains, Boole's realization "bears witness to Leibniz's belief in the power of appropriate

[182] Davis, *The Universal Computer*, 28.

mathematical symbolism, of the manner in which the symbols seem to magically produce correct answers to problems almost unaided."[183] This treatment of symbolical algebra placed emphasis on the ways in which the symbols were combined to produce meaning, rather than the meaning of the symbols themselves. As he stressed, "They who are acquainted with the present state of the theory of Symbolical Algebra, are aware, that the validity of the process of analysis does not depend upon the interpretation of the symbols which are employed, but solely upon the laws of their combination."[184] As I will demonstrate, Boole's creative heterodox application of mathematical operations guided by the constraints of an alternative discourse and his emphases on the abstract relations between generalized symbols and on internal consistency rather than outward truth have clear parallels within Victorian nonsense poetry.

It seems to me that Babbage's and Boole's mathematico-poetic comments indicate some awareness of a connection between the mechanical symbolic analytical discourse that their mathematical work contributed to and what I am proposing are equivalent forms of nonsense symbol-play concurrently occurring through Victorian mnemonic and poetic experiments with sound. Babbage's "D-ism" and "Dot-age" pun is enmeshed in a much larger literary discourse about the nonsensical mechanical nature of puns that paralleled the mathematical debates that his ideas sparked. His pun also revolves around a double mathematical and theological meaning that emphasizes his curious revelation that the Analytical Society actually had a dual founding mission: as he relates, he created the group not only to advocate for the adoption of symbolic mathematics in Britain, but also as a parody. He wanted to satirize the self-righteous solemnity of the Biblical

[183] Davis, 26.

[184] George Boole, *The Mathematical Analysis of Logic* (Cambridge: Macmillan, Barclay, & Macmillan, 1847), 3. Qtd in Binder, *Language and the Rise of the Algorithm*, 125.

debates then engulfing Cambridge. After "taking wine" with a friend during his second year at Cambridge, Babbage casually perused a leaflet for one of the Biblical societies. He recalls, "Taking up the paper, and looking through it, I thought it, from its exaggerated tone, a good subject for a parody. I then drew up the sketch of a society to be instituted for translating a small work of Lacroix on the Differential and Integral Lacroix. It proposed that we should have periodical meetings for the propagation of d's; and consigned to perdition all who supported the heresy of dots. […] My friend enjoyed the joke heartily."[185] The 1840 *Penny Cyclopedia* defines "parody" as a "poetical pleasantry, which consists in turning what is intended as a serious composition into ridicule, by adapting it to some new purposes, or by the affected imitation of its peculiarities. […] [One] form of parody is that in which, without any change in the original, it receives a ludicrous character by its application to some object quite foreign to the original intention of the author. […] The term parody is also employed in music and is given by the French writers to those pieces in which the words have been composed for the music and not the music for the words."[186] As this definition indicates, parody is metareferential 'poetical' concept that operates by humorously playing on the abstract similitudes between semantically unlike subjects. The French musical understanding of the term (especially relevant for Babbage, given his penchant for French mathematics) refers to compositions in which the sound predominates over the sense. It is also a form of return, and perhaps broadly even be conceived of as a kind of mnemonic remembering, in that it condenses the salient aspects of the original form and then reenacts them in a new linguistic form, often for humorous or nonsensical effect. As Sara Lodge has discussed in her study of Edward Lear's nonsense poetry (which I will discuss in detail later), musical parody was a central part of Lear's work that enabled him to explore

[185] Babbage, *Passages from the Life of a Philosopher*, 28.

[186] "Parody," in *The Penny Cyclopaedia of the Society for the Diffusion of Useful Knowledge* (London: Charles Knight, 1840).

themes of memory and recursion. Engagement with punning, unmeaning sound, and forms of humorous abstract transposition from one serious context to another totally unlike one demonstrates clear parallels with the sonic nonsense experiments occurring in nineteenth-century mnemonic and poetic discourses.

Although this conceptual overlap is intriguing—for it would seem to potentially signify Babbage's curiosity in examining poetic and mathematical symbol-play in conjunction with one another—he ultimately took his investigations in a more physical technological direction with his work on calculating engines. However, Ada Lovelace, an avid harp player and opera enthusiast who colloquially referred to herself as a song-bird or a thrush throughout her life to her mother and husband, specifically touted mechanical sound experimentation as one of the important breakthroughs made possible by the Analytical Engine. She foresaw the musical composition of "elaborate and scientific pieces of music of any degree of complexity or extent" premised on the symbolic expression and mechanical manipulation of the "fundamental relations of pitched sounds in the science of harmony and of musical composition" as an important application of the machine.[187] For this reason, Imogen Forbes-McPhail argues the Analytical Engine came to be associated with "the specter of machine-composed poetry."[188] Indeed, John Clark exhibited such a machine, the Eureka, in 1845; its process of poetic creation echoed both that of mnemonics and Babbage's Engine. Clark explains, "The machine contains *letters* in alphabetical arrangement. Out of these, through the medium of numbers, rendered tangible by being expressed by indentures on wheelwork, the instrument selects such as are requisite to form the verse conceived; the *components* of

[187] Ada Lovelace, "Notes by the Translator," in *Sketch of the Analytical Engine Invented by Charles Babbage, Esq.*, by Luigi Menabrea, ed. Ada Lovelace, 1st ed. (London: Richard and John E. Taylor, 1843), 694.

[188] Imogen Forbes-Macphail, "'I Shall in Due Time Be a Poet': Ada Lovelace's Poetical Science in Its Literary Context," in *Ada's Legacy: Cultures of Computing from the Victorian to the Digital Age*, ed. Robin Hammerman and Andrew L. Russell (Morgan & Claypool, 2015), 144.

words suited to form hexameters being along previously calculated, the harmonious combination of which will be found to be practically interminable."[189] Babbage subsequently met with Clark to assess the profitability of exhibiting automata as a potential means of funding the Engine's construction.

George Boole's recognition of the theoretical parallelism between his mathematical investigations of abstract symbol-play and the work of a poet was much more explicit. As I have previously noted, he reportedly professed that "a real mathematician […] must be something more than a *mere* mathematician, he must be also something of a poet." [190] Boole's biography likewise demonstrates his lifelong engagement with poetry, which began as a young child. Born in Lincoln to a cobbler and his wife, he received a primary school education augmented by guidance in poetry and practical science and from his father, who was an erudite amateur scientist despite being self-educated. Aided by access to the large circulating library of bookseller William Brooke and the collections of Rev. Richard Andrew, George Stephens Dickson, Edward Ffrench Bromhead (a founding member of the Cambridge Analytical Society), and later the Lincoln Mechanics' Institute, Boole managed to learn Latin, Greek, French, German, Italian, and of course mathematics by his early teens—all with very little formal assistance. His sister, Mary Ann Boole, relates that Boole had a voracious appetite for reading from a young age: he "devour[ed] eagerly every book that came in his way, travels, history, biography, poetry, and romances"[191] Although he was interested in many subjects, he was especially drawn to literature: "George had a fine appreciation of the higher kinds of poetry and himself possessed poetical powers of no mean order, which might have won him a name

[189] John Clark, "Eureka," *The Athenaeum*, no. 923 (July 5, 1845): 670.

[190] Boole, "Home-Side of a Scientific Mind," 106.

[191] Mary Ann Boole, "Life of George Boole—." (Unpublished Biography, n.d.), 8, BP/1/306, The Papers of George Boole, F.R.S. (1815–1864), University College Cork, http://georgeboole.ucc.ie/index.php?page=15#s01EI.

if the severer charms of science had not proved attractive to him. He was fond of translations and at various times produced beautiful renderings of Italian, French, and German poems." [192] He was especially interested in the work of Milton, which their father recommended and guided him in.

He reportedly only turned to studying mathematics after the dissolution of Brooke's circulating library left him without a ready source of new books, making it more economical to study mathematical textbooks because they took him longer to work through. Echoing Boole's previously quoted statement about 'mere' mathematicians and poetry, Mary Ann Boole relates that her brother credited this unorthodox literary self-education for his creative mathematical abilities, believing that a formal university education "would have had a contracting effect upon his mind and that he might have become a 'mere mathematician.'"[193] Although Boole's wife Mary Everest Boole appears to have been quite hostile towards his poetic endeavors—prohibiting him from writing poetry after marriage in 1855 on the basis that it wasted mental energy that should be reserved for mathematics, and burning sheets of his poetry to dissuade him from working on it—as recalls informing her children that their father was "*a 'genius,' as much as Tennyson or Dickens.*"'[194]

But although Boole was clearly invested in writing poetry, his verse fails to offer a literary corollary to his mathematical and philosophical innovations. Rather than embracing nonsensical linguistic play in the way that the poetry of his contemporaries Edward Lear and fellow mathematician Lewis Carroll (Charles Dodgson) did, the majority of Boole's verse is sincere and serious. It earnestly expresses raw negative emotions of depression, failure, and uncertainty; and grapples with intense theological mistrusts on troubling and often esoteric religious questions. He

[192] Boole, 14.

[193] Boole, 22.

[194] Boole, "Home-Side of a Scientific Mind," 108.

was heavily influenced by Milton and the Romantics, especially Wordsworth and Keats, and stale Romantic platitudes of moody natural imagery—falling autumn leaves, breaking waves, and rapidly building storms—dominate his poems. Although he did compose a good deal of secular poetry, some of it in charming verse letters to his friends from his summer holidays on the Isle of Wight, the focus of his work seems to be dedicated to the pressing and intricate theological questions that racked him throughout his lifetime—costing him the opportunity to marry his first love, Mary Jane Parry, and later his dream job, a mathematics professorship at Oxford. For example, his Biblical poem on 2 Peter 2:13 cloyingly depicts the world's "sunlight fields, and laughing woods, / And odorous gales and murmuring floods."[195] Another poem from June 1849 exuberantly cries, "O, fields! O, grassy slopes! so late bare / Now bright with marvelous Spring!"[196] Boole's verses, written in moments of relaxed solicitude away from the anxieties of his professional career, offered refuge from his intellectual pursuits rather than a medium to further explore his mathematical research.

II. Sound Over Sense

In chapter one I examined descriptions of Gregor von Feinaigle's 1811–12 London mnemonics exhibitions at the Royal Institution and the Surrey Institution, arguing that they showcased the performance of random-access memory (RAM). I briefly return to these spectacles here to highlight that these wonderous memory feats were exemplified through the spectacular recitation of poetry. But unlike the schoolhouse recitation common across Britain, featured in Catherine Robson's *Heart Beats: Everyday Life and the Memorized Poem* (2012), these were shocking displays of eighteenth-century

[195] George Boole, "[The Glories of This Visible World]," in *The Poetry of George Boole*, ed. Desmond MacHale (Lulu.com, 2020), ll. 6–7.

[196] George Boole, "Sonnet 3," in *The Poetry of George Boole*, ed. Desmond MacHale (Lulu.com, 2020), ll. 1–2.

poetic mutilation—or perhaps more aptly cannibalization, given that the mnemonics that enables these garbled recitations were themselves poetic verses, ones that relied heavily on nonsensical associative sonic connections to perform recall. Reminiscing in 1873, architect William Tite recalled: "some rather dull looking boys gave us poetical illustrations from (I think) Pope. They recited a poem, beginning at the beginning, and then said it backwards, beginning at the end."[197] This performative dismemberment of poetry was enabled by the mechanical recall of unmeaning sonic resonances such as sing-song rhyme and puns, and the choice of Pope's work is therefore quite ironic (or perhaps deliberately provocative).

In 1711, Pope's *Essay on Criticism* set a critical standard for the poetic relationship between sonic resonance and semantic meaning that persisted from the early eighteenth century through the New Criticism. His famous epigram proclaims: "'Tis not enough no Harshness gives Offence, / The *Sound* must seem an *Eccho* to the *Sense*."[198] Pope asserts that sound should always hold a mimetic and subordinate relationship to sense. As demonstrated by the balanced heroic couplet that serves as the exemplificatory medium for his message, sound must support and underscore the line's thematic meaning—it should never become coeval, much less dominant. Pope's prosodic theory views sound as an echo intended to deepen and enrich a line's sensical meaning, with the goal of producing a tidily balanced form of poetry where every rhymed unit is both complete unto itself and (somewhat paradoxically) intimately connected back to the holistic text. This poetic model of recall aided by rhyme structurally mirrors the associationist model of memory proposed by David Hartley, as discussed in chapter one through Coleridge's critiques.

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[197] William Tite, "Von Feinagle and Dr. Gray," *Notes and Queries*, 4, 11 (March 29, 1873): 258.

[198] Alexander Pope, *An Essay on Criticism*, 1st ed. (London: W. Lewis, 1711), lines 364–65.

Rhyme, as the most pronounced sonic component of poetic verse, is the most important element within this formulation. As W. K. Wimsatt's classic 1944 essay "One Relation of Rhyme to Reason" argues, the "sameness of the rhyme sound as a binding force" is crucial to the "fusion between sound and sense" that represents Pope's prosodic ideal.[199] Of course, not just any rhyme will suit: as Matthew Campbell elucidates, "consonance of rhyme is not enough in itself, rhyme must reason, mere taste must give way to sense."[200] In Pope's figuration, Wimsatt explains, rhyme is supposed to represent the "wedding of the alogical with the logical," in which "the words of a rhyme, with their curious harmony of sound and distinction of sense, are an amalgam of the sensory and the logical." By conjoining harmonizing sound and sense, rhyme holds the unique ability to transform mere prose into a poetic "art of words" replete with "aesthetic value." Such a balancing act requires a masterful treatment of rhyme words that plays upon disparities without grossly exploiting them, in order to produce "witty, epigrammatic, intellectual"[201] verse rather than childish singsong or low doggerel (such as Byron's pairing of "intellectual" with "hen-peck'd you all" in *Don Juan* for comedic effect, for example).[202]

Following Pope, many of the Scottish Common Sense critics explicitly commented upon the importance of sound in providing a basic level of formal cohesion that imbued it with a level of memorability not present in prose. James Beatie observed, "Verse is more easily remembered than prose, because the words are related in measure as well as sense; and rime than blank verse, because

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[199] W. K. Wimsatt, "One Relation of Rhyme to Reason: Alexander Pope," *Modern Language Quarterly* 5, no. 3 (September 1, 1944): 335.

[200] Matthew Campbell, "Rhyme," in *The Oxford Handbook of Victorian Poetry*, ed. Matthew Bevis (Oxford: Oxford UP, 2013), 76.

[201] Wimsatt, "One Relation of Rhyme to Reason: Alexander Pope," 337, 328.

[202] George Gordon Byron, *Don Juan*, 1st ed. (London: Thomas Davison, 1819), 1.22.8.

the words are related not only in sense and measure, but also by similar sounds at the end of lines. And, in general, elegant and harmonious language is better remembered, that what is harsh and incorrect."[203] Likewise, Maria Edgeworth asserted that the "regular recurrence of sounds, at stated intervals, much aids us. In poetry the rhymes, the cadence, the alliteration, the peculiar structure or the poet's lines, assists us. All these are mechanical helps to the memory."[204] Whatever Coleridge thought of the other elements of Pope's neoclassical style—considered by the Romantics, in the words of Francis Jeffrey, as guided by an insipidly "classical" and "polite" French taste that "clipped and trimmed" the "wings of our English Muses"—he nonetheless integrated Pope's valorization of the intricate intertwinement between sound and meaning into his own theory of poetic organicism.[205] He declared, "*The sense of Beauty subsists in simultaneous intuition of the relation of parts, each to each, and of all to a whole.*"[206] Likewise, in a December 1812 lecture at the Surrey Institution, Coleridge elaborated: "The Spirit of Poetry like all other living Powers, must of necessity circumscribe itself by Rules, were it only to unite Power with Beauty. It must embody in order to reveal itself; but a living Body is of necessity an organized one—& what is organization, but the connection of Parts to a whole, so that each part is at once End & means!"[207]

Building on these neoclassical and Romantic formulations, Victorian critics explicitly theorized the proper relationship between sound and sense as one that essentially made the poem

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[203] Beattie, *Elements of Moral Science*, 1:97.

[204] Edgeworth and Edgeworth, *Practical Education*, 72–73.

[205] Francis Jeffrey, review of *The Dramatic Works of John Ford*, by Henry Weber, *The Edinburgh Review*, no. 36 (August 1811): 278.

[206] Samuel Taylor Coleridge, "Essays on the Principles of Genial Criticism," in *The Collected Works of Samuel Taylor Coleridge: Shorter Works and Fragments, Part I*, ed. H. J. Jackson and J. R. de J. Jackson, vol. 11, Bollingen, LXXV (Princeton: Princeton UP, 1995 [1814]), 378.

[207] Samuel Taylor Coleridge, "Introduction to Lecture 8," in *The Collected Works of Samuel Taylor Coleridge: Lectures 1808-1819*, ed. R.A. Foakes, vol. 5 part 1, Bollingen, LXXV (Princeton: Princeton UP, 1987 [1811]), 493.

into a kind of mnemonic device. When properly balanced with sense, rhyme not only enhances a poem's aesthetic value, but aids memory by creating reverberances that conjoin disparate ideas, recuperating them by continuously weaving them throughout the poem's folds. Many Victorian critics went so far as to explicitly characterize poetry as a salubrious kind of mnemonic. The "real secret of poetry," one critic contended in 1866, is that it "is a *memoria technica*, an artificial memory. The regular recurrence of set sounds and the flow of measured words gave help to the thinker or repeater independently of the expressions, and made it able to be rehearsed more readily."[208] Likewise, in 1877 *The Dublin Review* explained that "verse was the earliest aid which the human mind made use of to register its ideas. Words are more easily remembered in the form of verse than of prose, because in verse the laws of association as regards sound are observed, and contrast, likeness, order, are all brought into play […]."[209] Just as the mind required ideas to be properly linked according to the laws of association in order to remember naturally, poetry's organic form relied upon the creation of proper sonic links that interwove with and nuanced textual sense. As Gillian Beer describes in her examination of Victorian poetry: "Rhyme aids recollection; it also brings things back. It creates memory within the poem, raising again words that might die out in the mind and straining them across lines as echoes, deformations, recurrences."[210] Matthew Campbell adds that the "echoing backwards and forwards movement of like sounds" interconnect "unlike sense," these sounds "linger in the ear as mnemonic and chronicle of duration."[211] This process of sonic

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[208] Philomathes [pseud.], "Does Poetry Decline with the Advancement of Civilization?," *The British Controversialist, and Literary Magazine* 1 (1866): 274.

[209] "Artificial Memory," July 1877, 179.

[210] Gillian Beer, "Rhyming as Resurrection," in *Memory and Memorials: From the French Revolution to World War One*, ed. Matthew Campbell, Jacqueline Labbe, and Sally Shuttleworth (New Brunswick and London: Transaction Publishers, 2004), 191.

[211] Campbell, "Rhyme," 78.

reverberation through rhyme lends traditional verse forms the mnemonic qualities that separate them from prose writing.

While perfect balance between sound and sense represented the poetic ideal, many texts—or their readers—failed to live up to this standard. On the one hand, if sense overtook sound, the result was the transformation of poetry into dull prose. Jane Austen satirizes this phenomenon in *Sense and Sensibility* (1811), when Eleanor's would-be admirer Edward fails her sister Marianne's marriageability test by reading Cowper too dully. Marianne laments, "how spiritless, how tame was Edward's manner in reading to us last night! […] To hear those beautiful lines which have frequently almost driven me wild, pronounced with such impenetrable calmness, such dreadful indifference! […] it would have broke *my* heart had I loved him, to hear him read with so little sensibility."[212] Edward's uninspired recitation of Cowper falls flat because he lacks the ability to understand how the poems' sonic and semantic elements create a rich aesthetic tapestry that becomes more than the sum of its parts. Although he literally understands the meaning of Cowper's poem—he reads tolerably enough to avoid attracting Eleanor's notice—he fails in the eyes of Romantic aesthete Marianne because he cannot perceive how the poems' sonic elements enhance and deepen its semantic descriptions. Thus, Cowper's lines are inappropriately "pronounced with such impenetrable calmness" rather than with "all the musical talents" and "sensibility and spirit"[213] that Willoughby passionately demonstrates. Edward's fails to perceive how the poem's musicality contributes to its organic unity; unlike Marianne, he cannot see how this harmonic synergy drives the poem's emotive force.

[212] Jane Austen, *Sense and Sensibility*, 1st ed., vol. 1 (London: T. Egerton, 1811), 37.

[213] Austen, 1:112–13.

If, on the other hand, sonic play was allowed to take over, the result was not poetry, but—in Joseph Addison's phrase—"a Sound, and nothing but a Sound."[214] Although all forms of doggerel sound-play that preferenced sing-song resonances over an expertly-crafted balance between sound and sense were subject to increased scrutiny, none was moreso, Addison declared in *The Spectator* in 1711, than that "Jingle of Words" that goes by "the general Name of *Punning*."[215] Puns, also known as paronomasia, deliberately play upon the slippage between word and sound to create witticisms. For our purposes, it is helpful to categorize them based on four kinds of linguistic and visual slippages: (1) homophones—same sounds but different meanings, like *hair* and *hare*; (2) homographs—same spelling but different sounds, like *read* and *read*); (3) homonyms—same spelling and sound are alike, but different intended meanings, like *bat* (animal) and *bat* (baseball); and (4) visual puns.[216] Of course, these components of nonsense—often found in poetic riddles and enigmata, such as those found in the tenth-century Exeter book—were a popular genre in Anglo-Saxon literature; and critical consternation over the potential duplicitousness of rhyme and puns are as old as the forms themselves (as the very etymology of the term 'doggerel,' which derives from the Middle English term *dogge* (dog), suggests).[217] As Joan Ferrante explains in a discussion of Dante's verse, it had long been recognized that "Rhymes are a demonstration of skill, but they can also reveal the dangers in human cleverness" because they "combine harmony of sound with confusion in meaning."[218]

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[214] Joseph Addison, "No. 60 (9 May 1711)," in *The Spectator*, 2nd ed., vol. I (London: S. Buckley, 1713), 236.

[215] Addison, 234.

[216] Leo Spitzer provides an etymological account of the word *pun* from the seventeenth century. See Spitzer, "Pun," *The Journal of English and Germanic Philology* 49, no. 3 (1950): 352–54.

[217] "Doggerel," in *The Oxford English Dictionary* (Oxford: Oxford UP, March 2023).

[218] Joan Ferrante, "A Poetics of Chaos and Harmony," in *The Cambridge Companion to Dante* (London: Cambridge UP, 1993), 172.

Recognizing and often playing upon this duality, Renaissance poets had regularly used puns in both serious and comedic situations. Think, for example, of Mercutio's dying speech: "Ask for me tomorrow, and you shall find me a grave man."[219] But beginning in the eighteenth century, the neoclassical emphasis on achieving the proper balance between poetic sound and sense led to increased scrutiny about the use of puns and related forms of wordplay that indulged the sonic elements of verse over its semantic meaning (incidentally, the modernist rejection of Pope's critical framework also included a revival of this older usage).[220] Thus Scottish Common Sense philosopher George Campbell's 1776 *Philosophy of Rhetoric* ranked paronomasia and puns as the two lowest forms of humor because "the wit here is so dependent on the sound."[221] Eighteenth-century commentators saw the dissonance created by puns not just as instances of uncouth humor, but as a treacherous disconnect with serious implications for the stability and veracity of text. Pope's "Peri Bathos" registers this anxiety over the textual instability produced by puns: "But for Variation and Confusion of Objects, nothing is more useful than the PARANOMASIA, or PUN, where a *Word*, like the *Tongue* of a Jackdaw, speaks twice as much by being *split*."[222] Samuel Johnson, for example, laments that a writer as great as Shakespeare at times sacrificed the pursuit of poetic excellence to indulge in the low, senseless play of "mere sound."[223] Comparing these diversions to a will-o'-the-wisp, he writes that a "quibble" (a synonym for a pun) "is to *Shakespeare*, what luminous vapours are

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[219] William Shakespeare, *Romeo and Juliet* (London: John Danter, 1597), 3.1.93-94.

[220] Cook explains, "Modernist poets (e.g., T. S. Eliot, Wallace Stevens) used paronomasia for serious effects, reviving the concept of *serio ludere*." See "Paronomasia," in *The Princeton Encyclopedia of Poetry and Poetics*, ed. Roland Greene et al., 4th ed. (Princeton: Princeton UP, 2012), 1003.

[221] George Campbell, *The Philosophy of Rhetoric*, 1st ed., vol. 1 (London: W. Strahan and T. Cadell, 1776), 56.

[222] Alexander Pope, "Peri Bathos: Or, the Art of Sinking in Poetry," in *Miscellanies*, by Alexander Pope et al., 1st ed., vol. 4 (London: B. Motte and C. Bathurst, 1728), 53.

[223] Samuel Johnson, *The Works of Samuel Johnson: The Lives of the Poets*, vol. 7 (London: G. Offor, 1818), 405.

to the traveler; he follows it at all adventures, it is sure to lead him out of his way, and sure to engulf him in the mire. It has some malignant power of his mind, and its fascinations are irresistible. […] A quibble poor and barren as it is, gave him such delight, that he was content to purchase it, by the sacrifice of reason, propriety and truth."[224]

This view continued into the nineteenth century, when commentators continued to express real consternation at "how dearly Shakespeare loved a pun," so much so that "at times, its attractions are irresistible to him."[225] Rather than analyzing the rich textual complexities produced by the "clashing between sound and sense" in Shakespeare's puns (as would be the critical impulse today), these commentators heaped ire on such unfortunate indulgences, viewing them as blemishes that tarnished the excellence of otherwise-masterpieces.[226] Summarizing the standard critical perspective on Western rhyme in the *Princeton Encyclopedia of Poetry and* Prose, Terry V.F. Brogan and Stephen Cushman stress, "It is essential that the definition [of rhyme] not be framed solely in terms of sound, for that would exclude the cognitive function."[227]

But as nineteenth-century commentators built on the prosodic tradition begun by Pope, they increasingly did just that. Focusing on puns and adjacent kinds of sound-heavy wordplay like singsong rhyme, these critics represented such literary elements not just as a clash between sound and sense, but as the complete overtaking of sonic play at the total expense of meaning. Often using the familiar terms of the Industrial Revolution, many expressed their distaste for this kind of poetic

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[224] Samuel Johnson, Preface to *The Plays of William Shakespeare*, by William Shakespeare, ed. Samuel Johnson, vol. 1 (London: J. and R. Tonson, 1765), xxiii.

[225] Horace Howard Furness, notes to *The Merchant of Venice*, by William Shakespeare, ed. Horace Howard Furness, vol. 7, New Variorum Edition of Shakespeare (Philadelphia and London: J.B. Lippincott & Company, 1888 [1600]), 192 nt. 38.

[226] Richard Green Moulton, *Shakespeare as a Dramatic Artist*, 3rd ed. (Oxford: Clarendon Press, 1893), 346.

[227] Stephen Cushman and Terry V.F. Brogan, "Rhyme," in *The Princeton Encyclopedia of Poetry and Poetics*, ed. Roland Greene and Stephen Cushman, 4th ed. (Princeton: Princeton UP, 2012), 1184.

imbalance by characterizing sound-based experimentation as a low, mechanical, automated form of rhyming. They objected most voraciously to the use of puns, asserting that their insularity and arbitrary slipperiness produced pure nonsensical soundbites that challenged the poem's creation of holistic meaning. For example, Godfrey Turner suggested that the increasingly mechanical nature of nineteenth-century verse had caused an upsurge in puns by disregarding the balance of sound and sense, lamenting: "We have fallen into a mechanical, engine-turned method of versification, alternatively with loose habits of rhythm and rhyme." He argued that this devolvement had caused an unfortunate proliferation of puns, which have "no *point*" because "the sound is senseless."[228]

Brander Matthews similarly decried the use of false rhymes because they forced the reader "to bestow a momentary consideration on the mechanism of the poem, when we should have preferred to reserve all our power to receive the beauty of its spirit."[229] According to Matthews, this destabilizing and artificial rupture of the poem's organic flow ran afoul of the "principle of economy of attention" theorized by Grant Allen, which "demands that in serious verse the rhyme must be not only so accurate as to escape remark, but also wholly unconstrainted. It must seem natural, necessary, obvious, even inevitable, or else our minds are wrested from rapt contemplation of the them to a disillusioning consideration of the sounds by which it is bodied forth."[230] Matthews characterized the loss of attention as a kind of intellectual tariff: "Whenever a poet cheats us of our expectancy of perfect rhyme, he forces us to pay exorbitant freight charges on the gift he has presented to us."[231] False rhymes intrusively force the unwanted "sudden discovery of relations in

[228] Godfrey Turner, "Rhyming and Punning," in *Cassell's Family Magazine*, vol. 5 (London, 1888), 238.

[229] Brander Matthews, "An Enquiry as to Rhyme," *Longman's Magazine* 32, no. 191 (September 1898): 455.

[230] Matthews, 456.

[231] Matthews, 453.

language"[232] upon the reader, disrupting the illusion that poems are pure organic forms. Inauthentic sound-play crudely calls attention to the poem's mechanicity.

This trend towards experimenting with nonsensical sound was not a trivial matter of literary style: these critics argued that such wordplay was not only poetically cheap, but morally dangerous. George Campbell warned that such sound-play came dangerously close to untruth: "equivocal terms ought ever to be avoided, unless where their connection with the other words of the sentence instantly ascertains the meaning."[233] Others more explicitly equated the polysemic nature of punning and sound-play to sexual immorality. Likening the poetic bonds of rhyme to marriage, Brander Matthews compared the "arbitrary matings" of half-rhymes such as "*river* and *ever*, *meadow* and *shadow*" to extramarital affairs: "it is as though," he retorts, the kind of poet who would enter into such unorthodox relations "did not object to the bonds of matrimony, but appreciated also the occasional advantages of free love."[234] The writer of an anonymous article in the conservative periodical *Blackwood's* summarized this position even more bluntly: "puns are the result of the Fall, and the fruit of the forbidden tree."[235] Discussing puns at a lecture at the Royal Institution, moral philosopher Sydney Smith passionately exclaimed, "the feeling of the ridiculous produces an immense effect upon human affairs. It is so far from being powerless or unimportant, that it has a strong tendency to overpower even truth, justice, and all those high-born qualities which have lawful mastery of the human mind." Smith likened the attempt to eradicate such wordplay to a kind of religious Crusade, urging learned critics to exterminate it at all costs: "The wit of language is so

[232] Smith, "Lecture XV: On the Beautiful, Part III," 130.

[233] Campbell, *The Philosophy of Rhetoric*, 1:251.

[234] Matthews, "An Enquiry as to Rhyme," 33.

[235] "Drama," *Blackwood's Edinburgh Magazine*, American edition, 42 (February 1856): 212.

miserably inferior to the wit of ideas, that it is very deservedly driven out of good company. […] it is a radically bad race of wit. By unremitting persecution, it has been at least got under, and driven into cloisters,—from whence it must never again be suffered to emerge into the light of the world."[236]

Many writers felt that the creation of rhyming dictionaries were to blame for the rise of mechanical rhymes and the punning 'false wit' they produced. Such books, most notably John Walker's popular *Rhyming Dictionary* (1775), enabled writers to easily choose words based foremost on sounds, subordinating semantic meaning to sonic resonance. Rather than celebrating Walker's ingenuity, most critics dismissed rhyming dictionaries as childish contrivances fit only for novices and frauds. For example, Isaac Disraeli asserted: "A dictionary of rhyme is as miserable a contrivance to assist a verse as counting the syllables by the finger is to regulate the measure; in the case of rhyme it is sense which should regulate the verse and in that of metre it is the ear alone which can give it melody. Looking back from 1841, Disraeli characterized the creation of the rhyming dictionary as the unfortunate product of the general predilection for innovative new rhymes during the late eighteenth century. He stated: "This torture of rhyme-finding seems to have occasioned a general affliction among modern poets; and an unhappy substitute was early found in arranging collections of rhymes, and which subsequently led to a monstrous device."[237]

Such aids made it too easy for anyone to write verse. Tom Hood wrote in 1877 that "a *poet* may well be allowed to effect the compromise of sacrificing a rhyme for a thought; but the versifier (for whom Walker's book is meant) must have no such license. He must learn to walk before he runs. […] Walker's book being simply mechanical should have been confined to the correct

[236] Smith, "Lecture XV: On the Beautiful, Part III," 114, 131.

[237] Isaac Disraeli, *Amenities of Literature*, ed. Benjamin Disraeli, 2nd ed., vol. 2 (London: Routledge, Warne, and Routledge, 1863), 38.

machinery of verse, and imagination should have been allowed to frame for itself the licenses, which it would not dream of seeking in a handbook."[238] Tennyson, who abandoned his copy of Walker's *Dictionary* early on because he felt that "there was no natural congruity between the rhymes thus alphabetically grouped together,"[239] seems to have supported this view. As Adam Mazel argues, "What makes words linked by similar sound seem 'naturally congruous,' rather than artificial or mechanical, Tennyson assumes, is that those words are linked not just by shared sound but also by a shared sense in the context of the poem; the intentions of the poet and the sense of a poem, not an artificial, mechanical contrivance like a dictionary, should produce the choice of rhyme words. Tennyson, in other words, feared that rhyming dictionaries made rhyme into an abstraction because they divorced rhyme from the requirements and constraints of the poem and the desires of the poet."[240] The ease with which rhyming dictionaries enabled this automatic and semantically arbitrary form of versification seemed to accelerate such disturbing poetic trends.

The nonsensical emptiness of this kind of verse made it fit only for consumption by children, the working classes, and the insane. As Sydney Smith remarked, "Children will go on for ten minutes together, repeating a rhyme, merely delighted with the sameness of the sound: so will mad people. I have seen laborers and common people in the country, quite delighted with the accidental discovery of a rhyme; it has appeared to have very much the same effect upon them as wit."[241] Likewise, another stated: "The quantity of rhyme with which our age abounds proves the

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[238] Tom Hood, *Practical Guide to English Versification*, 2nd ed. (London: John Hogg, 1877), 20.

[239] Francis Turner Palgrave, "Personal Recollections by F. T. Palgrave," in *Alfred Lord Tennyson: A Memoir by His Son*, ed. Hallam Tennyson (London: Macmillan, 1897), 496.

[240] Adam Martin Mazel, "The Work and Play of Rhyme in Victorian Verse Cultures, 1850–1900" (Ph.D. Dissertation, Ann Arbor, University of Michigan, 2014), 13.

[241] Smith, "Lecture XV: On the Beautiful, Part III," 205.

decline of true poetry. So low as the opinion got of what poetry is, that everybody versifies. Poets in the old times were prophets and teachers. […] Now the poet is condemned and his teaching is laughed at; for every haberdasher's apprentice, every factory girl, every shoemaker's boy, or guide of a sewing machine manufactures verse, and claims the sacred name and holy form of poet."[242] Oliver Wendel Holmes's *A Moral Antipathy* (1885) satirizes this view: a snobbish aesthete professor of belle-lettres complains, "I recognize the tendency to rhyming as a common form of mental weakness. […] Just now there seems to be an epidemic of rhyming as bad as the dancing mania, or the sweating sickness. After reading a certain amount of manuscript verse one is disposed to anathematize the inventor of homophonous syllabification. […] We have rhyming dictionaries,—let us have one from which all rhymes are rigorously excluded."[243] In this tradition, poetry that focused unduly on sound-play was undesirably structured by the arbitrary sounds of words, rather than by dynamic creative ideas forged by the poet's imagination. In the eyes of mainstream prosody critics, this form of arrangement gave it a cheapened mechanical quality.

Nowhere was the arbitrary, mechanical, nonsensical nature of punning more extreme than in nineteenth-century mnemonics discourse, in which many of the systems that gained popularity relied upon strings of symbols, linked by puns and arranged in verse, to produce recall. In the context of poetry debates about nonsense and puns, the widespread popularity of Victorian artificial memory systems represented a threat because it offered not just a new mechanical form of recall that was considered philosophically dangerous (as the last chapter argued), but also because it created an experimental form of poetry built upon the revelatory exploitation of puns and sonic nonsense.

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[242] Philomathes [pseud.], "Does Poetry Decline with the Advancement of Civilization?," 277.

[243] Oliver Wendell Holmes, *A Mortal Antipathy: First Opening of the New Portfolio* (Boston: Houghton Mifflin, 1885), 292–93.

Elizabeth Sewell remarks in *The Field of Nonsense* that "Puns […] are a safe enough game for Nonsense, because they are real portmanteaux, where two meanings are distinct but are incongruously connected by an accident of language formation."[244] Mnemonic puns, which are both linguistic-numeric and sonic-semantic portmanteaux, represented sonic nonsensicality taken to the absolute extreme. With mnemonics, "The whole principle by which these associations are effected is that Universal Analogy, by which the world is filled with similitudes, and linked in unity in an infinite variety of ways; they are otherwise arbitrary and partial methods only, not at all philosophical, nor logical."[245] In place of logic, artificial memory systems substituted sonic resonances and puns. Creating these kinds of mnemonic chains necessitated "neglect[ing] the association of facts and events with their causes and the history of their evolution" and instead "look[ing] for unessential quips, puns, or accidental suggestions with a view of strengthening the memory."[246] Critics viewed the "miserable horde of puns" produced by such systems as "equally superfluous and disgusting."[247] Victorian mnemonics engaged in an intense degree of arbitrary sonic play, inviting strange associations that seemed to threaten the very foundations of poetic form. In this context, it make sense that critics of mnemonics systems attacked them using an understanding of balanced sound and sense explicitly drawn from Alexander Pope's prosodic theory. An 1832 review in *Athenaeum* stated: "To all such [Memoria Technica] we have a decided objection, the cultivation of irrational memory is injurious to the mental faculties: to make students learn what is either unintelligible or

[244] Elizabeth Sewell, *The Field of Nonsense*, 1st ed. (London: Chatto and Windus, 1952).

[245] George Field, *The Logic of Analogy; or, the Third Organ Proposed* (London: David Bogue, 1850), 190.

[246] Horace S. Tarbell et al., "Report of the Committee of Fifteen on Elementary Education" (New York, Cincinnati, and Chicago: National Educational Association, 1895), 84–85.

[247] "Feinaigle and Grey's Artificial Memory," *The Quarterly Review* 9, no. 17 (March 1813): 132.

nonsensical, is to teach them to become contented with parrot-knowledge—to be satisfied with the sound and regardless of the sense."[248]

This intense vitriol was perhaps provoked by the innate, ancient connection between poetry and mnemonics. As virtually every artificial memory treatise from the period reminds its readers, not only did sound-play make poetic verse inherently mnemonic, but mnemonics, from their first genesis, had always been poetic objects—the first system of artificial memory being the invention of a classical Greek poet, Simonides of Ceos. The potential for aesthetic creativity inherent in mnemonic systems made this task attractive for those who were inclined to take initiative. Feinaiglian systems only imbued consonants with mnemonic meaning, and therefore provided ample space for the memorizer to exercise aesthetic choice in selecting words that fit into the imagined narrative of the mnemonic tableau. In some sense the process of mnemonic creation works like a fixed-sequence anagram; while the order of the mnemonic letters cannot be reversed, all other letters in the possible carrier words can. Even in Richard Grey's system, which specifies vowels as well as consonants, the fact that two letters are attached to every digit gives the mnemonic creator artistic license to create technical verses that speak to her own conception of the encoded information. These constraints are no more innately stringent or unusual than the requirement that a poetic line adhere to a certain number of accentual syllables per unit or follow other kinds of formal limitations.

Many mnemonicians recognized this opportunity for poetic creativity, directly encouraging memorizers to approach the task of producing mnemonics like a poet would. For example, this passage from Theodore Dwight's 1844 *Mnemonics, or, The New Science of Artificial Memory* reads like a poetry manual:

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[248] review of *The Classical Scholar's Guide*, by Richard Carr, *The Athenaeum*, no. 230 (March 24, 1832): 191.

> The first materials of a poetic edifice are to be found in metaphors, allegories, and in various kinds of fiction; and it is thus all images, comparisons, allusions, and figures, particularly those which personify moral subjects, concur in adorning such a structure. When these images are reduced into verses the ear is delighted to a high degree, and the mind insensibly repeats them while the eye reads them. This is particularly the case with rhyme. Cadence, harmony and especially rhyme, afford the greatest assistance to the memory that art can invent; and the images, or poetic fictions, that strike our sense, assist in engraving them deeply on our minds.[249]

Dwight's treatise instructs the viewer to begin with the literary goal of creating imagistic poetry, but then to transform the text into a mnemonic by condensing these "images" into nonsense sound that is unintelligible to the mind but catchy to the ear.

Schoolmaster Joseph Broader's visual mnemonics book *A New System of Artificial Memory* (1827) exemplifies this process of transforming visual images into memorable nonsensical sounds by relying on mechanical phonetic relationships. Finding writing too slow for the "quickness of fancy," Broader created a pictorial mnemonic system to represent historical information, as the "velocity of light seemed to approach the nearest" to the speed of the mind.[250] Visually, these magnificent proto-Surrealist drawings recall earlier nonsense artworks like Hieronymus Bosch's famous Renaissance triptych *The Garden of Earthly Delights* (c. 1495–1505)—note, for example, the horizontal subdivision of Broader's drawing into three sections, which fittingly flips the traditional triptych form sideways.

A New System of Artificial Memory presents a series of visual mnemonics that represent the history of the world from the seventh century BCE until the nineteenth century (up to 1827), with each drawing representing one century. Each picture includes decade segments at the top and bottom, and the mnemonic symbols occur roughly around the date they occurred, although some images span multiple decades for reasons that appear more aesthetic than historical. Importantly,

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[249] Theodore Dwight, *Mnemonics, or, the New Science of Artificial Memory* (New York: James Mowatt, 1844), 68.

[250] Joseph Broader, *A New System of Artificial Memory* (London: John Richardson, 1827), vi.

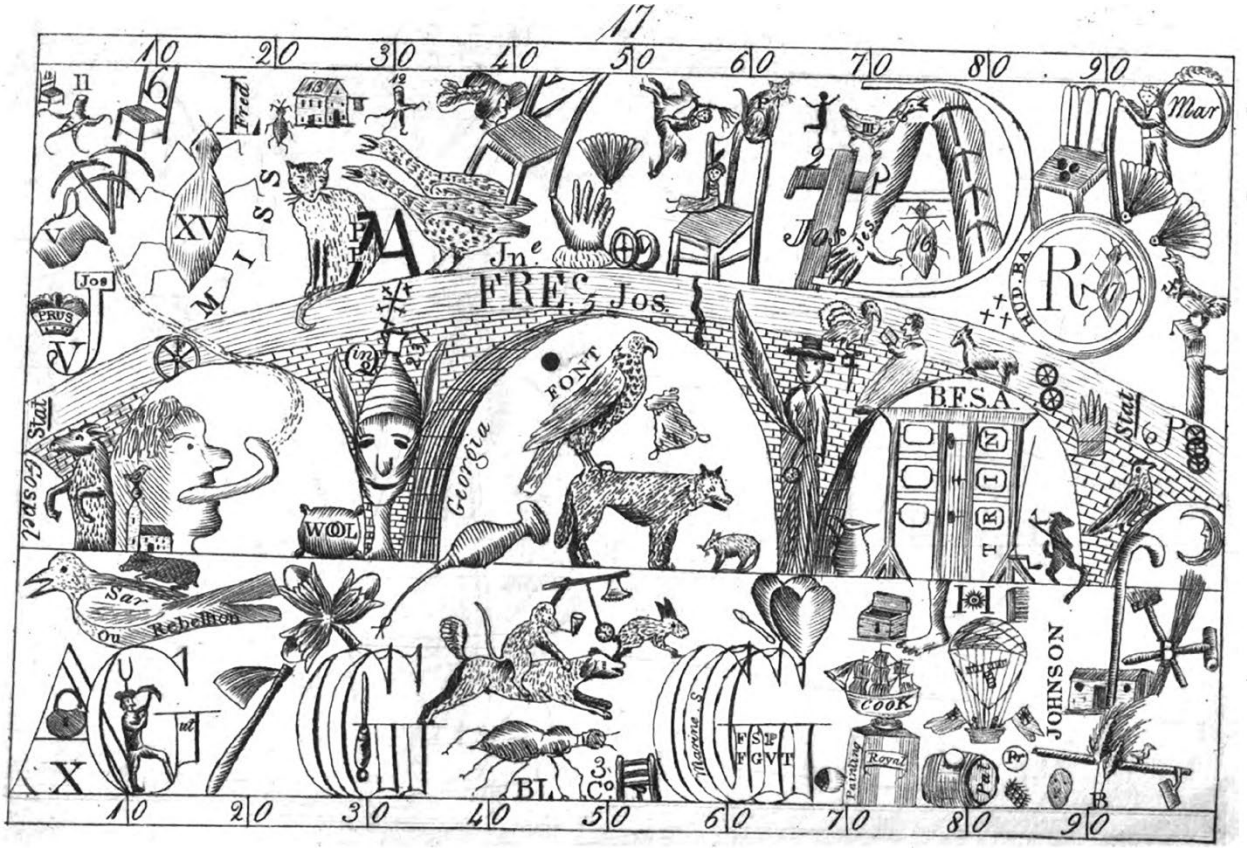


Figure 9: Mnemonic for the eighteenth century. Joseph Broader, *Plates to Accompany Joseph Broader's System of Artificial Memory* (London: John Richardson, 1827), n.p.

some images are compressed multivalent symbols that encipher more than one fact. Broader's book provides a brief explanation for each century's mnemonic picture by chronologically listing the major political, cultural, scientific, and literary events encoded therein. As his mnemonic representing the Western history of the eighteenth-century exemplifies, Broader's mnemonics use puns, rhymes, and other homophonic echoes to create intricate mnemonic tableaux layered with multiple levels of meaning. For example, the bridge spanning the picture represents the beginning of construction on Westminster bridge in 1738 and the 1740 birth of *Cyclopedia* creator Ephraim Chambers, who "translated and abridged many works."[251] At times, the accompanying facts to the

[251] Broader, 286.

mnemonic picture that Broader lists appear to be purely chronological and lack any sonic or imagistic relationship to the mnemonic they are listed under, while at other times the mnemonic picture clearly compresses multiple historical entries into a single image.

Most of the images rely on sound resonances, although the choice of pictorial symbol also often indicates Broader's feelings towards the subject in question. For example, the symbol for the French kings ("Lewis") is always a louse. Similarly, the monkey 'aping' human behavior by riding the dog's back above 1740–50 signifies the 1745 Scottish rebellion led by the 'Pretender' Charles Stuart. The pipe in the monkey's mouth symbolizes the death of Alexander Pope in 1744, while his swiftness signifies the death of Jonathan Swift in 1745. Here Broader visually connects Pope and Swift to the rebellion because of Pope's Catholicism and Swift's Tory politics, reminding the viewer that both groups supported the Jacobite uprising. As the pipe/Pope connection suggests, most of the mnemonic associations rely upon sonic resonances, which vary in their directness. Some, such as the use of cat symbols for the Russian empresses Catherine the Great and Catherine II, are so direct they might be best characterized as abbreviations; others, like two gooses for Frederic Augustus II, rely on less direct homophonic puns. Broader's mnemonics produce passive recall by condensing multiple concepts into symbols that operate differently depending on the user's mechanical manipulation of them, meaning which puns or phonetic resonances she follows, based on the desired outcome.

I suggest that Broader's work provides an important precursor to the poetry of Edward Lear, which develops the slippage of sonic nonsense play between text and image to its fullest extent. Poetically, this emerging engagement with the dichotomy between the abstract and the material is important in that it links Victorian nonsense literature to major early twentieth-century traditions like sound poetry and visual poetry; computationally, I argue that it offers an early

engagement with the ontological questions surrounding the relationship between computing hardware and software. Although we are most familiar with this problem as it arises from Cartesian philosophy of mind (running from Descartes through modern thinkers like David Chalmers and Daniel Dennett), I propose that Victorian mnemonics and nonsense poetry show that an iteration of this thought tradition also specifically from within the Victorian mnemonic history of computing. This developing interest with examining the irresolvable tension between the material and the abstract that comes out of nonsense sound-play in these discourses provides a further mirroring of the engagements between physical and abstract technology. In this way, I suggest, the work of figures like Broader and Lear mirrors the developments taking place on the other end of the continuum I have identified, specifically the emerging understanding of the relationship between Babbage and Lovelace's physical Analytical Engine technology and Boole's development of his abstract symbolical algorithmic system.

Although the conceptualization of sound in both Lear's and Carroll's work deserves reconsideration, Lear's verse especially explores what Edmund Gurney later described as "the boundary, in Music so dangerously infinite, between sense and nonsense."[252] Sara Lodge's important study *Inventing Edward Lear* (2019) has recently reasserted the importance of music to his nonsense poetry, arguing as its central contention that "most of Lear's poems can best be understood as songs." Music played an immensely important role in his life: Lear was "an accomplished musician who regularly sang for private audiences and played on the piano, and in his youth also on the flute, the small guitar and the accordion."' This musical aptitude intimately shaped his poetical work, informing the themes he explored and the relational nature of his sonic play. Lodge explains, "For Lear, memory and sound are deeply intertwined. […] Lear's nonsense poems or songs are influenced

[252] Edmund Gurney, *The Power of Sound* (London: Smith, Elder, and Co., 1880), 303.

with the emotive power of musical return, both in the sense of internal reprise—repeated words, rhythms and rhymes—and echoes of other literary and musical works." [253] She interprets Lear's setting to music the verse compositions of his favorite poets—some of them his childhood "poet-heroes," like Percy Shelley and Lord Byron—and performing his adaptations for the poets themselves or for their descendants as guided by a broader critical and emotive gesture of memory: "Song-settings, for Lear, are tributaries that offer opportunities for swimming back to the course. They are a form of critical response and reconfiguration." Compositionally, Lodge argues that she explains, he "enjoyed the element of 'call and response' in songs, the opportunities they offered for acting, the power of sound as a force that precedes other kinds of sense." This investment in responsorial form and sound-play is inherently tied to the passive memory, to the mechanical, nonsensical, playfully parodic return of originally sincere meaning.

At the same time, Lear's work was also heavily invested in the visual aspects of language play. Lodge explains that "For Lear, word and image are not discrete entities with separate lives on the page, but organic branches with shared roots." This intertwined conception of the visual and sonic becomes even more apparent when one considers his life. Lear was an artist who progressed from making exotic zoological studies to working as a landscape painter, eventually achieving enough renown that he privately instructed Queen Victoria in 1846. He created "over ten thousand beautiful watercolours and some three hundred memorable oil paintings of scenes ranging from France, Italy and Greece to Jordan, Egypt and India." This investment in material artistry offers a harmony or counterpoint to the ephemeral aspects of his musical activities that together dually shape his nonsense poetry and, indeed, his self-identity. Sara Lodge notes that "He often signed himself with an *L* curling into the shell-shape of an ear: L-ear. It is a suggestive motif, the visual and

[253] Sara Lodge, *Inventing Edward Lear* (Harvard UP, 2019), 2, 21–22.

the aural becoming a single ideogram."[254] Much in the way that William Blake's poetry can only be understood when considering it as both text and image, it is equally important to consider Lear's poetry in the context of his musical performances as it is to engage with the visual drawings.

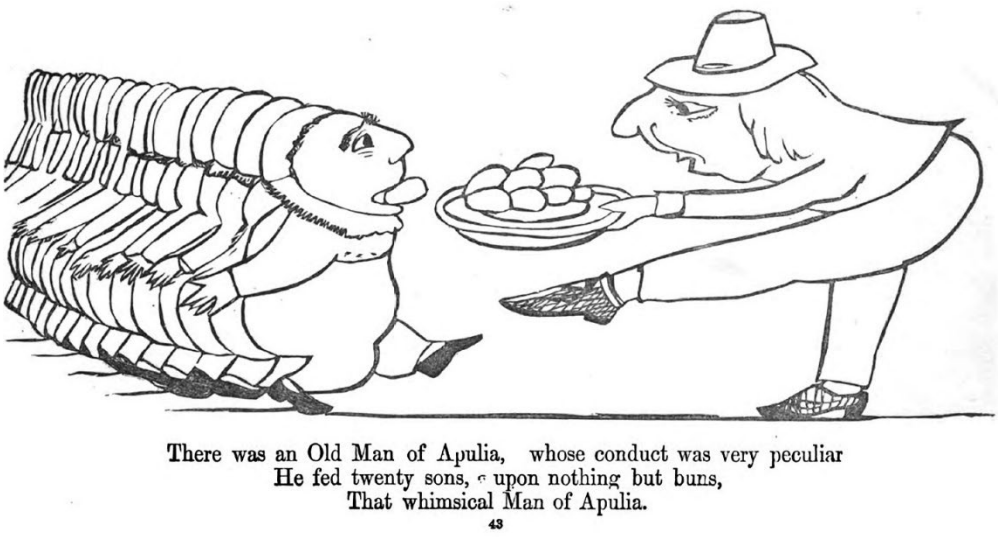


Figure 10: "There Was an Old Man of Apulia." Edward Lear, *A Book of Nonsense*, 8th ed. (London: Routledge, Warne, and Routledge, 1862), 43.

Much of Lear's work examines questions of memory, return, and nostalgia through this dual lens of the aural and the visual. For example, in a representative limerick from *A Book of Nonsense*, "There was an Old Man of Apulia," Lear represents the mechanical recall of his poem through the illustration, which features a vanishing line of leaping boys preparing to receive buns from their father. He underscores the seemingly infinite recursively of the synchronous line of boys—themselves a symbol of maximalist sexual reproduction—in the circularity of the buns, the plate, the man's circular hat, and the mirroring of the father's and son's leg positions. The visual effect approximates an infinite regress (note this effect—it will recur in the important final mnemonic scene from Alfred Hitchcock's *39 Steps*; as I will explore, the film is highly indebted to Lear's nonsense). As with all of the poems in the collection, the rhymes also demonstrate a mechanical circularity throughout: "There was an Old Man of Apulia, whose conduct

[254] Lodge, 24, 23, 3, 20.

was very peculiar / He fed twenty sons, upon nothing but buns, / That whimsical Man of Apulia."[255] Although the man's 'peculiar' behaviors locates the poem into the realm of the ridiculous from our external perspective, within the diegesis his actions make perfect sense according to the logic the story has set out. They only become nonsensical in reference to the extratextual environment. Even having feet that are green and hands that are blue and going to sea in a sieve, as the Jumblies do, is nonsensical in the sense that it could only happen in an outlandish fictional world. Lear emphasizes this point at the poem's close: despite the other characters' skepticism of the sieve's seaworthiness, the Jumblies successfully sail the globe and return in twenty years to gloat. They understand the logic of their fictional world; within the diegesis the rational naysayers are the nonsensical ones. Lear's poetry creates nonsensical worlds through the mechanical repetition of sounds and images that disrupt rational meaning, but in such a way that his systems of visual and aural symbol-play nonetheless exhibit internal consistency. In a structural sense, this formulation parallels the operations of Boolean logic, which likewise mechanically produces ideas without the use of the organic memory through the 'nonsensical' manipulation of abstract symbols in equations based on the desired end goal, rather than allegiance to a particular set of operations.

Despite this abstract structural resonance, Lear's poetry does not provide a full parallel for the experiments of Charles Babbage and George Boole taking place on the other side of the continuum because it does not engage with the mathematical questions that were central to these figures' investigations. However, the nonsense literature of Lear's contemporary Lewis Carroll importantly does. Edward Lear's poetry significantly developed the conceptual experimentation with sound-play drawn from contemporary mnemonic and prosodic discourses through his engagement with the abstract and material tension of nonsense play. I suggest that Carroll's work embodies the

[255] Edward Lear, *A Book of Nonsense*, 8th ed. (London: Routledge, Warne, and Routledge, 1862), 43.

most salient features of those experimentations and conjoins them with mathematical symbol-play in a manner that I suggest is directly informed by the structure of Boolean logic. In doing so, he bends the end of the continuum I have been describing back towards the corollary symbolic mathematical tradition that developed from the same starting point but in a different direction.

As is well known, Carroll—or more appropriately in this context, Charles Dodgson—was an Oxford mathematician who taught algebra, Euclidean geometry, and trigonometry.[256] What is much less well-known, even by most specialists, is that Dodgson held a deep lifelong interest in creating mathematical verse mnemonics, a pastime that formed part of his larger fascination with cryptography. His deep and longstanding interest in Greyian mnemonics spanned over forty years. Dodgson first recorded his intention to learn mnemonics in a December 1857 New Year's Resolution note; he created his last known mnemonic three months before his death in January 1898. After about fifteen years of using Richard Grey's system, in the mid-1870s Dodgson created his own dialect of *memoria technica.* As a brief reminder, Grey's original *memoria technica* system creates poetic strings of mnemonics by using a cipher to translate the numbers one wishes to remember into alphabetic letters. Then, one affixes these letters to an abridged version of the corresponding English term. This method creates a portmanteau word, where the prefix is a truncated English concept, and the suffix is a nonsense enciphered translation of numbers into letters. Traditionally, the user then strung together these half-gibberish 'technical words' and recited them aloud in dactylic hexameter, the classical epic verse form. For example, King Arthur's assumption to the throne becomes "Arth*laf*," where "laf" translates to 514.

[256] Francine F. Abeles, "Lewis Carroll's Ciphers: The Literary Connections," *Advances in Applied Mathematics* 34, no. 4 (May 2005): 697.

In general, we might assume that mnemonic poetry would resemble a kind of Surrealist chance operation, in which the verses are fully determined by the data. Grey's system does include a small amount of inherent creativity, in that one can choose between two different letters for every number. *Memoria Technica* provides some brief advice on the subject, urging the reader to select the nonsense letters that "by their Uncommoness are most likely to be remembered, or [have] any accidental Relation or Allusion […] to the Thing sought."[257] But Dodgson's *memoria technica* dialect drastically broadens the artistic scope of this unusual verse form, providing him much more opportunity for imaginative play with the numerical translations. He rearranged the cipher's letters, employed more modern rhyme schemes (usually alternating rhyme or couplets), and interspersed more null text between the enciphered mnemonic words. As Morton N. Cohen summarized: "the really significant difference between the two systems is that Dodgson turns *Memoria Technica* into a creative experience with literary overtones."[258]

As I described in the first chapter, the available information from newspaper accounts of mnemonics exhibitions and from the treatises themselves suggests that the average Victorian mnemonics user primarily used such systems to recall a wide variety of numerical information, from chronography, to conversions of

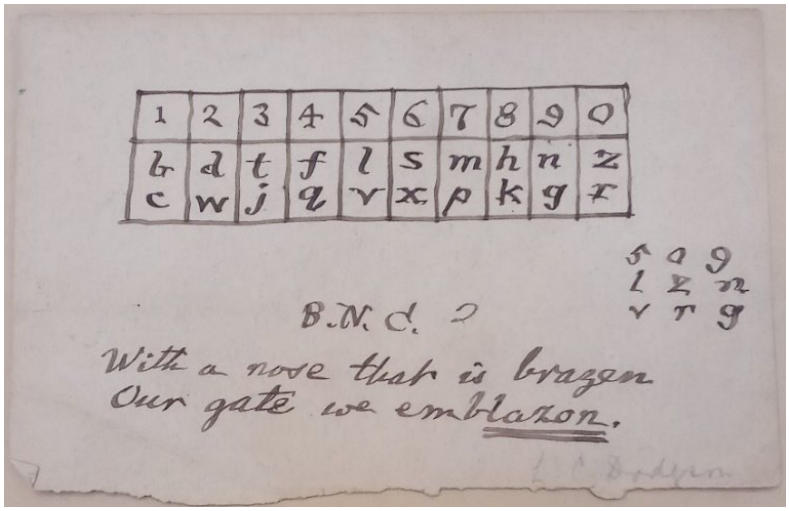
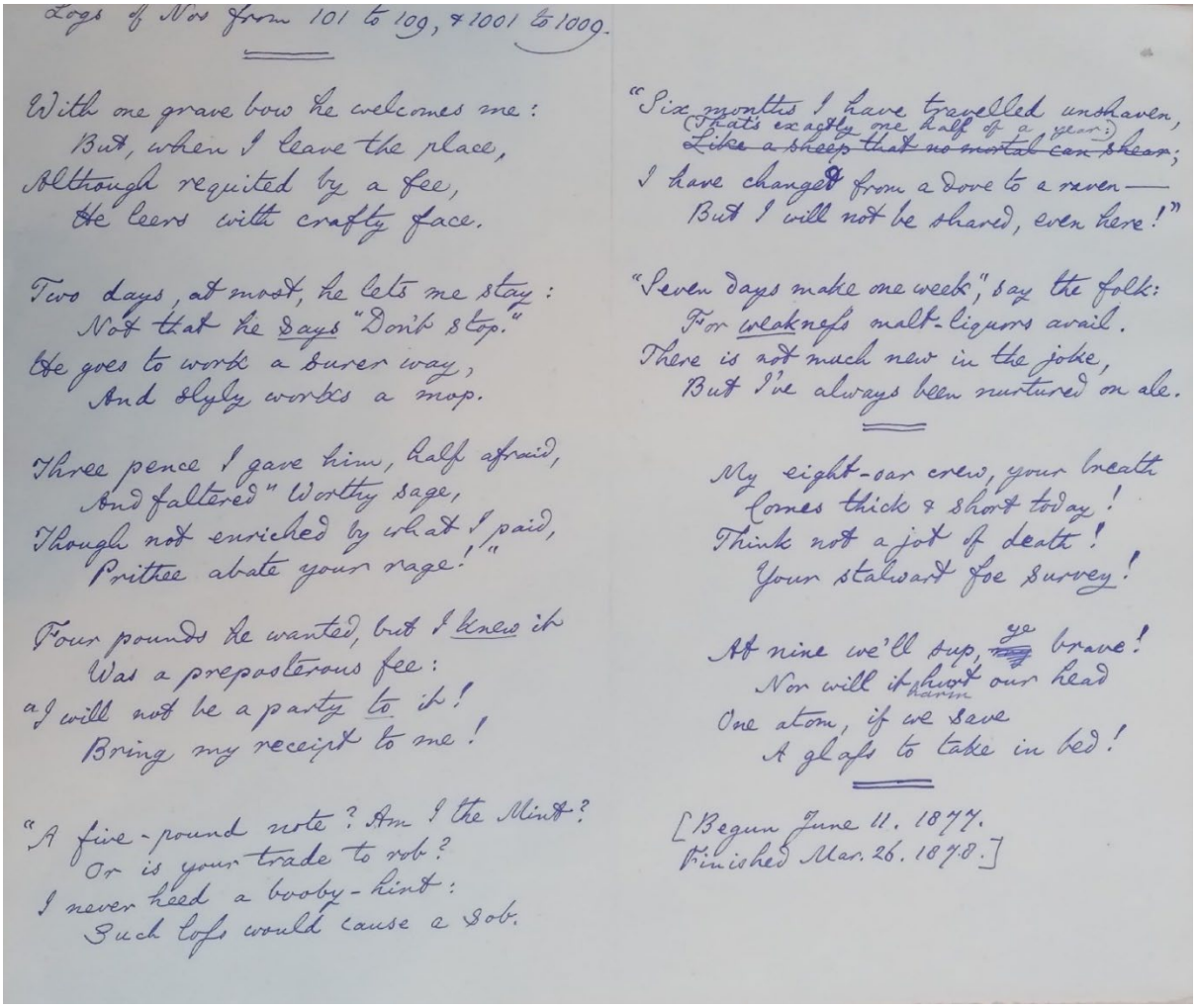


Figure 11: "B.N.C?" Charles Dodgson [Lewis Carroll], c. 1890s.
Reproduced by permission from the C. L. Dodgson Estate.

[257] Richard Grey, *Memoria Technica: Or, A New Method of Artificial Memory*, 1st ed. (London: Charles King, 1730), 4.

[258] Morton N. Cohen, "Lewis Carroll's Memoria Technica," *The Library Chronicle of the University of Texas at Austin*, no. 7 (Spring 1974): 83.

weights and measures, to the precise location of every word in a poem by line and word order. But Dodgson regarded mnemonics not just as a mental trick for recalling mildly interesting facts—although he did use them for that as well. For example, he created a mnemonic couplet series encoding the founding dates of every Oxford college late in life, during the 1890s, likely for use by students at the Oxford Girls' School. In the example shown here, "B.N.C." stands for Brasenose College, which was founded in 1509.


Logs of Nos from 101 to 109, & 1001 to 1009.

With one grave bow he welcomes me:
But, when I leave the place,
Although requited by a fee,
He leers with crafty face.

Two days, at most, he lets me stay:
Not that he says "Don't stop."
He goes to work a surer way,
And slyly works a mop.

Three pence I gave him, half afraid,
And faltered "Worthy sage,
Though not enriched by what I paid,
Prithee abate your rage!"

Four pounds he wanted, but I knew it
Was a preposterous fee:
"I will not be a party to it!
Bring my receipt to me!

"A five-pound note? Am I the Mint?
Or is your trade to rob?
I never heed a booby-hint:
Such logs would cause a sob.

"Six months I have travelled unshaven,
(That's exactly one half of a year;)
Like a sheep that no mortal can shear;
I have changed from a dove to a raven—
But I will not be shaved, even here!"

"Seven days make one week," say the folk:
For weakness malt-liquors avail.
There is not much new in the joke,
But I've always been nurtured on ale.

My eight-oar crew, your breath
Comes thick & short today!
Think not a jot of death!
Your stalwart foe survey!

At nine we'll sup, ye brave!
Nor will it hurt our head
One atom, if we save
A glass to take in bed!

[Begun June 11. 1877.
Finished Mar. 26. 1878.]

Figure 12: "Logs of Nos from 101 to 109, & 1001 to 1009." Charles Dodgson [Lewis Carroll], 1877–78. Reproduced by permission from the C. L. Dodgson Estate.

Especially earlier during the prime of his literary career in the 1870s, mnemonics primarily provided an occasion for Dodgson to write experimental sonic nonsense poetry that encoded numbers. Alongside his friend, Oxford physicist Robert Baynes, Dodgson created and employed poetic mnemonics that encoded numbers like π, the logarithms of 100–109 and 1001–1009 (shown here), and the logarithms of a series of decimals, among others. He used these mnemonics to rapidly compute extraordinary calculations, such as the value of any logarithm in five to eight minutes, the thirteenth root of the number 87654327 in nine minutes, and π^{π} in fourteen.[259]

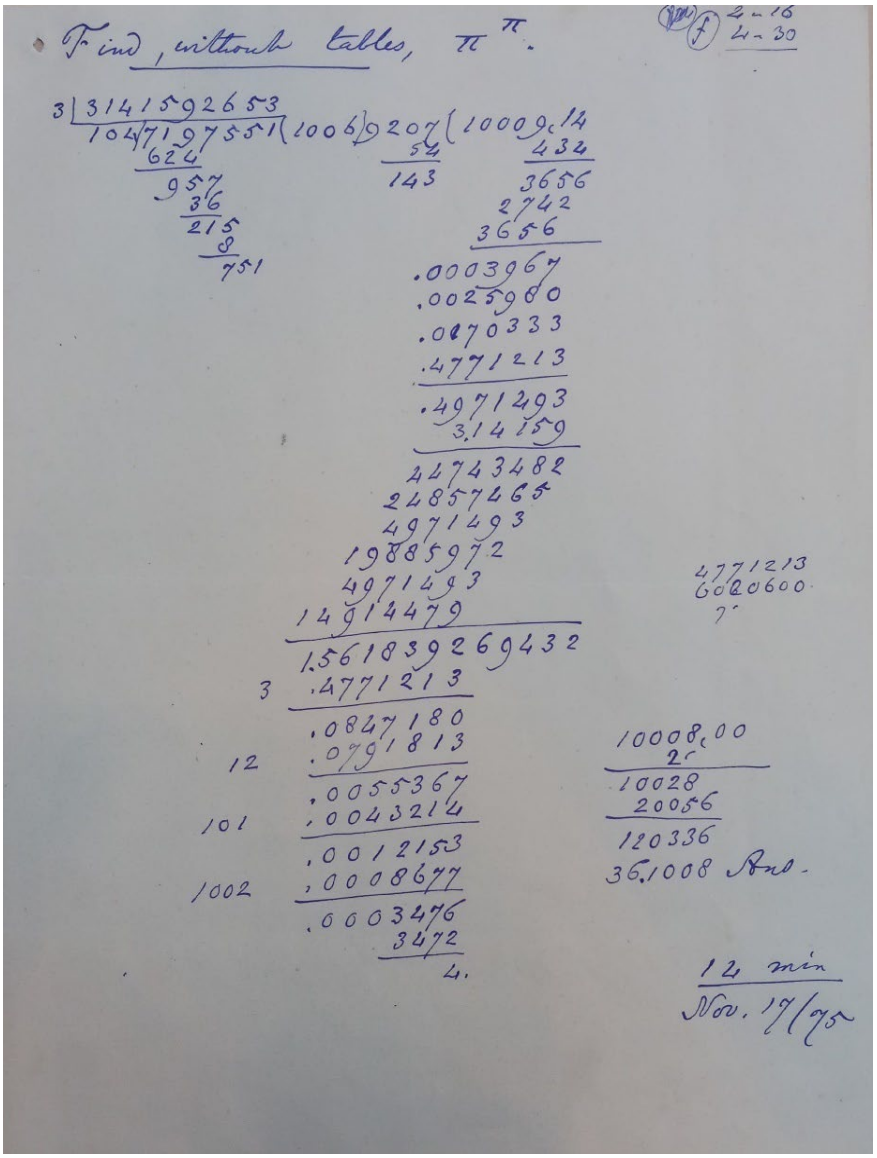


Figure 13: "Find, without Tables, π^{π}." Charles Dodgson [Lewis Carroll], 1875. Reproduced by permission from the C. L. Dodgson Estate.

Despite the exciting new dimensions that this imaginative poetical work brings to our understanding of his work and to the genre of

[259] Francine F. Abeles, "The Memoria Technica Cipher," *Cryptologia* 27, no. 3 (July 2003): 224.

Victorian nonsense poetry, nineteenth-century literary scholars have shown remarkably little interest in Dodgson's mnemonics. Morton N. Cohen and Edward Wakeling have briefly touched upon the subject, but most literary critics have gravitated towards humanistic topics like Carroll's treatment of childhood, philosophy, photography, and of course questions of sexuality. Historians of mathematics and cryptography, most notably Francine Abeles, have demonstrated slightly more interest in Dodgson's mnemonics, but understandably this scholarship has been more invested in the mathematical dimensions of these texts than the poetic elements. Unfortunately, the dual status of Carroll's mnemonics, which are both intricate mathematical and poetic objects, has plunged them deep into a modern disciplinary chasm. But despite this critical neglect, I suggest that Dodgson's mnemonic verses are hugely important—not only because they deepen our understanding of his larger corpus, and of Victorian nonsense in general, but also because they are a key touchstone within a revised history of computing that recognizes the theoretical role of Victorian nonsense poetry.

Many of the numbers Dodgson encoded in his intricate poetic mnemonics were the subject of the earlier debates about numerical nonsensicality, such as π and the irrational logarithms of prime numbers. Dodgson was well aware of these debates. He was friends with Augustus De Morgan, the experimentalist University of London mathematician who instructed Ada Lovelace, and whose public dispute with the Scottish philosopher William Hamilton (not to be confused with the Irish mathematician William Rowan Hamilton) inspired George Boole to write his paradigm-shifting *Mathematical Analysis of Logic*. De Morgan also, incidentally, anonymously reviewed several mnemonic treatises in the *Athenaeum* in 1849, 1862, and 1866. De Morgan kept up a large correspondence with 'circle-squarers'—mathematicians who attempted to exonerate π from the charge of nonsensicality by attempting to prove that it was actually a rational number. After De Morgan's death in 1871,

Dodgson took over this body of correspondence for De Morgan, arguing against these misguided notions and in support of π's irrationality and nonsensicality. He was also quite familiar, also at least in part through De Morgan, of the contemporary advances in symbolical algebra. For example, as Helena Pycior has pointed out, *Alice's Adventures in Wonderland* (1865) directly parodies a line from De Morgan's discussion of symbolic algebra in his textbook *Trigonometry and Double Algebra* (1849): "*with one exception*, no work nor sign of arithmetic or algebra has one atom of meaning throughout this chapter, the object of which is *symbols, and their laws of combination,* giving a *symbolic algebra*."[260] I suggest that we can see such examples of mathematical parody as doubles of Carroll's satirizing of Victorian poetry, as in, for example, the tense garden waiting scene from Tennyson's *Maud* (1855) in *Through the Looking-Glass* (1871) when the flowers literally speak back to Alice. Just as Lear parodies Tennyson—whose treatment of sound was famous—by setting his serious works to comical music and silly verse, Carroll parodies the aural communication in this scene; this kind of parody extended to mathematics as well as literature.

The full passage from De Morgan's textbook introduces the above quote through a poetic metaphor about sound and sense that uses the example of how operation of addition works in a symbolic context, and it is here that we get a clue as to how Dodgson's mnemonics poems also operate on the logic of symbolical algebra. De Morgan explains, "In abandoning the meanings of symbols, we also abandon those of the words which describe them. Thus *addition* is to be, for the present, a sound void of sense."[261] I posit that two of Dodgson's mnemonics for π, both from 8 November 1875, literalize De Morgan's point here, in doing so creating encoded mnemonic poetry

[260] Augustu Morgan, *Trigonometry and Double Algebra*, 1st ed. (London: Taylor, Walton, and Maberly, 1849), 101. Qtd in Helena M. Pycior, "At the Intersection of Mathematics and Humor: Lewis Carroll's 'Alices' and Symbolical Algebra," *Victorian Studies* 28, no. 1 (1984): 149.

[261] Morgan, *Trigonometry and Double Algebra*, 101.

using the rules of symbolic algebra. Lewis Carroll's use of mathematical mnemonic poetry for mental calculation operates performs the abstract symbolical play that I have been tracking through parallel eighteenth- and nineteenth-century mathematical and prosody debates about nonsense. Given that this play occurs sonically through both visual and aural mediums in ways that are both explicitly mathematical and that draw upon the mnemonic tradition and the work of Edward Lear, I argue that Dodgson's enciphered mnemonic poetry provides an alternative and parallel theoretical link between the symbolic algebra of George Boole and the physical technological application of these concepts to switching circuits proposed by Claude Shannon in 1937.

Although these two lines, written on two sides of a single piece of note paper, seem at first to be prose, I suggest that they are better understood as a pair of nonsense poems that together form a kind of double acrostic—like a nonsense poetic diptych, to borrow an art history term. The first, which reads—"Bob Loudsvill the coupon of the bogy Coochub – shoot it!"—enciphers the

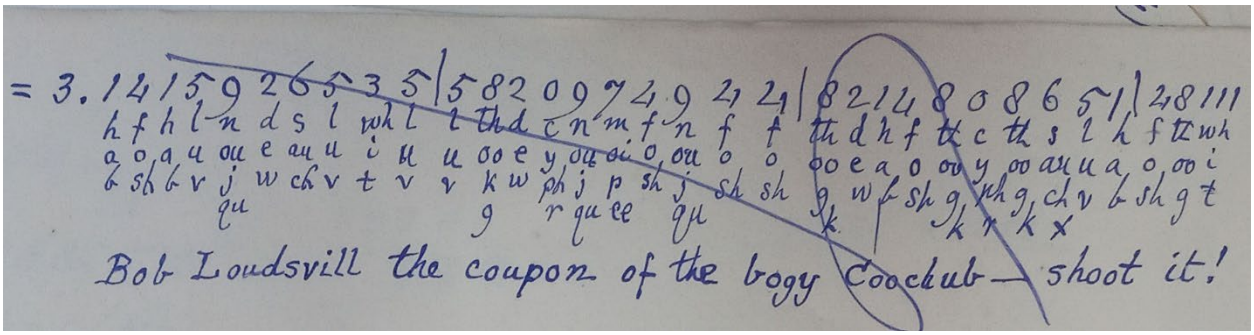


Figure 14: "Bob Loudsvill the coupon of the bogy Coochub – shoot it!" Charles Dodgson [Lewis Carroll], 1875. Reproduced by permission from the C. L. Dodgson Estate.

3.1415926535	8979323846	2643383279	5028841971	6939937510
5820974944	5923078164	0628620899	8628034825	3421170679
8214808651	3282306647	0938446095	5058223172	5359408128
4811174502	8410270193	8521105559	6446229489	5493038196

Figure 15: Digits enciphered in vertical π mnemonic.

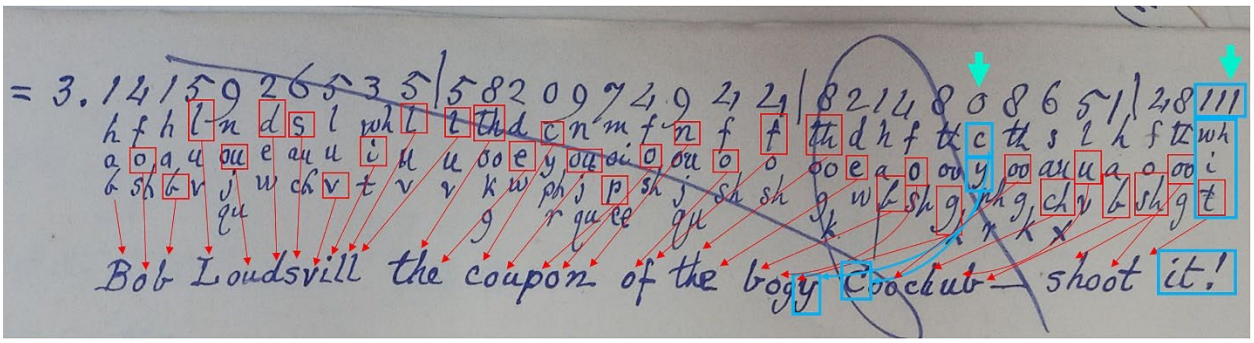


Figure 16: Anomalies in "Bob Loudsvill the coupon of the bogy Coochub – shoot it!" Charles Dodgson [Lewis Carroll], 1875. Reproduced with annotations by permission from the C. L. Dodgson Estate.

first 35 digits of the first *vertical* column of π, when written in columns of five.[262] Dodgson writes his cipher below, and everything seems straightforward—until one actually attempts to match it up. Dodgson divides the digits into three units of 10, and then one unit of 5, making 35 digits. However, there are 36 mnemonic letters (or letter pairs where relevant). The Y of 'bogy' and the C of 'Coochub' signify the same number (zero) twice.[263] Importantly, this overlap also falls on the only nonsense word in the line ("bogy" being a folk term for the devil). One explanation would seem to be that Dodgson treats the numbers that "C" and "Y" signify additively rather that sequentially. Because adding 0 to another number does not alter it, he applies this logic within his mnemonics, even though, in terms of decimals, adding a 0 obviously does change the number. What might have seemed like a random nonsense word begins to seem that much more, well, *calculated*. He also applies this additive logic at the end of the line, where he uses the cipher number for "3"—WH, I, T—for three 1's; 1 +1+1 equaling three. As with the previous case, one could imagine just finishing the line

[262] Charles Dodgson [Lewis Carroll], "Bob Loudsvill the coupon of the bogy Coochub—shoot it!," November 8, 1875, Morris L. Parrish Collection of Victorian Novelists, Princeton University.

[263] I thank Matthew Stone for this observation.

with the word "shoot!," which would have fit perfectly. Instead, Dodgson deliberately plays with different combinations of number forms to achieve his desired literary outcome.

We see this same logic at play in the companion poem, which similarly reads: "Bob Loudsvil. Knee out with those ox. Echo it, kid!" Forming the corollary to the previous piece, this line encodes the first 28 digits of pi *horizontally*. One way of reading this line is to interpret everything as aligning neatly. However, I am troubled by the inclusion of the word "those" above "with." Note that the "th" of "with" and "those" align perfectly, and that "those" is not crossed out, as is the case in other

3.1415926535 8979323846 2643383279 5028841971 6939937510
5820974944 5923078164 0628620899 8628034825 3421170679
8214808651 3282306647 0938446095 5058223172 5359408128
4811174502 8410270193 8521105559 6446229489 5493038196

Figure 18: Digits enciphered in horizontal π mnemonic.

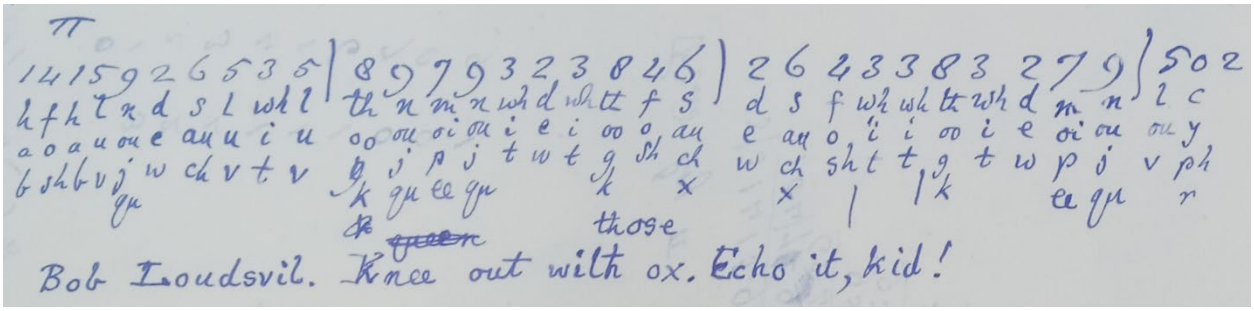


Figure 17: "Bob Loudsvil. Knee out with those Ox. Echo it, kid!" Charles Dodgson [Lewis Carroll], 1875. Reproduced by permission from the C. L. Dodgson Estate.

mnemonics where Dodgson is testing out possibilities. I suggest that an alternative way of reading this line is as follows. In this interpretation, Dodgson uses the '8' to dually encipher the "th" of *with* and *those*; he then uses the homophonic sound "au" to signify the "o" of *ox* (again mimicking a phonetic encryption technique he deploys in other *memoria technica*). By modifying the progression of

the encipherment in this way, the letters that spell "echo" are repeated so that they themselves

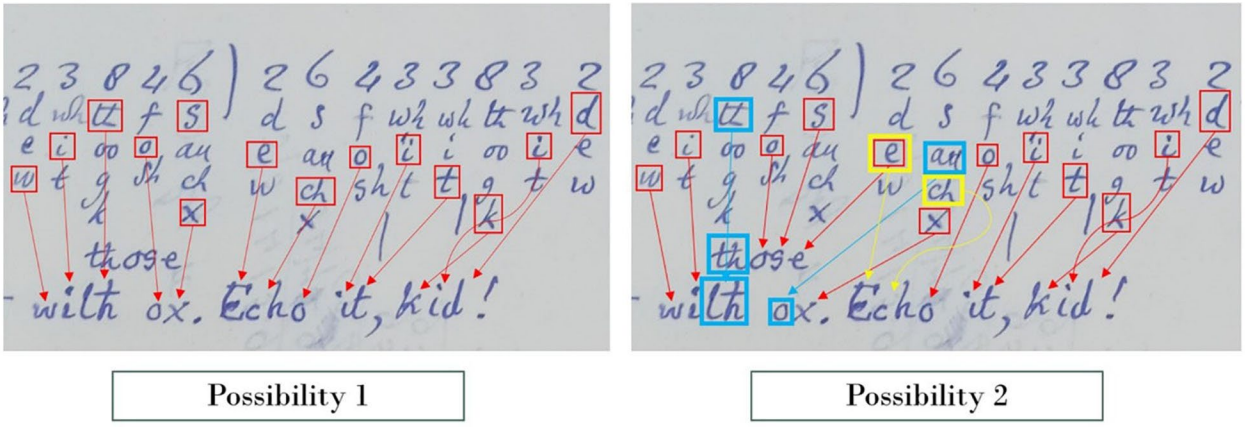


Figure 19: Interpretive possibilities for horizontal π mnemonic. Reproduced with annotations by permission from the C. L. Dodgson Estate.

become echoes. Note that this shift does not reverberate throughout the rest of the line but is confined to that single word. Taken together, the meters of these two mnemonics also seem to echo one another. After beginning with an iamb, both drop into two anapests, and then revert back to disyllables: the former, with three punchy iambs; the latter, with a trochee and an iamb that metrically reenact the echo described in the words. As with Lear's nonsense poetry, the internal consistency of the poetic system is defined largely by sonic considerations. Just as Boole described in the context of symbolical algebra, here the "process of analysis does not depend upon the interpretation of the symbols which are employed, but solely upon the laws of their combination."[264]

I argue that these two poems form a new kind of mathematical double-acrostic nonsense poem in which a pair of mnemonic lines encodes the same numerical concept in two directions. It is impossible to definitively determine which of the interpretive possibilities I have posed is the correct one, as they exist in a kind of perpetual alternativity with one another. The answer depends on the context; on which rules of the game one chooses to follow. It is, in other words, *Boolean*. This

[264] Boole, *The Mathematical Analysis of Logic*, 3.

experimentation, which plays fast and loose—although still within a system of nonsense meaning—with the normative rules of mathematics to achieve the desired outcome, directly reenacts George Boole's nonsense methodology through which he used his symbolic algebra to create Boolean logic.

Just as Boole derived his central equation $xx = x$ by creatively appropriating the operation of multiplication to achieve his desired logical (rather than mathematical) end, Carroll's poetry creatively uses the operation of addition to additively encipher digits that are normally not additive but sequential. His unconventional mixture of additive operations and sequential structure in the first poem, "Bob Loudsvill the coupon of the bogy Coochub – shoot it!" to encode two letters (C-Y) under 0 (because 0+0 is 0) employs the logic of Boolean logic, in which mathematical rules from one context can be applied to another in order to perform nonsensical operations that nonetheless work because they do not violate the artificial rules set internally by the form itself. As with Boolean algebra, Carroll renders the encryptional form of his symbols flexible. Carroll's two π poems show him embracing mnemonic, poetic, and mathematical forms of nonsense in a way that recognizes the structural resonances between these contemporaneous Victorian disciplines and masterfully synthesizes them into a single creative set of work. Carroll's mnemonic nonsense poetry does not just enact a formal metacommentary on structures of language and logic, nor produce emptied-out form nihilistically evacuated of referential meaning, but empties and then fills textual forms using extreme mathematical and sonic play (both visual and aural) to represent the possibilities of nonsense as creative associative practice.

III. Reconsidering Victorian Nonsense

In closing, I want to briefly address how this expanded understanding of the relationship between these mathematical, literary, and mnemonic discourses alters our understanding of

nineteenth-century nonsense in ways that could transform both critical accounts of Victorian poetry and the history of computing. From the standpoint of literary studies, based my historical examination of prosody debates about puns and nonsense wordplay, I am inclined to take quite seriously the repeated insistence of nineteenth-century prosody critics that the Victorian nonsense poetry of the most canonical figures, Edward Lear and Lewis Carroll, is also—perhaps even primarily in some instances—an experiment in the relations of pure sound. If critical resistance to such a view feels instinctual, it is perhaps because major twentieth-century theoretical movements like Russian formalism and semiotics asserted the inseparability of sound and sense as an unassailable, universally understood truth. In fact, as Richard Bradford explains, the Russian formalists consciously ushered in a "shift from the investigation of sound to the relation between sound and meaning" that moved away from the "post-Renaissance prosodic tradition" that I have been tracing and which runs from Alexander Pope through George Saintsbury. He elucidates: "The Formalists moved from traditional or 'phonetic' prosody, the study of sounds and structures as autonomous phenomena, to their own method of 'phonemic' prosody, the study of the relationship between sound patterns and their meaning-generating functions in the morphophonemic structures of language."[265] Although of course this earlier prosodic tradition was focused on the 'relation between sound and meaning' in the sense that it was invested in adjudicating proper poetic balance, commentators did not share the modern linguistic assumption that sound and meaning were so inherently and irrevocably interrelated that it was impossible to speak of one without the other (as illustrated by the sonic focus of eighteenth- and nineteenth-century debates about puns).

This critical difference is apparent in the Formalists' lack of interest in examining instances in which poetic sound dominates—a clear departure from the investigations of nineteenth-century

[265] Richard Bradford, *Roman Jakobson: Life, Language and Art* (London: Routledge, 2005), 24.

British and American commentators, which viewed such instances as important opportunities for expressing critical ire. Due to their siloed interest in the relationship between poetic sound and sense, Amy Mandelker notes that they considered sound-based devices like onomatopoeia "to be of little interest or aesthetic value. Since, by definition, onomatopoetic effects may occur only when sound is the subject (e.g., 'the murmuring of innumerable bees'–Tennyson), such phonic play seemed to the Formalists to be on the level of the pun."[266] Whereas the pre-twentieth-century prosodic tradition investigated these kinds of sonic phenomena within the framework of nonsense, later critics shifted their focus to exploring the fundamental inseparability of sound and sense—in Saussure's terms, the products produced by the inevitable cutting of the "sound-chain." Although it is conceptually possible to understand the existence of a kind of prelapsarian state in which sound exists on its own, in this formulation it is impossible to return to that state by breaking apart the sign's sound and meaning in order to consider the two separately, in the way that the Popic tradition suggested. Saussure explains: "Considered by itself, it [the 'sound-chain'] is only a line, a continuous ribbon along which the ear perceives no self-sufficient and clear-cut division; to divide the chain, we must call in meanings."[267] Because meaning it always present in the critics' materials, it is semiotically impossible to excise out language's euphonic elements and treat them on their own.

Yet in defiance of this concept of inseparability, early twentieth-century sound poetry explicitly embraced the Victorian nonsense poetry concept of pure-sound experimentation. Modernist sound poets Larry Wendt and Steven Ruppenthal cite Giordano Bruno's mystical Renaissance mnemonic system and Victorian nonsense poetry as earlier ancestors of the kinds of

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[266] Amy Mandelker, "Russian Formalism and the Objective Analysis of Sound in Poetry," *The Slavic and East European Journal* 27, no. 3 (1983): 329.

[267] Ferdinand de Saussure, *Course in General Linguistics*, ed. Perry Meisel and Haun Saussy, trans. Wade Baskin (New York: Columbia UP, 1959), 103.

aural experimentations that twentieth-century avant-garde poetry was invested in. They trace the Western manifestation of this tradition through "several 'outlaw' customs of 'verbal anarchy'" that include "Giordano Bruno's mnemonic language systems, [and] the 'nonsense' verse of Jonathan Swift, Lewis Carroll and Edward Lear." Notably, their explanation of the aims of sound poetry offers a materialist description in terms that recall Joseph Broader's production of sound-play through his visual drawings: "Sound poetry can be described as an artwork in which the physical and sonic aspects of language are subjected to artistic manipulations. […] Sound poetry is therefore a self-conscious attempt to get at the very 'palpableness' of the human language experience."[268]

This poetic lineage notwithstanding, most scholarly accounts of Victorian nonsense poetry have traditionally deemphasized the role of sound in favor of a conception that emphasizes nonsense verse's semantic meta-referentiality. This critical framework was predominantly shaped by a single study, Elizabeth Sewell's tour de force *The Field of Nonsense* from 1952. Sewell's treatise—which still arguably remains the definitive account of Victorian nonsense literature roughly seventy years later—revolutionized the critical understanding of Victorian nonsense, sparking a recuperation of Lear and Carroll after nearly a century of scholarly neglect. In his 1942 essay "The Music of Poetry," T.S. Eliot observed in his discussion of Lear's work that "nonsense is not vacuity of sense: it is parody of sense, and that is the sense of it."[269] Developing that concept in her field-defining study, Sewell famously proposed that Victorian nonsense is best understood not as a mishmash of childish absurdities intended to amuse a juvenile readership, but as a choreographed series of structural engagements that played with the constraints of philosophical and linguistic systems of

[268] Larry Wundt and Steve Ruppenthal, in *Text--Sound Texts*, ed. Richard Kostelanetz (New York: William Morrow and Company, Inc., 1980), 248.

[269] T.S. Eliot, "Music of Poetry" (1942).

meaning. She argued that the genre was broadly characterized by "an attempt at reorganizing language, not according to the rules of poetry or prose in the first place but according to those of Play. […] Each game of this type is an enclosed whole, with its own rigid laws which cannot be questioned by the game itself."[270]

Sewell comes to this theory of nonsense via a schematic examination of three disciplinary definitions of nonsense from the fields of logic, science (which for her includes mathematics), and linguistic philosophy. "Ordinary people," she states, "use the word 'Nonsense' in connection with situations or statements which do not conform to the facts as they are generally held to be, or which, more simply, are taken to be untrue." That understanding of nonsense, she argues, has led many readers to undervalue the work of Edward Lear and Lewis Carroll. But more technically, she explains, the term "may be used by logicians to describe some contradiction in a system, by scientists to describe statements which supposedly do not tally with the known facts, [and] by modern philosophers to describe sentences which seem to them to depart from the rules for making sense in the use of language." Sewell's scientific definition of nonsense, nonalignment with objective truth, forms the professional corollary of her layman definition, that which deviates from commonly accepted fact, and so she readily pushes it aside. More important for her—and for Victorian literary scholars who have succeeded her—are the logical and linguistic understandings of nonsense, which both focus on broader structural contradictions with an arbitrary system rather than objective falsities or aimless sonic playfulness. She states: "nonsense takes the form of contradiction, the breaking of the rules of the game. This game is a purely intellectual and abstract one, and it can make no valid pronouncement about sense and nonsense outside its own field."[271]

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[270] Sewell, *The Field of Nonsense*, 25.

[271] Sewell, 1–2.

Sewell's conception of nonsense notably excludes the 'scientific' (mathematical) understanding of nonsense and the predominance of sound-play emphasized in Victorian prosodic conceptions of nonsense verse—the very two forms of nonsense this essay tracks—because this narrower view enables her to develop a sharper theorization of Victorian nonsense verse as conscious structural play within a closed, constructed system of reference. Following Sewell's emphasis on Victorian nonsense poetry's complicated metareferential critique of structures of logic and meaning rather than its interest in playing with aurality or objective veracity, subsequent scholarship interpreted this characterization to mean that Victorian nonsense poetry's structural parody of sense exists in binary opposition to the earlier definition of nonsense poetry as defined in large part by an excess of unmeaning sound. For example, James Williams and Matthew Bevis's recent examination of Edward Lear discusses the definition of nonsense offered by the 1908 edition of the *Oxford English Dictionary*, which describes it as "verses consisting of words and phrases arranged solely with reference to the metre and without regard to the sense."[272] They argue that if such a definition "were true, nonsense would be only an extreme case of what William Empson regarded as the 'Cult of Pure Sound' […]. Lear's poems are not like this, and if they were they would be a good deal less playful, since there would be no imaginative tension between nonsense's pull towards semantic evacuation, and the continual reassertion of sense in the meanings and morphological relations of words."[273] To me, this formulation over-aligns sense with semantic meaning by implying that the isolated relations between pure sounds cannot be the predominant form of nonsense poetic play. The underlying assumption would seem to be that the "continual

[272] James Augustus Henry Murray, "Nonsense," in *A New English Dictionary on Historical Principles* (Oxford: Clarendon Press, 1908).

[273] James Williams and Matthew Bevis, introduction to *Edward Lear and the Play of Poetry*, ed. James Williams and Matthew Bevis (Oxford: Oxford UP, 2016), 8.

reassertion of sense" which produces the counterplay to nonsense poetry's semantic evacuation of meaning must primarily come from the "meanings and morphological relations of words" rather than sonic relationships.

In light of the historical devaluation of Victorian nonsense because of its association with children's literature, it is understandable that modern scholars have followed Sewell in representing it almost solely as a creative form of complex, parodic, predominantly semantic metacommentary. This critical move that, as I have illuminated, relies on a narrower understanding of nonsense drawn from logic and linguistics, rather than from adjacent Victorian discourses like literature, mnemonics, or mathematics that were concurrently exploring related questions about symbol-play and parody, but with different emphases (in the next chapter, I return to Sewell's contention that Victorian nonsense poetry displays little interest in engaging with scientific truth). But now, roughly seventy years from the time when those interventions were first necessary, it seems fruitful to reconsider what we might be missing by excluding these historically relevant understandings of nonsense from our examinations of this literary genre. In offering this corrective, I do not intend to stake a strong claim against the traditional conception of Victorian nonsense poetry *per se*, but simply to suggest that greater attention to those nonsense discourses that Sewell's conceptualization did not primarily consider—specifically, sonic poetic play and mathematics—both reveals new angles of Lear and Carroll's work that were not previously as visible and illuminates how Victorian nonsense poetry mutually drew from and contributed to the history of computing, paralleling and nuancing our understanding of the investigations of figures like Charles Babbage and George Boole.

Chapter Three: The Hunting of the Sine-Arc

This chapter explores an extraordinary possibility: what if Lewis Carroll's famed nonsense nautical epic poem *The Hunting of the Snark* (1876) actually contains mnemonics that encode mathematical figures related to maritime navigation? That a hidden code could exist undiscovered for roughly one hundred and fifty years in such a poem might seem extraordinary, given its canonical significance within Victorian nonsense literature and given its author's extreme popularity. Nonetheless, I think there is compelling textual, biographical, and compositional evidence to support such a possibility. This essay examines what I believe to be the most likely hypothesis: that Carroll encoded a series of logarithms related to the necessary spherical-geometry calculations for ship navigation in *The Hunting of the Snark* using a version of Richard Grey's *memoria technica* system that he created. Interpreting the poem within the mathematical history of maritime navigation—specifically as a nonsense narrativization of the famous 'race to longitude' that took place during the eighteenth and nineteenth centuries—lends weight to the possibility that Carroll augmented the poem's maritime narrative by encoding related mathematical information into the text. This presumed act of encrypting calculational information within the poem suggests clear parallels to the later development of computing technology for military encryption during World War II such as the Enigma machine, while the encryption of logarithms anticipates the modern use of logarithmic encryption mechanisms. In this way, Carroll's poem offers an alternative connection within the history of computing between the *Nautical Almanac* and the Enigma machine.

The *Snark* is such a notoriously challenging text precisely because of its experimental recursion and circularity seems to invite the reader to apply totalizing systems of allegorical meanings that seem as if they will satisfactorily 'explain' the story's true meaning; while simultaneously the text's mischievous twists and turns cast doubt on the relevance of any of them. Perhaps, as many

readers have come to believe, the *Snark* enacts this critical performance to hold a mirror to the critic's own inadequacies. Dante Gabriel Rossetti's tragically paranoid belief that the *Snark* was actually a biting allegory of his own life provides one particularly unpleasant example of this phenomenon. I want to be clear from the outset that I am not presenting mnemonics as a totalizing framework that explains what the *Snark* is 'truly' about, nor claiming that my suggestion of a possible mnemonic code in Carroll's text serves to make 'sense' of nonsense more conclusively than any other serious rival system of meaning. As Northup Frye expressed in an analysis of the mythos of poetic riddles: "like all interpretations that profess to say, 'this *is* what the poem means,' the answer is wrong because it is an answer. The real answer to the question implied in a riddle is not a 'thing' outside it, but that which is both word and thing, and is both inside and outside the poem."[274] Carroll's mnemonic poems and *The Hunting of the Snark* deftly explore how the logic of nonsense views meaning as fundamentally multivalent, indeterminate, and non-exclusive—not in the post-structuralist sense of constant Derridean *différance*, but in the sense that all multiple overlaid meanings are always present. Just like the links of a mnemonic chain, which are arbitrary and multidirectional, no single dominant meaning of these kinds of poems exists.

As seems fitting for a hypothetical exploration, I have structured this examination based on the chronology of insights that led to me to this hypothesis. My opening section investigates how the formal poetic anomalies of *The Hunting of the Snark* indicate the possibility that the text encodes a *memoria technica*. I then contextually examine the poem's compositional history through Carroll's unpublished mathematical archive papers from Princeton's Morris L. Parrish Collection, which lend further credence to the possibility that the poem is related to Carroll's creation of mathematical

[274] Northrop Frye, "Charms and Riddles," in *Spiritus Mundi: Essays on Literature, Myth, and Society* (Bloomington: Indiana UP, 1976), 147.

mnemonics during the exact same period. My second section reviews the eighteenth- and early nineteenth-century mathematical history of maritime navigation, specifically the so-called 'race' to find a reliable mathematical method for determining longitude, which produced a slew of scientific and technological advancements by competing inventors. I focus on two main threads of this history: the technological problems associated with finding longitude on board a ship and the calculational problems within the context of spherical geometry. This maritime mathematical history, I suggest, illuminates previously unnoticed mathematical jokes and references in the poem. My final section provides a brief overview of my own *Snark* hunt and lays out new directions for my future research. I haven't yet cracked the hunting of the sine arc in *The Hunting of the Snark*, but "Navigation was always a difficult art."[275] I believe that a complete breakthrough is just on the horizon.

I. Dodgson's Mathematical *Memoria Technica*

Charles Dodgson held a demonstrable interest in cryptography, investigating a number of encryption systems over his lifetime and even creating five of his own. Francine Abeles records that in addition to his version of Richard Grey's *memoria technica*, "Dodgson invented four ciphers, the two of the Vigenère type are known as the Alphabet Cipher (1868) and the Key-Vowel Cipher (1858). The Telegraph Cipher (1868) is a Beaufort cipher, and the Matrix Cipher (1858) is a Variant Beaufort cipher."[276] However, it is clear that mnemonic encryption held a special lifelong fascination for Dodgson—although this aspect of his life has received very little attention from scholars, perhaps in part because most of his mnemonic verse remains archival and unpublished (they are

[275] Lewis Carroll, *The Hunting of the Snark: An Agony, in Eight Fits*, 1st ed. (London: Macmillan and Co., 1876), l. 1.73.

[276] Abeles, "The Memoria Technica Cipher," 218.

mostly housed in Princeton's Morris L. Parrish Collection of Victorian Novelists). These papers, alongside Dodgson's diaries, indicate that his interest in this method spanned forty years, on and off. His diary first mentions *memoria technica* in his New Year's resolutions for 1858, when he was twenty-five, as part of a "list of things to be learned by heart": "Poetry; Elements of Mathematical Subjects; Proofs of formula, ditto; Formulae themselves; Chronology by Memoria Technica; Geometrical problems."[277] This early note intimates that Dodgson viewed poetry, mathematics, and *memoria technica* as areas of intellectual overlap, an intersection that his later work clearly develops.

Ostensibly, Dodgson initially followed Richard Grey's original enciphering system faithfully, but by 1875 he had created his own unique variation on Grey's *Memoria Technica* cipher and accompanying poetic system. Until now, I believe that it has gone unnoticed that Dodgson created at least *four* documented different versions of *memoria technica* encryption ciphers, not two; and that the first such unique codex dates from November 1875, two years before Dodgson produced the cyclostyled version (now housed at the Harry Ransom Center, The University of Texas at Austin; a cyclostyle was an early copy machine) that the existing scholarship commonly recognizes as the first. Morton N. Cohen's 1974 account focused on establishing the distinctiveness of the 1877 cipher from the similar one dated 1888 that Dodgson's nephew Stuart Collingwood published in his 1889 biography *The Life and Letters of Lewis Carroll* (the only difference between the 1877 and 1888 ciphers was that in the latter, 4 equates to *f* and *q*, rather than *f* and *qu*). Edward Wakeling's footnotes in his 2001 edited edition of

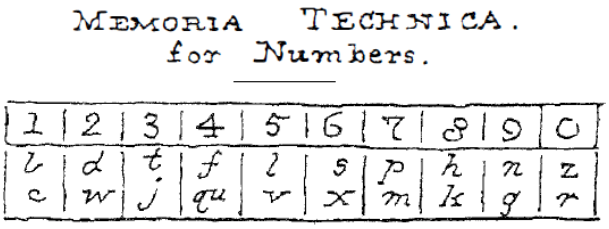


Figure 20: "Memoria Technica For Numbers." Charles Dodgson [Lewis Carroll], 1877.

[277] Lewis Carroll, "Diary Entry," December 31, 1857. In *Lewis Carroll's Diaries: Containing Journal 5 - January 1857 to April 1858*, ed. Edward Wakeling, vol. 3 (Lewis Carroll Society, 1993), 142–43.

Dodgson's diaries provide the corresponding *memoria technica* verses and phrases next to his descriptions of writing them from November and December 1875, and yet Wakeling does not appear to have recognized that the cipher from the earlier mnemonics is different from the oft-reprinted cyclostyled one.[278] His 2019 Carroll essay "Recreational Mathematics" likewise does not note the existence of a pre-1877 cipher, and also states (mistakenly, it appears to me) that Dodgson first came up with the idea of encoding *memoria technica* in meaningful poetic rhymes in June 1877.[279]

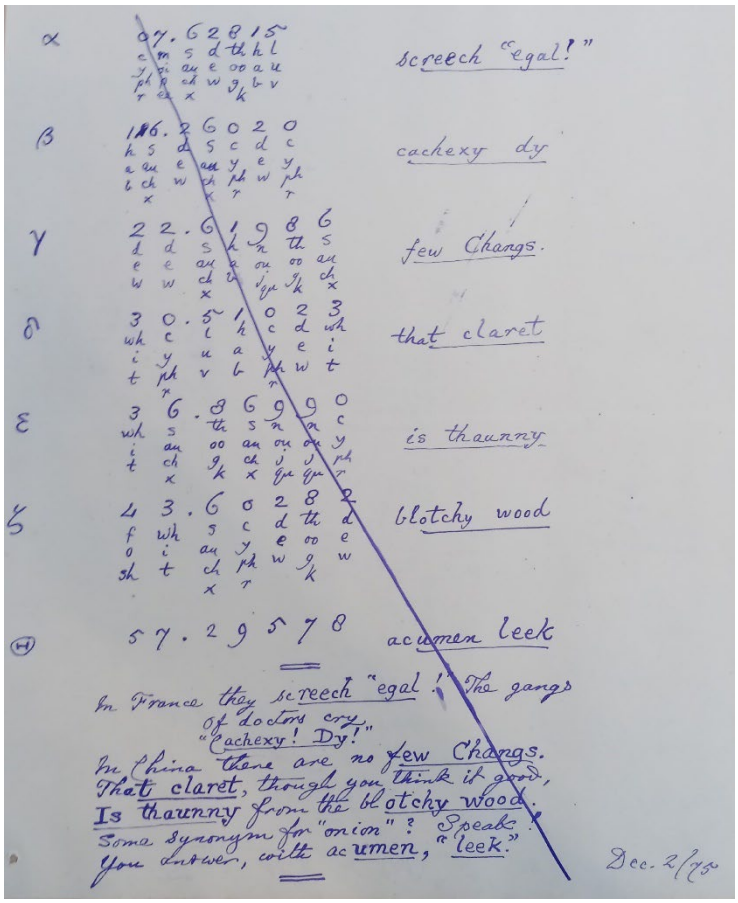


Figure 21: "Screech 'Egal!'" Charles Dodgson [Lewis Carroll], 1875. Reproduced by permission from the C. L. Dodgson Estate.

Francine Abeles, seemingly relying primarily on Dodgson's diary entries, suggests that he created his own version of Richard Grey's system on 27/28 October 1875 (his first mention of *memoria technica* since 1857), but the example she provides of the cipher is also the 1877 cyclostyled version.[280] However, working backward from the examples in Dodgson's mathematical papers from the Parrish collection, it is possible to reconstruct a different cipher dating from 8 November 1875

[278] Lewis Carroll, *Lewis Carroll's Diaries: Containing Journal 10, April 1868 to December 1876*, ed. Edward Wakeling, vol. 6 (The Lewis Carroll Society, 2001).

[279] Edward Wakeling, "Recreational Mathematics," in *The Mathematical World of Charles L. Dodgson (Lewis Carroll)*, ed. Robin Wilson and Amirouche Moktefi (Oxford: Oxford UP, 2019), 171.

[280] Abeles, "The Memoria Technica Cipher," 219.

(see below). I am, I believe, the first person to recognize the existence of this earlier cipher, which Dodgson writes below the "Bob Loudsville" mnemonics that I analyzed in the previous chapter. Dodgson wrote a very slightly different version under his *memoria technica* lines from 2 December 1875; the only difference is the later inclusion of *x* under 6 (shown here). My finding therefore corrects earlier accounts that often cite examples of *memoria technica* from the 1875 period alongside the 1877 cyclostyle cipher.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**
H	D	WH	F	L	S	M	TH	N	C
A	E	I	O	U	AU	OI	OO	OU	Y
B	W	T	SH	V	CH	P	K	J	PH
						EE	G	QU	R

Figure 22: Reconstructed cipher (c. October 1875).

Because previous scholarship has failed to recognize the existence of this earlier set of 1875 ciphers, earlier studies have also tended to treat the form and intention of all of Carroll's *memoria technica* as more or less uniform. However, a closer examination reveals that Carroll's earlier mnemonic compositions are much more experimental—both mathematically and poetically—than his later verses from the 1880s and 1890s, which appear to have been created more for relating to visitors to Oxford and for secondary students' use. These later mnemonics generally employ a simple couplet rhyme scheme, encode basic chronographic information, and deliberately draw attention to their mnemonic nature through heavy-handed puns. For example, Dodgson's poem encoding the foundation date of St. John's College: which takes advantage of the "salient fact of its large gardens, with larger *lawns* than any other College has, and made the rhyme: 'They must use a good bevel, /Their lawn is so level' where the 'l', 'v', 'l,' in the last word, give the date (1)555."[281]

[281] Lewis Carroll to Alice Cooper, January 21, 1892. In *The Letters of Lewis Carroll: 1886-1898*, ed. Morton N. Cohen, vol. 2 (New York: Oxford UP, 1979), 888–90.

In contrast, the earlier mnemonics that Dodgson created with Robert Baynes in 1875 and 1877 encrypt much more advanced mathematical concepts, such as logarithms, trigonometric functions, and the figures for concepts like *e* and π. It is difficult to make a blanket assessment of the normative rhyme scheme for these poems, as Dodgson's mathematical scratch paper often only includes the enciphered mnemonic words or phrases rather than finished lines of poetry (despite his statement in his diary on 1 November 1875 that he had written "anecdotal accompaniments for the [mnemonic] words, making most of them [his *memoria technica*] into one continuous story."[282] Especially in the 1875 examples, Carroll's mnemonic words do not align with those that rhyme. In an undated c. fall 1875 *memoria technica* poem, he intersperses the mnemonic words throughout the poem (the underlining is Carroll's): "One ~~The~~ rock~~s~~ upon my lee I jag / By pounding ~~them~~ it with cannon. Oo! / Its nobbut souch I call a crag, / 'Thy queen' is written 'queen thy,' too." But without the underlining, this unsystematic format makes it virtually impossible to identify the mnemonic, unless one knew what encoded information to look for (and even then, it would be difficult).[283] Similarly, in his 2 December 1875 poem reads: "In France they screech 'egal!' The gangs / of doctors cry / 'Cachexy! Dy!' / In China there are no few Changs. / That claret, though you think it good, / Is thaunny from the blotchy wood. / Some synonym for 'onion'? Speak! / You answer, with acumen, 'leek.'" The poem follows an ABBACCDD rhyme scheme, but the mnemonic ciphertext does not neatly align with the rhyme words. The *memoria technica* words do tend to be those words that make up the second rhyme of any given rhyme pair, but Carroll also places encrypted words in the middle and beginnings of other lines. Later on, he appears to have become more regular with the

[282] Carroll, *Lewis Carroll's Diaries: Containing Journal 10, April 1868 to December 1876*, 6:429.

[283] Lewis Carroll, "One Rock upon My Lee I Jag," n.d., Box 4, Folder 3, Morris L. Parrish Collection of Victorian Novelists, Princeton University.

placement of his *memoria technica*. Those written in ABAB generally encode the mnemonic in the third line. For example, Carroll's mnemonic June 1877/March 1878 poem for enciphering the mantissa of the logarithm of 106 (253059) uses the 1875 cipher but enciphers only the last six consonants from the third line: "Six months I have travelled unshaven, / That's exactly one half of a year: / I have change from a dove to a raven—/ But I will not be shaved, even here!" DVTRVN encodes 253059.

As these examples indicate, Carroll returned to mnemonics over fifteen years after his New Years' Resolution note, in the fall of 1875—precisely the same time when he was composing his nautical nonsense epic poem *The Hunting of the Snark*. Strikingly, his most intensive period of composing mnemonic verse occurred during the same two weeks in late October and early November 1875 when he was rapidly attempting to finish the *Snark* in hopes that he could publish it at Christmas 1875 (he eventually published an augmented version at Easter 1876). During these two months, Dodgson and his friend Robert Edward Baynes, a Christ Church physicist, created a series of verse mnemonics for logarithms that enabled them to rapidly perform astoundingly complex calculations in their heads without the use of tables. I quote his series of entries in full to show just how heavily intertwined Dodgson's composition of mnemonic verses was with what he thought would be his final burst of writing for the *Snark*:

> Oct: 25. (M). Finished the verses and sent them to Mrs Chataway, asking leave to print them. I think they might do for a dedication to the book, which I think of calling *The Hunting of the Snark*. […]
>
> Oct: 27/28. (W/Th). Sat up till nearly 2 making a '"Memoria Technica' for Baynes for logarithms of primes up to 41. I can now calculate in a few minutes almost any logarithm without book.
>
> Oct. 29. (F). Heard from Macmillan that Swain cannot finish the blocks in under three months. So my first plan must be given up.
>
> Oct. 30. (Sat). [Henry] Holiday arrived to be my guest till Monday. (See November 1).

Oct: 31. (Sun). It occurs to me that as one block (the "landing") is done, it might be worthwhile to publish at Christmas, using it as the frontispiece: this would have the advantage of keeping the other five pictures, to come out *new*, if the poem is ever introduced into a story. I have now completed the "Memoria Technica" to include the logarithms of all primes under 100.

Nov: 1. (M). Wrote anecdotal accompaniments for the words, making most of them into one continuous story. My system differs from Gray's [*sic.*] in having the words all *real*, no gibberish to remember. This I manage by having a larger choice of symbols. With the addition of similar words for useful statistics, such as the dates of the Kings of England, it might make a popular little pamphlet.

Nov: 2. (Tu). Sent Macmillan 14 stanzas of the *Snark*, which I think we shall now publish this Christmas, with frontispiece only.

Nov: 4. (Th). Received from Miss Lawrie two sketches about the "Jabberwock" by a Mr. E. Fairfield, which are so good that I wrote to ask if he would try a drawing for me.

Wrote "Memoria Technica" verses for logarithms of numbers from 101 to 109, and 1001 to 1009, which Baynes thinks will be a better set to use than the primes.

Nov: 5. (F). Wrote verses for logs of primes up to 20. Sent Macmillan text of *Snark* to the end of "Fit 3." I think of calling the other book "Logarithms By Lightning: A Mathematical Curiosity."

Nov: 6. (Sat). Wrote four stanzas of the Snark (viz: "And the Banker, inspired...", "But, while he was seeking...", "Without rest or pause....", "The Bandersnatch fled...") completing the poem (see January 17, 1876, which now consists of 88 stanzas.) The first stanza was composed July 22. 1874. "In the midst of the word..." which stands as the last verse of the poem. But the very last line, "For the Snark was a Boojum, you see" came into my head while out on a walk at Guildford, July 18)

Nov: 7. (Sun). Sent to Macmillan the rest of the MS. of The Snark, with the dedicatory verses (written October 24, 25) etc. Wrote to Fanny, and Mrs. Chataway, telling them of the intended publication. No one has yet known of it but Macmillan etc., and Mr. and Mrs. Holiday. […]

Nov: 29/30. After dining at the Prices, I went on working mathematics till about 1, and afterwards, while undressing, thought of a process (which I worked out next day) for finding angles from given sines and cosines.

Dec: 3. Went to bed at 2 ½, having had 12 or 13 hours altogether at mathematics (Baynes worked with me from 9½ p.m. to about 1), and ending with making three verses of

> Memoria Technica embodying angles and cosines for the six reduction angles whose sines are 0.1, 0.2, etc. [284]

Despite this astounding compositional overlap, previous scholars have taken Dodgson at his word when he muses in his November 5 entry about publishing the logarithmic *memoria technica* in a separate work entitled 'Logarithms by Lightning.' Morton N. Cohen notes that his lack of follow-through in printing "Logarithms by Lightning: A Mathematical Curiosity" was very uncharacteristic, given that he normally either published planned works in their entirety or sent sample puzzles to publications like the *Educational Times*:

> Dodgson never properly published his *Memoria Technica*, which is surprising because he generally did shepherd into print, sooner or later, his inventions, both literary and mathematical. Had he taken the time to get it published, he certainly would have shared with a sizeable reading audience his genuine advances on Grey's system of memory retention and might even have revolutionized a few stodgy educational techniques. Had he sent off examples of his method to one of the papers to which he had sometimes contributed puzzles and games, he might have given rise to a new craze of couplet-writing in the land. […] But that did not happen."[285]

Similarly, while Francine Abeles notes the intense compositional overlap between these mnemonics and Dodgson's *Snark*, she likewise posits that the two projects had nothing to do with one another: "Remarkably, [Dodgson] was working with his *Memoria Technica* in connection with the logarithms project at precisely the same time as he was writing his famous poem, *The Hunting of the Snark*, published March 1876, composed entirely of rhymed four line stanzas, 141 of them. […] Both his *Memoria Technica* verses and those of *The Hunting of the Snark* are humorous, imaginative, dramatic,

[284] Lewis Carroll, "Diary Entry," October 28, 1875. In *Lewis Carroll's Diaries: Containing Journal 10, April 1868 to December 1876*, 6:428–37.

[285] Cohen, "Lewis Carroll's Memoria Technica," 87–88.

and share the same rhymed couplet structure. That the purpose of these verses was so very different is further evidence of the genius of their creator."[286]

In contrast to these assessments, I assert that this intertwined period of composition between the *Snark* and the mnemonics, the relevance of the poem's nautical subject matter for Carroll's logarithmic trigonometric *memoria technica*, and his uncharacteristic decision not to publish any of his mnemonic material elsewhere altogether strongly indicate that he subsequently intertwined these *memoria technica* within the poem's text. For one, the very intensity of Carroll's focus on composing the mnemonics and the exact temporal overlap in writing these two forms of rhymed verse together seems to indicate that the two projects are related. For instance, one would expect his entries from the weekend of Oct. 30–Nov. 1, 1875, when *Snark* illustrator Henry Holliday was staying with him, to be filled with an account of their discussions regarding the book's illustrations. However, Carroll's entries for those days focus almost entirely on his progress composing logarithmic mnemonics. Although Carroll does not provide details as to how he and Holliday spent their time together, Carroll's hyperfocus on mnemonics during their visit at the very least opens up the possibility that Holliday was aware of this work, and perhaps even that Holliday's illustrations include mnemonic elements. Notably, after this burst of interest in writing mnemonic verse alongside composing the *Snark*, Carroll's interest in mnemonics seems to have drastically waned. He last records making new *memoria technica* for his trigonometry calculations on 3 December 1874: "Went to bed at 2 ½ having had 12 or 13 hours altogether at mathematics (Baynes worked with me from 9 ½ p.m. to about 1), and ending with making three verses of Memoria Technica

[286] Abeles, "The Memoria Technica Cipher," 227. Abeles, a mathematics scholar, slightly misspeaks here. The *Snark* is written in ABAB, not couplets.

embodying angles and cosines for the six reduction angles whose sines are 0.1, 0.2, etc."[287] After this point, his diary entries and his existing mathematical notes seem to indicate that he did not seriously resume composing *memoria technica* verse until two years later, in 1877.

Given the specificity of his entries in October and November 1875, one might wonder why Carroll did not record his intention to integrate an encoded mnemonic logarithmic series in the *Snark* in his private diary, if such an act occurred. I suggest two exculpatory reasons. Firstly, it was not Dodgson's usual practice to record specific details of his literary work in his diaries. He briefly tracks his progress from time to time, but he generally does not note the inclusion of jokes or the development of thematic elements. This is the case with his entries about other works like *Alice's Adventures in Wonderland*, and it seems to be true for the *Snark* entries as well. Ostensibly he does not note such information in his journals because the notebook entries are supposed to act as memoranda to help him recall details of meetings and activities, not the subject-matter of his own books. Secondly, although he does record his compositional work more minutely than usual from October to November of 1875, the subsequent entries suggest that he simply became more wrapped up in recording the social details of the Christmas season as the holidays approached. Carroll recorded sending a shorter version of eighty-eight lines to Macmillan on 7 November 1875 and noted his decision to wait until Easter to publish the poem on 13 November; he recorded calculating additional sines on December 10. But after that point, his subsequent diary entries until January focus almost exclusively on social visits and his holiday travels during the Christmas school break to his family home in Guildford, Surrey and to London. He was clearly working on composing *The Snark* during this time, because he wrote fifty-three additional stanzas—almost 40% of the poem's final version—between early November and mid-January. He was also corresponding with Henry

[287] Carroll, *Lewis Carroll's Diaries: Containing Journal 10, April 1868 to December 1876*, 6:436.

Holliday about the illustrations in early January. Yet he does not record his progress or, indeed, even mention the poem at all in his diary until his entry on 19 January 1876 abruptly states: "Wrote stanza 'In the matter of Treason,' completing poem." An examination of the manuscript could potentially shed light on this question, but unlike the manuscripts for Carroll's other works, *The Snark* manuscript seems to have vanished into thin air.

An examination of the *Snark*'s text further strengthens the possibility that Dodgson decided sometime after November 1874 to intermesh these two ideas by integrating the material for "Logarithms by Lightning" into the *Snark*, rather than saving it for a different publication. Indeed, viewed through the lens of mnemonic logic, I suggest that that the poem's title and preface explicitly spell out the relevance of mnemonics for understanding the *Snark*. After discussing the nonsensicality of the ship's tendency to sail backwards in the preface, Carroll abruptly shifts to a discussion of portmanteau. He states:

> As this poem is to some extent connected with the lay of the Jabberwock, let me take this opportunity of answering a question that has often been asked me, how to pronounce "slithy toves." The "i" in "slithy" is long, as in "writhe"; and "toves" is pronounced so as to rhyme with "groves." Again, the first "o" in "borogoves" is pronounced like the "o" in "borrow." I have heard people try to give it the sound of the "o" in "worry." Such is Human Perversity.[288]

This preface also explicitly connects the *Snark* to the concept of linguistic portmanteau: "Humpty-Dumpty's theory, of two meanings packed into one word like a portmanteau, seems to me the right explanation for all." It closes by describing the action of choosing one set of meanings over another by quoting a line from Shakespeare; whose work was infamous in Victorian prosody criticism for his appalling use of paronomasia (among countless other features, of course). It is noteworthy that the line Carroll quotes has to do with the impossibility of binary choice, however. He states that the best

[288] Carroll, *The Hunting of the Snark*, x.

answer to the Shakespearean question "Under which king, Belzonian? Speak or die!"—is neither William or Richard, but "Rilchiam!"[289] Within the context of mnemonics, this description of portmanteau logic as "the right explanation for all" seems to be as close to a direct invocation of mnemonics as an interpretive framework for the *Snark* as one could wish. Richard Grey's mnemonic method, upon which Dodgson's own is based, famously creates portmanteau chronograms strung together in the classical epic verse form. Especially given Dodgson's description of the *Snark* as governed by portmanteau logic, it is difficult to see his creation of his own poetic epic during a period of intense interest in mnemonics as anything but an invocation of Grey's *memoria technica*.

All of this material brings us back to the poem's title: *Snark*. Snark, Sine arc, even possibly arcsine. Applying Humpty-Dumpty's mnemonic portmanteau logic reveals that Dodgson is gesturing to the existing of a mnemonic code, mathematically related to spherical geometry and trigonometry—and therefore to logarithms and nautical mathematics—right in the poem's very title.[290] It is difficult to know whether the title gestures to the sine (of an) arc or the inverse sine function arcsine. I think the former is most likely, since taking the sine of an arc is only possible within spherical (rather than plane) trigonometry, which is the subject that was relevant for maritime navigation.

Closely analyzing the formal structure of the *Snark* further reveals a neat pattern of anomalies structured around the number eight that are similar to those found in Dodgson's contemporaneous 1875 mathematical mnemonic poems. While the majority of the *Snark* is written in ABAB verse, there are exactly sixty-four instances throughout the poem where the rhyme is missing from the end of line one or line three. In the vast majority of these cases, Carroll creates an

[289] Carroll, xi.

[290] I am extremely grateful to Jonathan Grossman for proposing this important possibility to me.

internal rhyme in both lines to create three pairs of rhymes in the stanza, rather than the usual two. For example, the speaker describes the Baker as such: "While, for those who *preferred* a more forcible *word*, / He had different names from *these*: / His intimate *friends* called him 'Candle-*ends*,' / And his enemies 'Toasted-*cheese*'"[291] (AABCCB; my italics). But in a select number of very strange cases, Carroll displaces the rhyme into a single line, rather than creating two new internal ones. For example, here is the previous stanza: "He would answer to '*Hi*!' or to any loud *cry*, / Such as 'Fry me!' or 'Fritter my wig!' / To 'What-you-may-call-um!' or 'What-was-his-name!' / But especially 'Thing-um-a-jig!'"[292] (my italics). Here the transposal of "hi" into line one frees up space in line three for Carroll to include the amusing phrase "What-was-his-name." When conceived of together as a rhyming pair, the two lines do not break the rhyme pattern, as the stanza as a whole still contains two pairs of rhymes. There are eight of these highly unusual instances.

There is a kind of nonsensical symmetry here: eight times eight is of course sixty-four; the poem's subtitle is "an agony in eight fits" (cantos), there are eight nonsense portmanteau words borrowed from the "Jabberwocky" in the *Snark*, and Carroll had originally intended for the poem to contain eighty-eight stanzas (since he returned to writing after its publication was delayed, and the final version contains 141). It is quite easy to go on one's own 'snark hunt,' following these kinds of numerological recurrences across the text in the belief that Carroll is sincere when he describes the *Snark* as an "instructive poem" with "arithmetical principles so cautiously inculcated in it" (especially when it occurs on page nine of the preface—applying the 'Rule of Three,' is what the poem tells us three-times-three true as well?).[293] Nonetheless, to me it appears significant no other cases of

[291] Carroll, *The Hunting of the Snark*, 1.37-40.

[292] Carroll, 1.33-36.

[293] Carroll, ix.

internal rhymes appear outside of these cases, and that the number of cases mathematically resonates with the nonsense logic of the rest of the poem. If there is a mnemonic in the poem, these lines likely hold some significance. Considering the verse form of Dodgson's few existing *memoria technica* verses from 1875, it appears to me quite plausible that *Snark* encodes mnemonics in the eight lines with internal rhymes, which only happen in lines one and three throughout, or perhaps even in all of the sixty-four strange cases.

Francine Abeles notes that Dodgson's earlier ciphers, all of which were based on the principle of substitution, included substantial camouflaging elements: "In both the Key-Vowel and Matrix ciphers, Dodgson added embellishments designed to protect the cipher by inserting randomly chosen letters or integers, nulls, into the ciphertext." In the *memoria technica* system, Dodgson's embedding of mnemonic 'technical words' into a meaningful poetic line fits into this larger encryption strategy: "just as nulls disguise a cipher system, varying the placement of the lines in the verse that hold the consonants enciphering the integers is a form of disguise."[294] Abeles argues that Dodgson's *memoria technica* cipher is exempted from this deliberate camouflaging because in her estimation, "By 1875, Dodgson's purpose in constructing ciphers had changed from creating ciphers to ensure secrecy of communication to that of a system of remembering significant numbers." Without following Abeles to that conclusion, I note that Dodgson's potential encipherment of a mnemonic mathematical code in the *Snark* fits this larger pattern.

Based on my research into Carroll's interests, I think it most likely that the poem would encode a sequence of logarithms for sines of various great-circle arcs (a great circle is a circle that cuts through the Earth's center), given that he was writing trigonometric and logarithmic *memoria technica* at the same time as writing the *Snark*. Although it is very difficult to guess exactly what form

[294] Abeles, "The Memoria Technica Cipher," 225.

such an enciphered sequence would take, I suggest that foregrounding the poem's nautical narrative context offers the best way forward. Most other critics have seen the nautical setting of the *Snark* as somewhat peripheral to the story itself, in the way that contemporary Edward Lear's descriptions of geography serve purely nonsensical rhyming purposes. However, I suggest that focus more seriously on the nautical setting of the poem by considering the historical context of late eighteenth- and nineteenth-century sailing in relationship to mathematics further illuminates the plausibility of a mnemonic connection. This refocusing may also help to explain some of the materials on gravity and spherical geometry found in the Parrish collection, which are surprising in that they appear otherwise unrelated to our current understanding of Dodgson's main mathematical interests. Examining this possibility requires briefly relating the history of navigational mathematics.

II. Nautical Nonsense: The Race to Longitude and the Problems of Navigation

At the Royal Observatory in Greenwich, there is a museum display of an eighteenth-century pendulum clock behaving as it would onboard a ship. Rather than metronomically ticking back and forth in routine motion, as it would on land, the clock's pendulum momentarily floats at the top of its oscillation cycle as the simulated sea waves rock it upwards. After seemingly defying gravity for a moment, it abruptly surges in the other direction. There is something at once wonderous and deeply unsettling about the disordered motion of this normally regular cycle. By the eighteenth century, the pendulum had become a common household sight, in the form of the pendulum clock. Invented by Christiaan Huygens in 1658, the pendulum clock became the primary means of standardized timekeeping by the early eighteenth century, when increasing mercantile wealth rendered such luxury goods available to the broader public. But, as the Royal Observatory's display illustrates, translocating the pendulum clock from the land to the sea excised it from the terrestrial laws of

physics, causing this familiar object to produce strange new phenomena. As Isaac Newton outlined his testimony the House of Commons in 1714, "the motion of a Ship, the variation of heat & cold, wet and dry, and the difference of Gravity in different Latitudes" all contributed to bizarre inconsistencies in the rhythm of pendulums on the ocean.[295] Temperature and humidity fluctuations caused the metals of the timekeepers to expand and altered the density of the surrounding air, causing clocks to run slower in hot and humid weather and faster in cold and dry climes. Based on the science of the time, the effects of these constantly shifting factors were very difficult to predict. But what made these inconsistencies more than just a series of anomalies interesting only to seafarers was their importance for the largest mathematical problem of the eighteenth century: the question of how to calculate longitude at sea.

To transverse the ocean away from familiar coastlines, ships need a reliable means of reestablishing their coordinates after they are blown off course by winds and currents or caught in storms that obscure the navigator's view of the stars. It had long been known that latitude (the position north or south) could be easily calculated from astronomical measurements using basic geometry. But until the mid-nineteenth century, there was no reliable *in situ* method for determining longitude (the position east or west) at sea. Traditionally, mariners kept, rather than calculated, longitude using a technique called 'dead reckoning,' in which one approximated the ship's relative position by considering its speed (measured using knots) and its heading over time, and then extrapolating the ship's movement by plotting onto a map. However, this imprecise technique could lead to navigational delays, shipwrecks, and sometimes even to tragically misguided forays into the oceanic abyss, since once the ship's longitude was lost, "there was no way of finding it again."[296]

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[295] "Proceedings: 11 June 1714," in *Journals of the House of Commons*, vol. 17 (London: H.M. Stationery Office, 1803), 677.

[296] James A. Bennett, *Navigation: A Very Short Introduction* (Oxford UP, 2017), 67.

European mariners had struggled with the problems arising from longitude's incalculability since the fifteenth century, when they increasingly began to venture away from European coastlines and therefore had to develop new techniques beyond those of coastal navigation. The problem grew as Britain's colonizing interests expanded during the seventeenth and eighteenth centuries. As Graham Jagger expounds: "In an age of expanding trade and colonization, the country which could develop new navigational techniques had a competitive advantage over its rivals in the quest for new colonies and their attendant natural resources."[297] Establishing safer navigational methods to overseas colonies became a key priority for British financial backers and the insurance bodies who underwrote such voyages.

In 1714, Parliament established the Board of Longitude to adjudicate developments in this area—most importantly, to award £20,000 to the inventor of a suitable solution for determining longitude. The full prize was to be awarded to the man who devised a widely adoptable means of establishing longitude to within half a degree; half that sum would be awarded for a solution that offered accuracy to within one degree. Two main approaches showed promise: the lunar-distance method and calculation by chronometer. The lunar-distance method used the angle between the moon and another celestial body to calculate longitude. This method required the use of powerful long telescopes to observe the moon's complicated changes in position, which were not feasible for ships. In contrast, the chronometer method proposed determining the longitude by subtracting the difference in local time between two places. If a clock could be constructed to avoid the problems demonstrated by the pendulum in the Royal Observatory's modern museum display, it could be used to carry Greenwich Mean Time across the globe—thereby providing a means of computing the

[297] Graham Jagger, "The Making of Logarithm Tables," in *The History of Mathematical Tables: From Sumer to Spreadsheets*, ed. Martin Campbell-Kelly et al. (Oxford: Oxford UP, 2003), 56.

longitude onboard the ship wherever it went. Although the Board of Longitude had hoped that the reward money might spur a solution within two to three years, these techniques competed with one another and alongside traditional dead reckoning for roughly a century. Frustratingly, both new methods were, to use Newton's phrase, "True in theory, but difficult to execute."[298] Eventually, after clockmakers Thomas Earnshaw and John Arnold made improvements to the chronometer's technology in the 1780s that enabled its economical mass production, the chronometer method of calculating longitude won out; by the late nineteenth century, it was virtually ubiquitous.

In addition to these technological problems, maritime navigation was also mathematically challenging because it required a number of advanced calculations in spherical geometry and trigonometry. In the early seventeenth century, the field had experienced a huge leap forward when Scottish mathematician John Napier's 1614 invention of logarithms produced a mathematical shortcut that majorly simplified the traditional required calculations. Logarithms—which, as Graham Jagger notes, Napier also called 'artificial numbers' in his posthumously published *Constuctio* (1619)—are a mathematical operation that expresses the exponent that a given number must be raised to in order to produce another given number. Expressing numbers in this exponentialized notation greatly simplifies the required operations of long numbers, such as those found in maritime trigonometry, because it transforms multiplication and division into addition and subtraction (as, mathematically, the exponents of two numbers are always added). Since addition is much quicker than multiplication for long numbers, using logarithms enables faster calculation. One can also use tables of pre-calculated base-10 logarithms to further hasten the process. Jagger explains that Napier invented logarithms and created his corresponding calculational tables with maritime calculations in mind: "From the very beginning of logarithms their utility to navigators has been of supreme

[298] "Proceedings: 11 June 1714," 667.

importance in their development." […] Realising that astronomical and navigational calculations involved primarily trigonometrical functions, especially sines, Napier set out to construct a table by which multiplication of these sines could be replaced by addition: the tables in the *Descriptio* are of logarithms of *sines*."[299] Sine and cosine are two trigonometric functions; the sine of an angle in a right triangle equals the ratio of the opposite side to the hypotenuse; cosine triangle equals the ratio of the adjacent side to the hypotenuse (readers may recall the familiar mnemonic SOHCAHTOA, which gives these ratios). Logarithms were one aspect of Napier's larger interest in speeding up and improving calculation. In 1617 he also created the calculating device known as 'Napier's bones,' which used rods to aid calculation.[300]

Institutionally, much of this work was associated with the tradition of Oxford mathematics. Henry Briggs, who greatly developed John Napier's conceptualization to make logarithms more useable, was the first Savilian Professor of Geometry at Merton College, Oxford (from 1620–1630). As Jagger explains, "Brigg's two great works, the *Arithmetica Logarithmica* and the *Trigonmetria Brittanica*, formed the basis of all logarithm tables published for the next 200 years or so" (until they were recalculated by French mathematician Gaspard de Prony in 1785, Charles Babbage in 1827, and Scottish mathematician Edward Sang in 1871.[301] The other two important contributors to the emerging concept of logarithms were also Oxonians. Edmund Gunter, who coined the terms cosine and cotangent and invented important astronomical measuring instruments like Gunter's quadrant and Gunter's scale, took his degree at Christ Church (Dodgson's college) and had been in

[299] Jagger, "The Making of Logarithm Tables," 52.

[300] Jagger, 51.

[301] Jagger, 66.

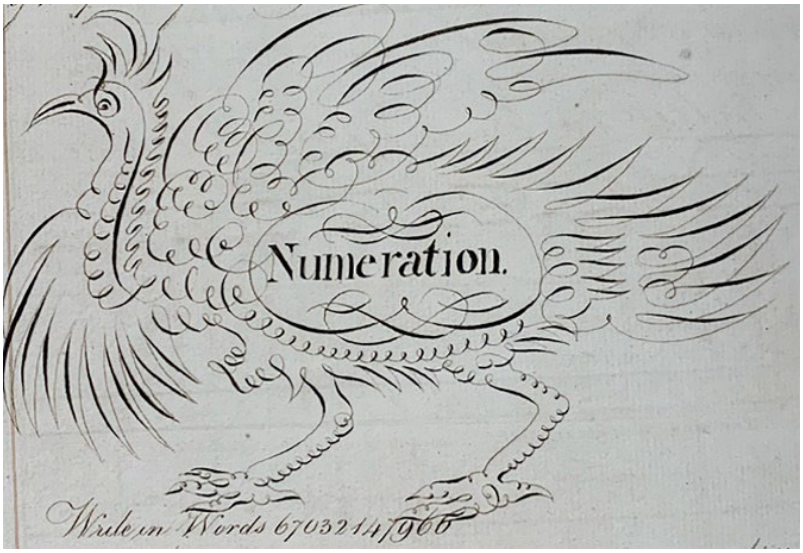


Figure 23: "Numeration" (detail). William Middlemist, "Elements of Navigation," 1813.

Figure 24: "Numeration" (detail). William Middlemist, "Elements of Navigation," 1813.

contention for the Savilian professorship; John Newton, who produced the first cheap, readily accessible English logarithmic tables, graduated from St. Edmund's Hall.[302]

Recognizing the importance of simplifying maritime navigation, in 1767 the Royal Observatory began publishing *The Nautical Almanac*, which contained pre-calculated astronomical tables based on the future positions of navigational heavenly bodies produced by a team of human computers. Mary Croarken explains that its "*pre-computed predictions* of lunar distances […] [reduced] the lengthen of time necessary to perform calculations to 30 minutes," which likewise also reduced the amount of calculational errors made."[303] It was vital for a given year's almanac to be published several years in advance, so that sailors could take it with them on multi-year voyages. Although this solution largely resolved the underlying mathematical issues during the latter half of the eighteenth century because the publication was highly accurate under the editorship of fifth Astronomer Royal Nevil Maskelyne, it became a live issue again during the 1810s, when the quality

[302] Jagger, 60.

[303] Mary Croarken, "Providing Longitude for All," *Journal for Maritime Research* 4, no. 1 (December 2002): 109.

of the calculations declined under the guidance of his successor, John Pond.[304] As my first chapter noted, the prevalence of errors in the logarithmic tables famously sparked Charles Babbage's idea to create the Difference Engine to mechanically calculate the *Nautical Almanac* figures in 1821.

Even with the use of the *Nautical Almanac*'s tables, maritime calculation was still an important and constantly improvable site of mathematical research well into the nineteenth century, as both front-runner solutions for the calculation of longitude—the lunar-distance method and calculation by chronometer—still necessitated intensive calculations that routinely took three to four hours every day to perform; any slight error could make the difference between successfully navigating to an island port and leading an entire crew into the open ocean. It was therefore crucial to have a skilled mathematical navigator on board every voyage, and educational apparatus arose in Britain in the late seventeenth century to fill this need. Until the late nineteenth-century, maritime navigation was therefore arguably the most significant application for geometry and trigonometry. Importantly, mathematical maritime workbooks were known in the period as cyphering books. Most British cyphering books were produced by the Royal Mathematical School at Christ's Hospital, which opened in 1680 to train maritime navigators for the Royal Navy. There, young boys around



Figure 25: "Examples" (detail). William Middlemist, "Elements of Navigation," 1813.

Figure 26: "Examples" (detail). William Middlemist, "Elements of Navigation," 1813.

[304] Mary Croarken, "Tabulating the Heavens: Computing the Nautical Almanac in 18th-Century England," *IEEE Annals of the History of Computing* 25, no. 3 (July 2003): 48–61.

ages eleven or twelve would learn the mathematics requisite for sailing by copying out rules and worked-out examples of the calculations that would be necessary for voyaging. As these books needed to be comprehensive, most are around 800 pages in length. But far from being tedious standardized facsimiles of a master textbook, each cyphering book is a unique handcrafted work. They are as much artistic objects as they are mathematical workbooks. For example, in this cyphering book, a copy of John Robertson's *Elements of Navigation*, created by William Middlemist in 1813, illustrations of intricate birds, fantastical sea-creatures, Spanish conquistadors, and figures from other mythical legends (like St. George slaying the dragon) line the pages. These wonderous drawings interact with the mathematical subject-matter, often providing a kind of metacommentary.

For example, the proliferation of bird drawings gestures to the medium itself—quill pen—obliquely remind the reader that cyphering books were also an exercise in penmanship. Other drawings, like these from an 1807 cyphering workbook, plunge the ship into an immersive geometric world.

To me, what is especially important about these cyphering workbooks is the extent to which they conceptualize the sea as a nonsense space—a world in which fantastical legend and mathematical knowability persistently intertwine. These representations artistically register what the distorted ship pendulum in my opening anecdote also exemplifies: that, mathematically, the ocean was a persistently and frustratingly nonsensical space that continued to elude the grasp of the

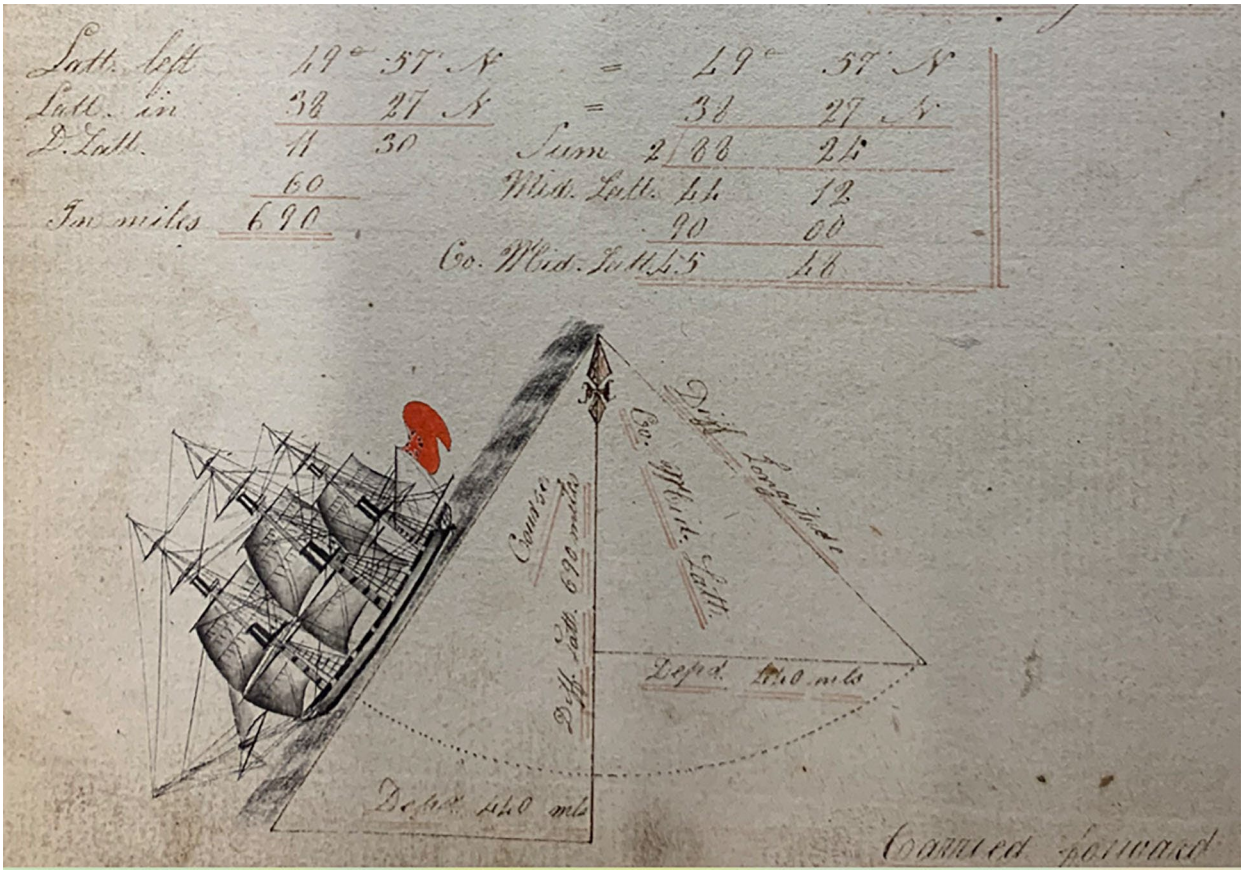


Figure 27: Trigonometric ship (detail). "Navigation Notebook," 1807.

Figure 28: Trigonometric ship (detail). "Navigation Notebook," 1807.

otherwise panopticonic Enlightenment worldview well into the nineteenth century. Wonderous Western representations of the ocean are most associated with much earlier periods of European voyaging and colonization in the fifteenth and sixteenth centuries. For example, in maps like Magnus Olaus's *Carta marina* (1572), the sea figures as a mythical space where sea-monsters, fantastical weather events, and other frightening perils abound. Even as such maps were attempting to schematically represent a known seascape, the inclusion of mythical beasts alongside actual landmarks and hazards emphasizes that Early Modern sailors viewed the sea much in the way that their ancient forerunners did. As W. H. Auden describes in a wide-ranging historical study of Romantic representations of the sea, in this classical tradition, which originally hailed from the Greeks, "The sea or the great waters […] are the symbol for the primordial undifferentiated flux, the substance which became created nature only by having form imposed upon or wedded to it. The



Figure 29: *Carta marina et descriptio septemtrionalium terrarium.* Magnus Olaus, 1572.

Figure 30: *Carta marina et descriptio septemtrionalium terrarium.* Magnus Olaus, 1572.

sea, in fact, is that state of barbaric vagueness and disorder out of which civilization has emerged and into which, unless saved by the effort of gods and men, it is always liable to relapse."[305]

In contrast, the standard critical view of the Enlightenment presents it as a period in which the world was becoming progressively more scientifically knowable to European eyes, and thus more mundane and ordinary. Alongside (and increasingly instead of) travel accounts that sincerely represent non-European lands as fantastical mythic spaces, we get satires like *Gulliver's Travels*, which take aim at such accounts as naïve, overly credulous remnants of a narrow pre-Enlightenment worldview. From this vantage point, my claim that the scientific inconsistencies that surrounded the problem of longitude contributed to an eighteenth-century conceptualization of the sea as a mathematically wonderous space might seem to cut across the accepted view of scientific progress in this period. But as Sarah Kareem demonstrates in her study *Eighteenth-Century Fiction and the Reinvention of Wonder* (2014), this period witnessed a transformation of the concept of wonder, which transitioned from a reaction provoked by the medieval supernatural to a response elicited by the anomalies of everyday life. Paradoxically, the growing Enlightenment knowledge of the world—out of which literary realism arose—did not do away with the concept of the marvelous. Instead, the eighteenth-century, in large part due to scientific developments that occurred as a result of global voyages, generated a new aesthetic of wonder in which, as Kareem puts it, "the prosaic rubs up against the marvelous […]—a marvelous defined not by its opposition to, but by its integration with realism."[306] This amalgamation of the ordinary and the wonderous—perhaps a milder ancestor of

[305] W. H. Auden, *The Enchafèd Flood* (New York: Vintage Books, 1950), 6.

[306] Sarah Tindal Kareem, *Eighteenth-Century Fiction and the Reinvention of Wonder* (Oxford UP, 2014), 1–2.

what Sianne Ngai has called "stuplimity" (boredom conjoined with the sublime)—aptly describes how eighteenth-century mariners represented the mathematical environment of the sea.[307]

I suggest that this mathematical history is especially important with respect to *The Hunting of the Snark*, given that Charles Dodgson studied and then taught mathematics at Oxford, which followed a curriculum that included topics in astronomy and spherical trigonometry that were also central to maritime navigation. As I have laid out, eighteenth- and early nineteenth-century maritime navigation was largely a field of applied geometry; the mathematical problems associated with the 'race to longitude' therefore constituted the very recent applied history of Dodgson's field of interest. I suggest that this context helps illuminate that the *Snark* is rife with mathematical and nautical features jokes and references.

I suggest that the race to longitude arises specifically in a passage from Fit II, in which the narrator describes the navigational preparations that the Bellman has made: "He had bought a large map representing the sea, / Without the least vestige of land: / And the crew were much pleased when they found it to be / A map they could all understand. / What's the good of Mercator's North Poles and Equators, / Tropics, Zones, and Meridian Lines?' / the Bellman would cry: and the crew would reply / 'They are merely conventional signs!' / 'Other maps are such shapes, with their island and capes! / But we've got our brave Captain to thank' / (So the crew would protest) 'that he's bought us the best-- / A perfect and absolute blank!'"[308] In reversing the Enlightenment project of mathematically representing the entire globe by making the map itself a nonsense space of unknowability, Carroll satirizes the competition between paradigms that characterized the race to

[307] Ngai characterizes this experience as one of "'dread' and 'holy awe' eventually superseded by disinterested pleasure that are particular to the sublime," creating an "aesthetic experience in which astonishment is paradoxically united with boredom as stuplimity." Sianne Ngai, *Ugly Feelings* (Cambridge, MA: Harvard UP, 2005), 271.

[308] Carroll, *The Hunting of the Snark*, 2.13-16.

longitude. He does so not by refuting any one method in favor of the others, but by nullifying the applicability of all of these methods of navigation by removing the objective grounding that made them meaningful. In other words, it doesn't matter whether one calculates one's position from the stars, or from knots on a rope, or from a clock—if one can't turn this relational location into an objective one. The crew all have the same uniform understanding of the map, not because they have reached a consensus on which navigational method to use, but because no one can understand it at all. In this way, Carroll invokes the historical race to longitude in order to turn it into an arbitrary nonsense game. Here, as elsewhere in the poem, recognizing his nonsensical intervention only becomes possible when one understands the mathematics underpinning the game.



Figure 31: *Xie (Alexandra) Kitchin as Chinese Tea Merchant.* Charles Dodgson [Lewis Carroll], c. 1876. Courtesy of Victoria & Albert Museum Department of Photography.

Figure 32: *Xie (Alexandra) Kitchin as Chinese Tea Merchant.* Charles Dodgson [Lewis Carroll], c. 1876. Courtesy of Victoria & Albert Museum Department of Photography.

This context illuminates many other mathematical jokes and references inside the *Snark* that have, until now, largely evaded notice. The entire premise of the narrative—the casting off of nine crew members on their nonsense quest to hunt the Snark—is a mathematical pun on the "casting out nines," which is a well-known arithmetical 'sanity check.' Similarly, the poem boasts about the supreme power of the 'Rule of Three,' which is a basic arithmetical operation. Interpreting the poem in the context of the history of maritime navigation lends additional weight to the possibility that there is a hidden cipher in the poem—for after all, one cannot have a cyphering book without a cipher. As Martin Gardner's *Annotated Snark* points out, the Banker's rattling of bones

is undoubtedly a reference to blackface minstrelsy and potentially also to the black-and-white negatives of photography; but I suggest that it might also be a reference to Napier's bones (the calculating device related to logarithms). Perhaps most importantly, the fact that the famous mathematical lesson between the Butcher and the Beaver goes in an enormous circle is perhaps a play on the use of 'Great Circle' calculational methods in maritime navigation. Finally, the maritime context offered by the problem of longitude suggests an allusion to the famous tea-clipper *Cutty Sark*, which provides an explanation for why the Snark hates all of the accoutrement of Victorian teatime. Carroll was interested the Chinese tea trade during this period, as demonstrated by his photographing Xie (Alexandra) Kitchin in the costume of a Chinese tea merchant in 1873 and again in 1876. In addition to the phonic resonance between 'sark' and 'snark,' the reference to the *Cutty Sark* may have appealed to Carroll because of the passage in Robert Burn's original poem *Tam O' Shanter* (1791) from which the phrase "cut sark" comes includes a reference to longitude. In Burn's poem, a drunken Scotsman named Tam O' Shanter happens upon a coven of witches dancing in the church yard. As he watches them, he becomes erotically fixated on the young witch Nannie Dee, who is wearing a particularly short chemise (or 'cutty sark' in Scots).[309] The name "Cutty Sark" originates from the poem's famous climactic line, in which O' Shanter betrays his presence by enthusiastically screaming "Weel done, Cutty-sark!"[310] The most notable line for our purposes, however, comes a few stanzas earlier: the narrator describes Nannie Dee's "cutty sark" as "In longitude […] sorely scanty."[311] This maritime reference is extremely suggestive, given the narrative

[309] John Jamieson, "Snark," in *Jamieson's Dictionary of the Scottish Language*, ed. John Johnston and John Longmuir (Edinburgh: William P. Nimmo, 1867).

[310] Robert Burns, "Aloway Kirk; Or Tam O' Shanter," in *The Edinburgh Magazine, or, Literary Miscellany*, 1st ed., vol. 13 (Edinburgh: J. Sibbald, 1791), l. 189.

[311] Burns, ll. 171, 173.

context of the *Snark*. Together these references suggest Carroll's fittingly playful treatment of maritime mathematical history in his nautical epic nonsense poem.

III. Hunting the Sine Arc

In closing, I want to briefly explain how I came to develop this hypothesis, detail how I have pursued it thus far, and provide an overview of my next steps for identifying the mnemonic code. After learning that Lewis Carroll created his own version of Richard Grey's *memoria technica*, I began to research his interest in artificial memory systems. As a literary scholar with a deep investment in archive research, I was first struck by the idea that *The Hunting of the Snark* might contain a mnemonic code when I came across his highly suggestive diary entries from the fall of 1875. My interest increased when I saw how previous commentators both had recognized the unusual nature of the mnemonic and poetic overlap but had also subsequently chosen not to pursue the possibility, seemingly without comment. It increased still more when I read the poem and identified what appeared to me to be deliberate formal anomalies that echoed the formal marking techniques of other mnemonic poetry from the nineteenth century that I was aware of. Fully appreciating the outlandishness of the hypothesis and not desiring for my critical scholarship to veer down the path towards the kinds of oddball interpretations of Carroll's work that one finds on Wonderland fan blog sites, I posed the possibility only semi-seriously at the end of a conversation with Jonathan Grossman. "I think that *The Hunting of the Snark* might contain a secret mnemonic code," I tentatively offered. To my surprise, he did not dismiss such a possibility as ridiculous out of hand, but countered, "Well, does it?" Using the 1877 version of Carroll's cipher that has been reproduced in several studies, I attempted to decipher the poem, focusing on the lines that formally deviate from

the overall structure of the poem. This approach did not yield any results, and for a time I dropped the matter.

But the more I thought about it, the diary entries seemed so strange. I set out to explore the possibility more fully from a different angle by locating all known examples of Dodgson's *memoria technica* compositions in their original form. The Morris L. Parrish Collection of Victorian Novelists at Princeton was the primary repository for the examples that Edward Wakeling and Francine Abeles had discussed and republished. But as Carroll's mathematical research has not attracted as much attention from scholars as the other aspects of his work has, the majority of his archive remains unpublished and basically unexamined. I hired a research assistant to photograph the collection, and then I set out to make sense of the materials by transcribing and meta-tagging them. This task was quite daunting for a literary scholar not trained in nineteenth-century mathematics because the majority of the material is composed of mathematical notes, calculations, teaching materials, and some related correspondence. Carroll clearly intended for the future public to view the papers; he organized the entire collection into thematic bundles before his death and physically marked the materials according to an idiosyncratic notational system. Even so, it was often very difficult for me to assess the relevance of a given scrap of calculations or even to understand it, given that he was constantly innovating new methods that are not usual or widespread today.

Although this process was extraordinarily labor-intensive, it led me to discover that previous scholars had not checked to see whether the *memoria technica* examples that they were citing actually enciphered the information using the cipher they were reproducing alongside it. As I have mentioned, working backwards enabled me to discover that there was a substantive difference between the *memoria technica* in his various periods of composition, and that Carroll was using a different cipher in 1875. This major find strengthened my belief in the existence of a mnemonic

code. Perhaps other scholars had attempted to examine this possibility but had used the wrong cipher, which had of course yielded nothing, and that was why they had dismissed the mnemonic diary entries as curious with little further comment. I tried deciphering the poem again—now using an automated spreadsheet running an SQL code that substituted letters, rather than pen and paper—but it still yielded nothing.

I began to appreciate the importance of treating the *Snark* as a dual mathematical and literary object, rather than a simple one-to-one ciphertext. Concentrating more exclusively on the mnemonics from October and November 1875, which I deemed the most relevant, in tandem with the literary themes of the poem—irrationality, nonsense, circularity, tangents, impossible quests—led me to hypothesize that the most likely mathematical concepts to be enciphered had something to do with logarithms, trigonometric calculations (sines, cosines, tangents, angles, etc.), irrational numbers like π and e, or imaginary numbers. I came to believe that the code in this Eastertime poem was not an irrelevant 'Easter egg'—to use a modern computing term for an unexpected hidden joke—but a mathematical concept that was in some way relevant to the poem itself. Its inclusion must enable Carroll's playful investigation of some shared concept in two different mathematical and literary modes.

As I became more aware of just how interdisciplinary my problem was, I increasingly began to appreciate that such an investigation required an advanced level of mathematical analysis to match my own work from the standpoint of literary criticism. At this point I determined that I needed to bring in collaborators who understood the mathematical material better than I did, and who could help me devise a more advanced deciphering system than my spreadsheet. I began working with Matthew Stone, who was at the time a Ph.D. candidate in the UCLA mathematics department. Stone has an interest in puzzles and enjoyed the *Alice* books, and he agreed to look over the archive

materials and see what he could make of them. His mathematical perspective was invaluable for several reasons. Firstly, he identified problems that I would likely never have become aware of, such as that Carroll's calculational method in some of the *memoria technica* included some rounding operations that would tend to introduce errors into the calculations that would accumulate in the last digits of a given figure. This was a particular problem for deciphering mnemonic poetry because it is most common for the mnemonic code word to be at the end of a poetic line, meaning that one must work backward from right to left when deciphering. If the last digits are the least accurate to a known calculation, then it would be very easy to mistake an enciphered word for null text. Secondly, it was enlightening to observe that some of the mathematical material that had puzzled me when transcribing Carroll's mathematical archive was also not immediately intelligible to Stone, despite his clear expertise in the field. This inscrutability underscored the double problem that the mathematical angle entailed: it required not just understanding the modern trigonometry that students learn in secondary school today, but parsing Victorian trigonometry and developing a more nuanced understanding in historical methods of calculation and Carroll's many innovations.

Most importantly, Stone took the time to do a task that neither I nor any previous scholar had thought to do: rather than accepting the letters that Carroll writes above his ciphers as accurate encipherments, he laboriously checked all of the existing *memoria technica* to see if the letters actually encoded the numbers that Carroll's writing indicated that they did. Not all of them lined up. This realization was extremely important, because it highlighted the central compositional problem that makes these texts at the same time so poetically fascinating but also mathematically and cryptologically fraught. Rather than mechanically applying the rules of the mnemonic ciphering system, Carroll regularly played with the constraints of his encryption system when it suited his literary purposes. Most mnemonics nonsensically fit the English words to the encoded numbers;

Carroll's *memoria technica* fit numbers to poetry. I gave an example of this type of play in Chapter 2 when I discussed how Carroll uses an extra letter in his 8 November 1875 π mnemonic "Bob Loudsvill the coupon of the bogy Coochub – shoot it!"[312] because the additional letter ('C') enciphers 0, and adding 0 does not change the number based on the rules of addition. From the standpoint of decipherment, this kind of creative play creates a huge problem, since adding 0 in a decimal sequence obviously *does* change the number by shifting all of the subsequent digits over by one place. Even if we knew exactly what numbers Carroll encoded in the *Snark* and found a way to determine their precise location in the poetic lines—which we don't and haven't—a simple keyword search would likely come up empty because he probably made these kinds of creative substitutions fairly routinely. The more substitutions he introduced, the more likely it was that any supposed identification of the hidden numbers could be due to the pure chance of numerical randomness, rather than a statistically significant finding.

These problems were made more difficult by the number of possibilities and the lack of calculational standardization in the period before mechanical calculators. Considering relevant concepts that were both mathematical and literary, and that appeared somewhere in Carroll's mathematical archive—like tangents and irrationality—had left me with too many numerical possibilities. Even if we could ascertain that the given sequence was specifically, say, a sequence of logarithms that built upon those found in Carroll's November 1875 mathematical *memoria technica*, the digits might differ based on which logarithmic tables he was using; they might also be those attained using the experimental method for calculating sines without tables. These calculational possibilities greatly magnified the range of potential numbers that could be enciphered. Given the scale of these possibilities, I decided that it could be fruitful to take a more maximalist big-data

[312] Carroll, "Bob Loudsvill the Coupon of the Bogy Coochub—Shoot It!"

approach with respect to determining the identity of the enciphered numbers. If I could create a database of possible numbers, taken from Carroll's existing calculations and the options found in contemporaneous publications of logarithmic tables and *Nautical Almanacs*, it should be possible to create a computer program to search for resonances within a given degree of variation. Theoretically, it should also be possible to have the program's search deal with the kinds of discontinuities I discussed above (just as, for example, Google searches for 'Louis Carroll' or 'The Hunting of the Snarw' will still yield relevant results). To explore these possibilities, I consulted with Craig Messner, who is a nineteenth-century Americanist with a secondary area of technical expertise in digital methods. Messner realized that it should be possible to create another software program based on the existing examples of Carroll's experimental calculation methods that could calculate an entire range of figures as Carroll would have. This inclusion would fill in major gaps in our planned database. However, even with this innovative computational solution, the amount of work required to transcribe the contents of multiple Victorian logarithmic tables and *Nautical Almanacs* would have been immense. For that reason, we decided to pause and see if I could find any means of taking a better guess as to the specific numerical sequence we were looking for.

Examining the early cipher I discovered in Carroll's Princeton archive, Stone made another important realization: the '0' digit encoded the letters C-Y-PH-R—cypher. I researched the word and realized that this detail was both a little metareferential linguistic mathematical joke and, I believe, a larger reference to the history of maritime mathematics. The term 'cipher' refers to a means of encoding text; it is also an older term for 'zero.' However, the alternative spelling "cypher" would have been antiquated in the late Victorian period; it was much more common in the eighteenth century, when it appeared frequently in the context of 'cyphering books.' From the Middle Ages until the mid-nineteenth century, students learned mathematics not by directly studying

textbooks, but by creating their own version of mathematical instructional manuals called cyphering books. These books—some maritime examples of which I presented above—included elaborate artistic drawings, information on basic arithmetical rules like the "Rule of Three," and worked-out solutions to navigation problems. Recognizing the relevance of this discourse, I spent a week photographing early nineteenth-century archival examples from the UK National Maritime Museum in Greenwich in order to better understand how sailors actually calculated navigational directions and what other material such books commonly included that the *Snark* might obliquely reference.

At this point, my hunt received a huge boost from a brilliant close-reading insight by Jonathan Grossman, who suggested that 'snark' was a portmanteau for 'sine arc.' The identification of the sine function especially made sense given the cyphering book nautical context that I had identified, and given the archive papers and diary entries showing that Carroll had been working on sine calculations at the time of writing the *Snark*. 'Sine arc' also fit in perfectly with Carroll's comments in the poem's preface of the importance of portmanteau logic and the inclusion of important mathematical lessons in the text. However, 'sine arc' confused me because in planar geometry and trigonometry, the kind of mathematics I learned in school, it is only possible to take the sine of an angle, not an arc (an arc is a part of a circle's circumference). I wondered if 'snark' perhaps referred to the reversal of those words, arcsine, which is the inverse function of sine.

Paradoxically, this breakthrough led to a long plateau, as all of the potential pathways towards a solution—mathematical, computational, and literary—suffered from serious drawbacks. It was difficult to know which one to dedicate time to, and the necessary work was also getting farther and farther away from the literary project I was ultimately working on producing. I spent months attempting to relearn trigonometry, parse the archival cyphering books, and teach myself cryptography. As I read more about cryptography in particular, it became apparent that many of the

traditional methods of decipherment—which rely on the fact that most encoded text translates to messages that linguistically make sense—would not work, as the *Snark* code is ostensibly a sequence of calculations. Some codes can even be mathematically proven to be unbreakable.

When I returned to the project after a hiatus, I deliberately tried to return back to basics. Arcsine or sine arc? I researched the technical specifics of historical methods of navigation, and this turn, combined with Grossman's close-reading insight, illuminated a new way forward. The concept of taking the sine of an arc was initially nonsensical to me because I was only familiar with planar trigonometry from my high school education. The nautical context enlightened me as to the existence of spherical trigonometry. Now a very specialized subject, spherical trigonometry was widely taught until the end of the nineteenth century because it had many important practical applications to astronomy, surveying, and navigation before the invention of GPS. And in spherical geometry, it *is* possible to take the sine of an arc.

I believe that I have once again come to an inflection point in my search for the *Snark*'s hidden mnemonic code in which it is necessary to collaborate with outside scholars who have specific technical expertise in the history of eighteenth- and nineteenth-century trigonometry and maritime navigation and in cryptography. Moving forward, I plan to connect with two scholars in those fields and jointly pursue the next phrase of the *Snark* hunt. If we are successful, such a finding will surely revolutionize the traditional understanding of Carroll's famous poem. Despite the winding path that this hunt has taken, my "courage is perfect! And that, after all, / Is the thing that one needs with a Snark."[313]

[313] Carroll, *The Hunting of the Snark*, l. 1.43-44.

Chapter Four: Military Machines

Thus far, I have argued that nineteenth-century mnemonics discourse theorized artificial memory systems as external memory machines that produced automatized random-access recall; operated by leveraging the poetic possibilities offered by humorous nonsense sound, a framework that intersected with contemporaneous mathematical developments that drove the invention of Boolean symbolic algebra; and conceptualized logarithm-based encryption in a manner that anticipates modern computer encryption systems. This nineteenth-century story, I have emphasized, is quite distinct from traditional histories of twentieth-century computing, which present the development of the computer as a product of wartime research and development, especially during and directly after World War II. This standard account emphasizes the militaristic dimensions of the computer and underscores the unequal gender dynamics underpinning its creation. Thus far, the Victorian literary history of computing centered around mnemonics that I have put forth—which has emphasized the working-class, radical liberationist, popular-culture influences on the nineteenth-century theorization of key computational concepts—has likely seemed a far cry from the traditional scholarly accounts offered by new media studies and digital humanities through the foundational work of scholars like N. Catherine Hayles, Lev Manovich, and Wendy Hui Kyong Chun.

By way of closing my study, I want to examine the meeting point between these two histories, which, surprisingly enough, do cleave together. To do so, I will examine the shift between the representation of passive remembering from John Buchan's 1915 Great War spy novel *The Thirty-Nine Steps* and Alfred Hitchcock's 1935 film adaptation *The 39 Steps* (note the title difference). Both stories follow protagonist Richard Hannay's quest to stop a German espionage ring from stealing top-secret British government plans in the immediate lead-up to the outbreak of war between the two nations. But there the similarities basically stop. Indebted to an understanding of

memory derived from eighteenth-century Scottish Common Sense philosophy of mind, Buchan's narrative is fundamentally structured around a series of remembering episodes that evaluate the utility of active versus passive remembering. Whereas the Common Sense philosophers ultimately asserted the superiority of active recall, Buchan's *Thirty-Nine Steps* inverts this valuation by presenting Richard Hannay's most impressive achievements as made possible by surprising spontaneous recollections. Passive remembering enables Buchan to craft the sudden miraculous revelations that are crucial to his goal of writing a "shocker" in which "the incidents defy the probabilities, and march just inside the borders of the possible."[314]

Whereas Buchan structures his novel around a traditional understanding of passive and active memory drawn from the eighteenth-century Scottish Common Sense tradition, Hitchcock develops Buchan's representation of passive memory by introducing a mnemonic framing for the narrative—and in so doing, offers a crucial link between the world of Victorian mnemonic computational theorization and the wartime invention of the computer. Hitchcock's loose adaptation of Buchan's story strengthens this emphasis on passive remembering in the sense that the story's central reveal revolves around automatized mnemonic recall. However, Hitchcock's *The 39 Steps*—produced twenty years after Buchan's, in the lead-up to World War II, rather than at the start of the Great War—enriches and modernizes the older Victorian understanding of artificial memory systems as autonomous machines by presenting mnemonics explicitly as a mechanized wartime weapon that can encrypt top-secret military intelligence and is susceptible of falling into German hands. Hitchcock's explicit militarization of mnemonic technology connected to sonic nonsense transforms it into an automatized war weapon. This representation of artificial memory systems simultaneously highlights the importance of the earlier threads I have analyzed over the course of

[314] John Buchan, *The Thirty-Nine Steps* (London: William Blackwood and Sons, 1915).

the nineteenth century together—the mechanicity of passive recall, the importance of sonic nonsense, and the encryptional security function of mnemonics—and links them to the traditional twentieth-century gendered, racialized, military histories of computing, Tracing the treatment of memory from Buchan's novel to Hitchcock's film provides the final link illustrating how the eighteenth- and nineteenth-century history of computing centered around Victorian mnemonics meets up with the standard technological history of computing as a product of the World Wars. In restructuring the story around Mr. Memory, a character based on the last great mnemonic showman of the nineteenth-century tradition, but representing him as the ultimate war technology, *The 39 Steps* bridges the intellectual theorization of computing concepts by Victorian mnemonics discourse with the twentieth-century military development of the computer as a wartime weapon, in doing so presaging the rise of the modern cybernetic relationship between humans and computing machines.

I. Buchan's *The Thirty-Nine Steps*: Scottish Common Sense Philosophy, Redux

Set three weeks before the outbreak of World War I, John Buchan's *The Thirty-Nine Steps* follows the harrowing adventures of Richard Hannay, who becomes embroiled in the world of international espionage after his neighbor, Franklin Scudder, is murdered in Hannay's apartment, leaving him as the prime suspect. Scudder had unveiled an impending plot by a German espionage ring called the Black Stone to steal secret British military engineering documents for the development of a new aeroplane. To save his country and clear his name, Hannay must fully uncover the details of their plan and then derail it before they escape abroad. In a modern twist on David Balfour's flight across the Scottish Highlands in Robert Lois Stevenson's *Kidnapped*, Hannay's quest takes him from his London flat through the wild regions of Scotland. While working to uncover the Black Stone's secrets from Scudder's enciphered notebook, he must also evade the British police, who want him in

connection with Scudder's murder, and the spies who are attempting to kill him for his knowledge of their plot. After a series of lucky escapes and one especially fortunate meeting with a passing motorist who has high connections in the British Foreign Office, Hannay manages to warn the British government of the plot; with their help, he foils the Black Stone's attempt to escape England with the plans.

Although *The Thirty-Nine Steps* is distinctively cutting-edge in that it "invented the modern spy thriller," its narrative is fundamentally structured around much older philosophical framework: the conceptualization, now familiar to us, of active and passive memory derived from Scottish Common Sense philosophy.[315] As a young man, Buchan zealously "read and analysed many of the English and Scottish philosophers" while at the University of Glasgow. He records that his "philosophical reading" left him with an anti-associationist "dislike of grandiose mechanical systems, and a distrust of generalities." He studied under Idealist Henry Jones—then Chair of Moral Philosophy, a position previously occupied by Thomas Reid and Dugald Stewart—but his philosophical views appear to have been more in line with the older tradition of Scottish philosophy than with the Scottish Idealism that replaced it. He remarks that although he and Jones forged a "life-long friendship, […] the semi-religious Hegelianism then in vogue, first preached by Edward Caird and continued by Jones, did not greatly attract me." Buchan's philosophical views had a strong influence on his literary work: indeed, he recalls that his early style was so "stiff-jointed, heavily brocaded, and loaded with philosophical terms," that he worked for "years to supple it."[316]

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[315] Adrian S. Wisnicki, "Reformulating the Empire's Hero: Rhodesian Gold, Boer Veld-Craft, and the Displaced Scotsman in John Buchan's *The Thirty-Nine Steps*," *Journal of Colonialism and Colonial History* 8, no. 1 (Spring 2007).

[316] John Buchan, *Memory Hold-The-Door* (London: Hodder and Stoughton Ltd., 1940), 37, 39, 41–42.

The narrative framework of *The Thirty-Nine Steps* illustrates how this intellectual tradition shaped Buchan's literary writing through its treatment of memory. The main roadblock facing Hannay is actually not the external dangers posed by his two groups of adversaries, but the challenge of overcoming his own memory's shortcomings. At the beginning of the story, Hannay's inability to remember threatens to stymie his quest before he has even embarked. Although Scudder revealed many significant details of the plot to him, he ruefully relates that "I did not give him very close attention. […] So a lot that he said slipped clean out of my memory." This unfortunate—and rather incredible, given the clearly titillating subject-matter—act of forgetting leaves him "[knowing] nothing but the barest facts."[317] Likewise, during the direst moment of his adventures, when the Black Stone agents trap him in a shed with the intention of killing him shortly thereafter, he must overcome another memory failing to escape. The shed he is trapped in holds explosives that he had previously worked with in Rhodesia as a mining engineer. However—strangely for a man who had only "been three Months in the Old Country"—he states: "I had forgotten most that I knew about lentonite"; specifically, "I had forgotten the proper charge and the right way of preparing it, and I wasn't sure about the timing."[318]

With the exception of the shed scene, Hannay's early inattentiveness and poorly trained memory shifts when he begins to journey to Scotland, where his strong memory abilities allow him to recall important information at will and employ it to his advantage. For example, on his first night in Scotland, he converses with a local man and "picked up from him a good deal about the local Galloway markets, which I tucked away in my memory for future use."[319] When Turnbull's friend

[317] Buchan, *The Thirty-Nine Steps*, 33–34, 40.

[318] Buchan, 149, 151, 2.

[319] Buchan, 56.

Hislop later gives him a ride on his journey back to England, Hannay reiterates the information he had stored about "Galloway markets and sheep prices" to convince the man that he is a local shepherd—a memory performance that augments his physical costuming of a "plaid" and an "old hat," which altogether gives him "a fine theatrical Scots look."[320] Hannay's new-found recognition of active remembering's importance to his mission enables him to effectively masquerade as a traditional Scotsman at key moments during his journey.

For the majority of the narrative, Hannay's incredible ability to actively recollection information at pivotal moments serves as the most important key to his success. He demonstrates an incredible ability to recall the details of Scotland's geography from his memory of maps. This skill is essential, as effectively navigating Scotland's remote regions enables Hannay to progress along his journey across the Highlands and back to England while evading the British police and his mercenary assailants. Although he views several maps of Scotland over the course of his adventure, Hannay unaccountably never takes them with him, despite his complete unfamiliarity with the country. This choice forces him to rely primarily on his memories of the documents—an action that mirrors and foreshadows the Black Stone agent's ploy to steal the British engineering plans by recalling the documents from memory. For example, after stealing his adversaries' green car at the inn, he relates, "I steered east by the sun, for I remembered from the map that if I went north I could come to a region of coal-pits and industrial towns."[321] He later views another map from Sir Harry, the motorist who connects him to high-ranking Foreign Office officials, but doesn't bring it with him. It is only by following his "memory of the map" that enables Hannay to successfully retrace his steps back to the road-worker Turnbull's cabin to retrieve Scudder's precious notebook

[320] Buchan, 170.

[321] Buchan, 85.

containing the encoded explanation of the entire mystery—crucially, the only real evidence Hannay has that proves the truth of his story and thus his innocence in Scudder's murder (which, incredibly, Hannay had *also* unaccountably declined to take the notebook from his coat-pocket when they switched clothing a few days before).[322]

Hannay's powers of active memory, displayed most prominently through his memory of the map documents, make him the only real match for the Black Stone agent who steals the information contained in the engineering plans by memorizing it. In response to the suggestion that the imposter "could not carry away several pages of figures and strange names in his head," a French government official compares the thief's memory skills to the famed memory capabilities of Thomas Babbington Macaulay.[323] He explains, "A good spy is trained to have a photographic memory. Like your own Macaulay. You noticed he said nothing, but went through these papers again and again. I think we may assume that he has every detail stamped on his mind. When I was younger I could do the same trick."[324]

But although Hannay's impressive memory enables him to traverse Scotland without getting caught, his powers of active recollection betray him in his final challenge: the identification of the spies. The true unreliability of active recollection becomes clear after Hannay tries, and utterly fails, to remember whether the men that he has tracked to Dover are, in fact, the same Black Stone assailants whom he has been crossing paths with in Scotland for the week. He states, "I simply can't explain why I who, as a roadman, had looked into two pair of eyes, and as Ned Ainslie into another pair, why I, who have a good memory and reasonable powers of observations, could find no

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[322] Buchan, 165.

[323] See, for example, "Lord Macaulay's Memory," in *The Spectator* (F.C. Westley, 1876), 429–30.

[324] Buchan, *The Thirty-Nine Steps*, 208.

satisfaction. They seemed exactly what they professed to me, and I could not have sworn to one of them."[325] In this tense climax, Hannay is forced to recognize that in spite of his innate memory skills and his strenuous efforts at recollection, he simply cannot remember the men's likenesses—an action that will make the difference between apprehending the spies and protecting Britain's military superiority, and allowing them to escape with the secret plans. This inability to remember the men's immutable characteristics clearly enough to see through their stereotypical English disguises foreshadows the impending failure of the spies' plan to steal the documents through the same processes of memorization and active recollection.

The ultimately undependability of active recollection is ameliorated by Hannay's spontaneous passive remembrances, which act as a form of Providence by guiding his steps along the dangerous journey and eventually precipitate his most important and surprising discoveries. He begins his journey by deciding to take the train to "Newton-Stewart" in Dumfries and Galloway because the name "had suddenly come back to my memory."[326] This isolated starting location turns out to be quite fortunate, for it uniquely enables him to avoid capture by the network of British police that have been sent to search for him. Likewise, Hannay's unexpected passive recall of information from his previously forgotten conversations with Scudder enable him to unravel details of the Black Stone plot. Following hours of work trying to guess the enciphered notebook's codeword, he spontaneously cracks the encryption after "the name Julia Czechenyi flashed across my memory. Scudder had said it was the key to the Karolides business, and it occurred to me to try it on the cypher. It worked."[327] Likewise, Hannay's unexpected remembrance of the final note in

[325] Buchan, 244.

[326] Buchan, 49.

[327] Buchan, 73.

Scudder's notebook—"*Thirty-nine steps—I counted them—High tide,* 10.17 P.M."—during his impromptu meeting with senior British Foreign Office officials enables him to identify the correct rendezvous location on the Dover coastline where the Black Stone spies are planning to abscond.

After Hannay's powers of active memory fail him during the pivotal closing scene at Trafalgar Lodge in which he falteringly watches the three suspected spies, a series of random associative recollections of his previous life in Rhodesia save the day by miraculously guiding his maneuvers and eventually clenching his suppositions. After observing the men's unassailably English mannerisms during a game of tennis, Hannay becomes convinced that he has identified the wrong suspects. "Feeling [like] a precious idiot," he dismayingly concludes that he "had been barking up the wrong tree this whole time. […] It was simply impossible to believe that these three hearty fellows were anything but what they seemed." But just when hope seems lost, Hannay's spontaneous recall of some advice about the logic of disguises puts him back on the men's scent: "suddenly I remembered a thing I once heard in Rhodesia from old Peter Pienaar … The recollection of Peter's talk gave me the first real comfort I had had that day." When his resolve fails again as he walks to confront the men directly, he gets another "piece of solid comfort from the sight of a greyhound that was swinging along at a nursemaid's heels. He reminded me of a dog I used to have in Rhodesia, and of the time when I took him hunting with me in the Pali hills."[328] Hannay's associative train of memories from the greyhound dog to Rhodesia memory of a rhebok camouflaging itself enables him to see through the agents' disguises and foil the espionage attempt. He relates, "Suddenly as these memories chased across my brain I thought of my present case and applied the moral. […] I was on the right track, and I jammed that down in my mind and vowed never to forget it." Buchan's frequent use of adjectives like "suddenly" and "flashed" in these

[328] Buchan, 230–31, 232–33, 235.

moments of memory inspiration underscore the unexpected nature of Hannay's random recollections.

The narrative intensively emphasizes the value of passive memory at the story's climax by making Hannay's breakthrough identification of the spies hinges on a moment of double passive remembrance. Hannay successfully identifies the spies after a momentary habitual gesture by the old man enables him to see past their disguises: "The old man lad down his hand to light a cigar. He didn't pick it up at once, but sat back for a moment in his chair, with his fingers tapping on his knees. It was the moment I remembered when I had stood before him in the moorland farm with the pistols of his servants behind me." As Hannay gazes upon the man following this flash of recognition, another of the old man's habitual bodily movements cements his identity: "as I glanced at him his eyelids fell in that hawk-like hood which fear had stamped on my memory." These corporeal habits—the gestural expressions of unconscious bodily memory—trigger Hannay's own passive remembrance of the earlier scene, leading to the key moment of true recognition.

Hannay's passive-memory revelation reverses the supernatural power dynamic that had previously existed, breaking through the 'mesmerism' of the fake domestic scene that had previously bewildered him and granting him the miraculous ability to expansively remember the missing elements of the case, even those he did not experience first-hand. Upon initially entering the house, he recalls that "the whole business had mesmerized" him—a term he repeats three times when describing the scene—and had made the confrontation feel "like a kind of dream." This occult environment transforms the men: "it was not that they looked different; they *were* different."[329] However, the sudden triumph of his powers of passive recall over the old man's telltale expression of passive bodily remembrance provides the key to breaking the oppressive illusion. After

[329] Buchan, 236, 247, 250, 246–47.

recognizing the man through his momentary habitual gesture, "The three faces seemed to change before my eyes and reveal their secrets. The young one was the murderer. Now I saw cruelty and ruthlessness, where before I had only seen good-humour. His knife, I made certain, had skewered Scudder to the floor. His kind had put the bullet in Karolides." By winning this battle of passive remembrance between himself and the old man, Hannay gains the mesmeric ability to 'see' the past ill-deeds of the men, fully confirming his belief in their guiltiness.

In addition to the link to Scottish Common Sense philosophy of memory that Buchan's novel provides, with respect to the role of Hitchcock's adaptation in the twentieth-century history of computing, it is important to note that in *The Thirty-Nine Step* it is arguably *Hannay*—rather than the spy with the naturally stellar memory who memorizes the plans—who is functionally most akin to a computing machine, due to his powerful passive memory, his military intelligence background, and his prowess at cracking the encrypted cipher. Hannay's experience during the Boer War leads him to suspect that Scudder's notebook is encrypted via a cypher, "the numerical kind where sets of figures correspond to the letters of the alphabet." As Hannay relates, the book "was pretty well filled with jottings, chiefly figures, though now and then a name was printed in. For example, I found the words 'Hofgaard,' 'Luneville,' and 'Avocado' pretty often, and especially the word 'Pavia.'" Believing it to be a kind of Vigenère cipher, he attempts to crack the code by guessing "they key word which gives you the sequence of the letters."[330] Hannay's breakthrough comes when he suddenly passively remembers Scudder mentioning the name Julia Czechenyi, which turns out to be the code word. He explains, "The five letters of 'Julia' gave me the position of the vowels. A was J, the tenth letter of the alphabet, and so represented by X in the cypher. E was U = XXI, and so on. 'Czechenyi' gave me the numerals for the principal consonants. I scribbled that scheme on a bit of paper and sat

[330] Buchan, 248, 52–53.

down to read Scudder's pages." Unlike Hitchcock's film, which represents mnemonic recall as a dangerous modern military technology, Buchan's novel actually distances militarization, computational decryption, and passive remembering—all embodied here by Hannay—from the sleekness of modern machinery. This schism is clear when Hannay exists the train right after cracking the code, where he "sight of myself in the mirror of an automatic machine" on the platform and is struck by "my brown face, my old tweeds, and my slouch," which make him look like "the very model of one of the hill farmers who were crowding into the third-class carriages."[331] Hannay's triumph of passive remembering and computational decryption actually moves him in the *opposite* transformational direction with respect to mechanicity. It makes him more real; more intimately connected to the ancient customs and traditions of the Scottish countryside—in short, more human. If Buchan's narrative strategy of reinfusing passive remembering with humanity and narrative power represents one solution to the concerns voiced by the eighteenth-century Common Sense philosophers, Hitchcock's simultaneous development of Buchan's memory ideals and modern transformation of them through the lens of military conflict and totalitarian surveillance offers a different cybernetic path, one that begins in Edwardian music halls and continues into the present.

II. Music Hall Nonsense and Mnemonic Spy Technology

Like Buchan's novel, Alfred Hitchcock's adaptation *The 39 Steps* follows Londoner Richard Hannay's quest to clear his name after being wrongly accused of a murder associated with a mysterious international spy ring. But in the two interwar decades between Buchan's 1915 novel and Alfred Hitchcock's 1935 film, the world changed momentously. For our purposes it will be enough to note

[331] Buchan, 73, 53.

the breakdown of the "shift toward an economic and political autarky that emerged especially after the 1914–1918 war" during the Great Depression, which, as Robert Hassan and Julian Thomas explain, represented a fundamental contextual backdrop for the invention of the computer. The interwar period had ushered in a time of relative international isolationism, in which "many areas of everyday life and culture [were] left almost untouched" by the incremental technological developments surrounding them. They explain that the years immediately after the war experienced "a kind of 'local–global' form of development where the political 'local' still had preponderance over the natural 'global' instincts of capitalism."[332] Hitchcock's adaptation dramatizes that shift, legitimizing fears of the spread of internationalist political oppression into Britain—not just circulating within fashionable internationalist intelligentsia circles, but as infiltrating and controlling even the music hall, representative of most quintessential sphere of everyday working-class British social life—by developing Buchan's representation of passive memory's power through the introduction of mnemonics, which offers both a broad narrative framework and the nexus for the film's startling plot denouement.

Before examining Hitchcock's plot in detail, it is important to recognize that *The 39 Steps* is only a nominal adaptation of Buchan's Great War novel, given that it registers contemporaneous 1930s British anxieties about the darkening international political landscape between Britain and Germany. As Toby Miller puts it, "Hitchcock's film [was] adapted as much for the 1930s as the screen."[333] Walter Raubicheck and Walter Srebnick explain that the narrative explores the "political tensions that developed after the war," such as "a growing fear of outside forces attempting to steal

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[332] Robert Hassan and Julian Thomas, introduction to *The New Media Theory Reader*, ed. Robert Hassan and Julian Thomas (Maidenhead: Open UP, 2006), xix.

[333] Toby Miller, "39 Steps to 'The Borders of the Possible': Alfred Hitchcock, Amateur Observer and the New Cultural History," in *Alfred Hitchcock: Centenary Essays*, ed. Richard Allen and Sam Ishii-Gonzales (BFI, 1999), 319.

military secrets, as epitomized by the self-possessed, patrician, duplicitous Professor Jordan, representing the emerging German threat."[334] To do so, Hitchcock conspicuously removes all of the plot details that identify the story as set just before the outbreak of World War I. That includes Hannay's settler-colonialist past as a Rhodesian mining engineer, which locates him within an earlier period of British 'New Imperial' expansion (replacing Rhodesia with Canada, ostensibly a nod to John Buchan's recent appointment as Governor General of Canada. Hitchcock also omits the assassination of a leader from the unstable Balkan region by an anarchist group named 'Black Stone' (an explicit nod to the Serbian 'Black Hand'). Gone too is the explicit representation of anticipated escalatory steps between Austria-Hungary and Germany, and Russia and Britain that reiterates the start of the Great War; and the anti-Semitic suggestion of a Jewish financial conspiracy underpinning it all. The film's post-war setting is also briefly but definitively asserted by Hannay's off-hand quip to Pamela about Armistice Day during the bedroom scene in the Argyll Arms. Hitchcock declines to fill this narrative vacuum, masterfully leaving an unsettling vagueness that underscores the shadowy uncertainty surrounding the film's adversaries. This future-oriented military context is important for understanding how the film's representation of mnemonic technology fits within the history of computing.

The film's opening scene depicts Hannay attending the music-hall performance of Mr. Memory. When the crowd turbulently rushes out of the theater after a shot is fired, Hannay is randomly pushed against Annabella Smith, a mysterious Germanic *femme fatale* who coyly asks to come home with him. There she reveals that she is a spy who has uncovered a plot by another espionage organization called 'The 39 Steps' to steal British military secrets. Despite her precautions,

[334] Walter Raubicheck and Walter Srebnick, "Wrong Men on the Run," in *Hitchcock and Adaptation: On the Page and Screen*, ed. Mark Osteen (Plymouth: Rowman & Littlefield, 2014), 26.

members of the organization find her that night and fatally stab her. She dies clutching a map of the Scottish Highlands with a place called Alt-na-Shellach circled. Forced to flee, Hannay decides to travel there to solve the crime in the hopes of clearing his name and also preventing the secret papers from leaving England. He embarks on a series of adventures in Scotland in which he narrowly avoids an assassination attempt; escapes kidnapping by the henchmen of Professor Jordan, the mastermind responsible for the papers' theft; and becomes comically becomes handcuffed to Pamela, an attractive woman who becomes his sidekick after initially trying to turn him in to the police. After Pamela overhears the spies discussing Professor Jordan's plans to rendezvous at the London Palladium, they travel to the venue. Although Pamela attempts to warn the police about the plot, they dismiss her tip because no important papers are missing. As they enter the Palladium, the showtune sparks Hannay's remembrance of his previous time seeing Mr. Memory's show. After he notices Professor Jordan communicating with the mnemonist, Hannay realizes that the spy ring has stolen the information by having Mr. Memory memorize the papers. Desperate to stop the men as the police are hauling him away, Hannay roars, "What are The 39 Steps?," and Mr. Memory automatically provides the information. Professor Jordan immediately shoots Mr. Memory; as he lays dying, he automatically begins to recall the top-secret engineering plans for a new aircraft design.

The film's most significant alteration revolves around Hitchcock's addition of a mnemonist character who is ultimately revealed to be at the heart of the mystery. Fittingly, Hitchcock's idea to restructure Buchan's original exploration of the power of passive remembrance, was inspired by a memory of his own: his youthful remembrance of attending a music-hall performance by the famous Edwardian mnemonist 'Datas, the Memory Man.' Datas, whose real name was William James Maurice Bottle (1875–1956), was the last great mnemonic stage performer of the spectaclized nineteenth-century tradition begun by Gregor von Feinaigle in the 1810s. Born to a cobbler and

largely self-educated (just like George Boole), Bottle worked as gas-stoker at the Crystal Palace Gasworks in Lower Sydenham before comedian Tom Bass discovered him in 1900 and immediately put him upon the stage, just a few weeks shy of his twenty-seventh birthday. After Bass overheard Bottle offer the correct closing date and salient facts of the 1874 Tichborne trial to two gentlemen discussing the event—a surprising deed, given the trial's antiquatedness and Bottle's youth—he secured Bottle a trial slot at the Terriss Theater in Rotherhithe and the Standard Music Hall in Pimlico in 1901. His immediate successfulness vaulted him to a regular position at the Palace Theater in 1902, which was to become his primary venue for decades. Theater manager Fitzroy Gardner recorded that around 1905, Datas was making £50 per week (roughly £5,000 per week in today's terms)[335] and was "known to the music hall public of the whole English speaking-world."[336] Although his popularity was concentrated between the early 1900s through the 1920s, he did briefly make the leap from stage to television at the end of his performing career, answering questions from viewers sent by letter during a 1932 BBC broadcast.[337] Over the course of his career, he toured the United Kingdom, America, and Australia; and performed for private audiences of aristocrats and the British Royal Family. Just before his death at eighty-one in 1956, he shared that "one of his most treasured memories is of the late King Edward VII presenting him with a diamond pin at Sandringham."[338]

While many scholars have briefly noted that Datas provided the model for Mr. Memory—a connection that Hitchcock explicitly acknowledged as well—I suggest that a more thorough

[335] "Inflation Calculator," accessed July 18, 2023, https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator.

[336] Fitzroy Gardner, *Days and Ways of an Old Bohemian* (London: John Murray, 1921), 125.

[337] "National Programme [25 November 1932]," *The Radio Times*, November 18, 1932, 560.

[338] "Am I Right, Sir?," *East Kent Gazette*, July 22, 1955.

examination of their similarities reveals that Hitchcock modelled Mr. Memory's performances on Datas's much more minutely than has been previously recognized. Datas inhabited a performative identity defined by the objectified mechanical manifestation of data that was nonetheless nonsensically humorous at times. Although Victorian mnemonists had long emphasized the utility of their systems for mechanically recalling information, Datas was the first mnemonician to fully embrace the coldly inhuman abstraction inherent in pure numerality as his entire performative identity—an act that pushed the embrace of mnemonics' artificial mechanicity by earlier supporters during the 1840s to a new representational extreme. He states,

> You will have noticed, if you have heard me at the 'Halls,' that I refuse to answer a question unless it is put in the form of an inquiry as to a date. That is how I work, and that is principally 'how I remember,' by being certain as to my dates, all of which have been carefully and thoughtful committed to memory, and accordingly, to me a date is a starting-point from which to pick up the threads of memory which run here, there, and in every direction. Everything must have a beginning; there must be something to work from.…With me it is just a date, and it is as well that I am termed 'Datas,' for therein the secret lies.[339]

Whereas earlier commentators had conceptualized mnemonic users as something more akin to emptied-out automata, Datas's objectifying representation of himself literally *as* data concurrently seems to reciprocally reject his own humanity (as least as far as the performance went) and personify raw information. This representation goes a long way towards collapsing the distinction between the mechanicity of the external mnemonic system and the fundamental inalienable humanity of the mnemonic user, which had largely held throughout the Victorian period in spite of the fiery industrial rhetoric voiced by figures like Orson Squire Fowler. In keeping with his performative identity as the physical incarnation of data itself, Datas broke from the traditional practices of nineteenth-century mnemonics exhibitions by rigidly specifying the structural format in which

[339] Datas [William J. M. Bottle], *Memory by "Datas": A Simple System of Memory Training* (London: Gale & Polden, 1904), 31–32.

questions must be posed to him. This precise algorithmic structure reinforces his objectifying performance of mechanicity. At the same time, Datas performances incorporated humorous nonsensicality, which, as I suggested in Chapter 3, is not in the mnemonic context in binary opposition with mechanicity but was actually a central feature of it.

Fully recognizing the extent of Hitchcock's indebtedness underscores how this blending of mechanical memory, humor, and identity constructed around what we might now call 'big data' informed Hitchcock's portrayal of mnemonics as a military technology. In an interview with biographer Charlotte Chandler, Hitchcock stated, "Mr. Memory is one of my favorite characters. I have many favorites among those who people my films, but none of whom I'm fonder of than Mr. Memory. The character is based on a real person named Datas, who had an act in London when I was young. I found Memory's compulsion to answer quite fascinating."[340] Likewise, discussing the film in an interview with fellow director François Truffaut, Hitchcock explained the special allurement that both Datas and Mr. Memory held for him:

> There was also another interesting character in the film, Mr. Memory. He's based on a true-life music-hall personality called Datas. The audience would ask him questions about major events, like "When did the *Titanic* sink?" and he would give the correct answer. There were also trick questions. One of them was: "When did Good Friday fall on a Tuesday?" and the answer was: "Good Friday was a horse running at Wolverhampton race track and he fell at the first hurdle on Tuesday, June 21, 1864." […] Mr. Memory *knows* what the thirty-nine steps are, and when he is asked the question, he is *compelled* to give the answer.[341]

I suggest that Datas was so alluring to Hitchcock because his performances offered a mixture of automatized recall and humorous nonsensicality drawn from the Victorian mnemonic tradition but tinged with a more modern sensibility with respect to big data, all elements that Hitchcock explicitly develops in *The 39 Steps* alongside his expansion of Buchan's conceptualization of passive memory.

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[340] Charlotte Chandler, *It's Only a Movie: Alfred Hitchcock: A Personal Biography* (New York: Simon & Schuster, 2006), 98.

[341] François Truffaut, *Hitchcock* (New York: Simon & Schuster, 1985), 98.

Despite examining distinct themes, virtually all of the critical studies examining *The 39 Steps* rely, whether explicitly or implicitly, on the basic (and correct) assumption that memory offers an important framing for Hitchcock's narrative. Many critics have observed that memory recall provides *The 39 Steps* with its fundamental structure, from the overall plot structure down to the innumerable small details (like camera angles, character positions, and sounds) that recur throughout the film. As Tom Cohen describes, the entire film "involves an operation of referring back, of folding, against which 'narrative' cannot quite progress." [342] Examined broadly, William Rothman explains, the plot is fundamentally symmetrical: "The second half of the film doubles back on the first until, at the conclusion, Hannay is back where he started. He does not continue his journey but rather retraces his steps. He does not discover and unmask the villain but rather finds him again and provokes him to unmask himself stain. He again meets the woman he encountered on the train. And at the climax of the film, Hannah finds himself in a music hall, face to face with Mr. Memory."[343] These kinds of realizations have served as the basis for most of the film's scholarship; no matter the theme, *The 39 Steps* invariably offers a doubled pair of scenes that provides fertile critical ground.

The most developed body of scholarship on *The 39 Steps* focuses on Hitchcock's inclusion of women in Buchan's homosocial novel. Scholars like William Rothman, Charles Silet, and Walter Raubicheck and Walter Srebnick have examined how Hitchcock's new romantic plot transforms the story into a *bildungsroman* narrative of gender education in which Hannay must reverse the violent sexual narrative of the film's first half—as portrayed by his sexualized interactions with Annabella Smith, her murder, his banter about adultery with the milkman, the travelling lingerie salesmen's bawdy sexual jokes, the crofter's domestic assault on his wife, and Hannay's own comico-serious

[342] Tom Cohen, "Hitchcock and The Death of (Mr.) Memory," *Qui Parle* 6, no. 2 (1993): 52.

[343] William Rothman, *Hitchcock—The Murderous Gaze*, 2nd ed. (New York: SUNY Press, 2012), 153–54.

performance as a murderer towards Pamela—in order to become worthy of his and Pamela's union in the final scene. Such studies often also examine how the inclusion of the romantic plot transformed the espionage genre, providing a model for later Hitchcock films like *North by Northwest*. Ina Rae Hark, Toby Miller, William Rothman, and Elizabeth Weis have examined *The 39 Steps* within Hitchcock's broader treatment of the masses, democracy, and the rising internationalist threat of totalitarian fascism in the 1930s; noting the amateur Hannay's role as an exemplar of what John M. Smith famously termed Hitchcockian "conservative individualism."[344] Finally, Lacanian and deconstructive accounts by Slavoj Žižek and Tom Cohen have analyzed the film's interest in the breakdown of signs and meaning. Cohen especially focuses on the relationship between Mr. Memory and the circulation of linguistic nonsense in the film, such as puns and symbols.

But because the contextual history of Victorian mnemonics discourse is missing from all of these accounts, I posit that each of these critical traditions has only unearthed partial fragments of the film's full meaning, which underlies all of these strains but has not yet been recognized in its totality. I argue that understanding the central memory structure underpinning *The 39* as mnemonic recall specifically enables us to see how the film's various themes—the inclusion of women and circulation of tropes of sexual violence, the political treatment of the British masses, the nonsensical elements that point to the breakdown of meaningful language into recirculating symbols, and of course the depiction of memory as a technological war machine—are all intertwined parts of Hitchcock's masterful representation, which bridges Victorian mnemonics discourse with the wartime development of the moder computer. As I show, Hitchcock's representation emphasizes the various aspects of nineteenth-century artificial memory systems that I have been highlighting in

[344] John M. Smith, "Conservative Individualism: A Selection of English Hitchcock," *Screen* 13, no. 3 (October 1, 1972): 51.

my examination of this discourse as an early site of computational theorization—their automatic mechanicity and isolated externalism within the mind, their reliance on associative sonic nonsense play, and their encryption. I argue that it is only by recognizing mnemonic recall as the root of all of the film's other various themes that we can begin to understand the film as a whole, in a way that refuses to subvert one particular critical tradition to another. For our purposes specifically, understanding the film as fundamentally about mnemonics illuminates how the story of Victorian mnemonics that I have been telling links up and becomes subsumed by the traditional history of twentieth-century computing familiar to us from histories of technology, new media studies, and critical software studies.

Firstly, I suggest that it is important to nuance the common critical presupposition that 'memory' is the film's structuring principle by suggesting that it is more appropriate to understand *The 39 Steps* as staging a conflict between two different kinds of passive recall—one that is genuine, though often distorted, and associated with Hannay and Pamela and ultimately with humanity; and a perfect form represented by Mr. Memory that is linked with the coldness of modern technology, totalitarian surveillance, and the threat of fascistic military violence. Offering a more tenuously nuanced account of the *bildungsroman* interpretation, William Rothman argues that Hannay refuses to progress across the film, instead folding back on himself and failing to learn or grow from his tribulations. Tom Cohen has suggested that this stagnation occurs because the most direct narrative plot level operates as a kind of McGuffin. Applying this logic with respect to mnemonics, I suggest the narrative's central struggle does not really operate on the direct level of character action between Hannay and Pamela, but instead involves a more existential conflict between human and machine that is represented through two competing expressions of memory. Seen in this way, the structure of the film can be viewed as presenting a kind of mnemonic circumscription, where mnemonic recall

offers a kind of violent surveillance environment that attempts to encapsulate and contain the protagonists. The story follows Hannay and Pamela as they try to break themselves out of the overarching mnemonic structure of the film, a narrative set by The 39 Steps and Professor Jordan that seeks to destroy them.

The film's opening stages the tension between these two types of remembering by foregrounding the centrality of sonic nonsense and symbolism, which will be crucial to the representation of memory conflict throughout. The opening credits begin with a double-time version of Mr. Memory's showtune leitmotif, so that the viewer's first exposure to the tune actually occurs outside of the narrative's diegesis. Its slowed-down reemergence during Mr. Memory's first performance shortly afterward therefore sparks an unsettling remembrance that mirrors Hannay's own distorted passive remembrance of the partial tune in the film's second half. Jack Sullivan notes that Hitchcock visually reenforces this experience by opening the film with "a 'MUSIC HALL' sign gliding across the screen in close-up, each letter lighting up one at a time so that when the image is finally complete, it is subconsciously imbedded in our memory. Its significance is not apparent until the end, when in another venue, the Palladium, the hero experiences a musical epiphany that brings the film to closure."[345] Both of these instances play upon the strange and fragmentary nature of passive remembrance by presenting two entities as distorted—the former through the double-time speed of the tune, and the latter through the letter-by-letter shots that make it difficult to comprehend the words until the very end (as in the airplane sky-writing scene in *Mrs. Dalloway*). This sound-based representation of distorted remembrance provides the structure for the entire narrative, which begins and ends with two performances by Mr. Memory that tragicomically parallel one another. It also sets up the importance of sonic nonsense play.

[345] Jack Sullivan, *Hitchcock's Music* (New Haven and London: Yale UP, 2006), 39.

Although Tom Cohen does not examine the film in the context of Victorian mnemonics or the prosodic literary history of nonsense, he comes the closest to understanding the importance of nonsense in the film. He states, "The reason it is Mr. Memory who would smuggle the 'formula' for the silent war plane out of England, is that memory seems to do two things: first, it (or out he) appears as the machinal enforcer of mimesis, or representation, out ideological of which the closure of identification and subjectivization occur (the domain of the symbolic police), yet as a machine of repeated 're-marking,' it is also that which breaks up or destroys mimesis as figures, syllables, sounds, letters, and visual puns or objects (*sinthomes*) which emerge through repetition."[346] As Cohen notes, expressions of sonic nonsense and symbol-play proliferate across the film, beginning with this scene. As the opening shots make clear, sonic nonsense is a crucial element that illuminates how mnemonic recall structures the entire story.

The film initially intimates that Mr. Memory's performance will follow the format of the standard mnemonics exhibition, as familiar to the implied viewer from her assumed memories of Datas the Memory Man's famous performances (whether formed from personal experience or second-hand knowledge). The scene conspicuously invites this expectation by emphasizing the relationship between the two through their obvious similar stage-names, mannerisms, and biographical details. Like Datas, Mr. Memory solicits questions from ladies first. The host announces that Mr. Memory that has sold his brain to the British Museum, a transaction that notoriously occurred twice in Datas' life. In 1904, he sold his brain for an incredible £2,000 to a group of American doctors. In 1932, Datas made headlines when he re-sold his brain again to scientists at King's College Hospital Medical School "for £1000 down and £90 a quarter for life," plus "a grave

[346] Cohen, "Hitchcock and The Death of (Mr.) Memory," 55.

for four and a coffin"[347] (a feat made possible by the first purchasers all predeceasing him). Finally, the question "When was Crippen hanged?"—referring to Dr. Hawley Harvey Crippen, who notoriously murdered his wife, the music-hall singer Belle Elmore (Cora Crippen), to marry his lover in 1910—is a biographical reference to Datas, who was good friends with the couple, having performed in the same theaters alongside Elmore. Mr. Memory notably ignores this question, which remains uniquely unanswered despite its simplicity and clarity.

Hitchcock makes this likeness unmistakable by taking several questions from ostensibly the most well-known account of a performance by Datas, published in his 1904 book *Memory by 'Datas'*:

> Datas, the Memory Man, is still a great favorite at the Palace and shows that in his answers to his questioners he is as shrewd and clever as he is in his mnemonics. Datas claims to be an illiterate man—sometime a worked in the Crystal Palace Gasworks. But he is a born humourist all the same. His question, 'Is that right, sir?' after answering some question as to the number of letters in the Bible, and so on, causes shouts of laughter. On the night I heard him he gave, in addition to his answer as to the next winner of the Derby— "The first past the post—if he's not disqualified" —a smart answer as to the age of Marie Lloyd. "I never give away a lady's age."[348]

In Hitchcock's rendition, after a man asks Mr. Memory which horse won the Derby in 1936 (an unanswerable question, since it is presumably 1935), he humorously replies, "Come back in 1937 and I'll tell you." Likewise, Hitchcock substitutes Marie Lloyd's name for Mae West's in the most prominent question from the scene, "How old is Mae West?"—a query that Mr. Memory initially puts to bed by offering the same cheeky response as Datas did.

Hitchcock also initially appears to signal consistency with the Victorian mnemonic tradition by explicitly representing Mr. Memory's memory skills as arising out of the associative

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[347] "Man Sells His Head," *Midland Daily Telegraph*, October 5, 1932.

[348] Untitled review in *The Referee*. Reprinted in Datas [William J. M. Bottle]. *Memory by "Datas": A Simple System of Memory Training*. London: Gale & Polden, 1904.

illogic of mnemonic recall that, as I examined in chapter 3, often makes use of the inherent multidirectionality of linguistic and visual symbols to recall information via nonsensical sonic links and puns. For example, when a small boy leans over Hannay's shoulder to ask, "What won the cup in 1936?" Mr. Memory immediately replies, "Cup? Waterloo, football, or tea?" This response makes visible the internal workings of the artificial memory system (a revelation that importantly recurs in the final scene). However, although Mr. Memory shares the mechanical memory and reliance on nonsense associative sound as his predecessors, it becomes quite clear that Mr. Memory's mnemonic performance is not a benign replication of the popular Victorian tradition of mnemonic entertainment that Hitchcock's audience would have been familiar with through Datas's performances. I suggest that a crucial rupture occurs when Mr. Memory responds to Hannay's question about the distance from Winnipeg to Montreal. Mr. Memory immediately retorts with a mild pun: "Miss Winnie who, sir?" This nonsensical follow-up is quite unexpected, given that the crowd is quiet, and Hannay speaks in a clear, ringing voice. Hannay repeats his query and Mr. Memory welcomes him as a foreigner from Canada, to which the audience politely cheers their approval. Mr. Memory's odd initial response goes unfinished and forgotten. He perfunctorily answers Hannay's original question correctly— "Winnipeg, the third city of Canada and the capital of the province of Manitoba. Distance from Montreal: 1,424 miles—am I right, sir?"—and the audience admiringly applauds in agreement. But immediately after this polite communal moment of shared welcome and appreciation, the crowd fragments as pandemonium suddenly and unaccountably breaks out, eventually leading to mass panic and a stampede after a shot is fired.

I argue that the key to understanding this shift can be found in Mr. Memory's nonsense question to Hannay, specifically through the recognition that "Miss Winnie who, sir?" is an unfinished name pun, like Al E. Gator or Holly Day, that plays on the dual phonetic meaning of the

truncated sound *winnie* as also signifying a woman's name (note the tonal and letter mirroring of *in-ni*). Following this logic would suggest a play on *peg*, which was a Victorian slang term for "leg"; and in the 1920s became cant for "a legless person" (ostensibly a crude reference to a person using a peg-leg).[349] Tom Cohen argues that "as a machine of repeated re-marking," memory in *The 39 Steps* "breaks up or destroys mimesis when figures, syllables, sounds, letters, and visual puns or objects emerge through repetition."[350] As one example of this phenomenon, Cohen argues that the name Hannay is a pun that "suggests a *negation* of hands"[351]—*han(d)-nay*—that Hitchcock plays upon by making Hannay handcuffed and therefore rendering him unable to use his hands throughout the majority of the narrative. On a symbolic level, Cohen suggests that the "cuffed hands imply and inability to write *directly*, yet also, inversely, a kind of hyper-writing that will pour across the surface of the film in puns, and through 'secret agents,' like Hannay's political double-talk before the public Assembly Hall in Scotland (like Albert Hall, an A. H. signature)."[352] I posit that a crucial corollary pun to Hannay/*han(d)-nay* occurs in Mr. Memory's unfinished name pun "Miss Winnie who?," the unfinished nature of which associatively recalls to our mind the word *peg*. Although darkly nonsensical, in a film entitled *The 39 Steps*, this implied associative link between Mr. Memory with leglessness is serious indeed (the final scene hyper-compensates for by representing the machinal workings of Mr. Memory's mind through the line of chorus girls' disembodied legs, as I will show).

Following this interaction between Mr. Memory and Hannay, the crowd descends into chaos. After a fight breaks out when a policeman tries to apprehend a man whom a woman has

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[349] Eric Partridge, "Peg," in *Slang Today and Yesterday* (New York: Macmillan, 1934).

[350] Cohen, "Hitchcock and The Death of (Mr.) Memory," 41.

[351] Cohen, 52.

[352] Cohen, 52.

pointed out (a circumstance also repeated in the ending scene), the working-class music-hall crowd—filled with idle, intoxicated clusters of men who are down on their luck—erupts. Crucially, I argue, the crowd's disorder manifests not just through physical blows, but also through increasingly ferocious verbal expressions of repetition and nonsense sound-play that transgress the normative boundaries of British social order by violently mimicking the associative logic of Mr. Memory's mnemonic recall. Most pronouncedly, men aggressively scream "How old is Mae West?" over and over again above the din of the crowd, in defiance of Mr. Memory's earlier conclusive side-stepping of the question by citing the cultural taboo of revealing a lady's age. Tom Cohen argues that this question forms a corollary visual pun to Hannay's inquiry, in that both questions offer a reverse mirroring of the letters "M" and "W"—characters that are themselves mirrored and reversed images of one another—in the pair of questions "How old is *M*ae *W*est?" and "How far is it from *W*innipeg to *M*ontreal?" Cohen asserts that Mr. Memory empties language of its meaning through the mechanical repetition of facts, and he views the film's many visual and semantic puns as exemplifying this kind of empty symbolization (a concept I examined through my analysis of Victorian nonsense poetry and Boolean symbolic algebra in Chapter 3). He cites this repetitious flipped as instances of visual puns that echo the film's overarching memory recall logic.[353] To this observation I would add the nonsense connection to mirror-writing in Lewis Carroll's *Alice* books.

Additionally, Cohen argues that the crowd's absurdist insistence on repeating the question about Mae West—a reference that, as I previously noted, Hitchcock deliberately introduced by substituting West's name for Marie Lloyd's in his filmic adaptation of a well-known review of Datas's performance—is for Mr. Memory unresolvable. When understood as referring both to her status as a queer icon because of her work as "the foremost female female impersonator, a

[353] Cohen, 55.

deconstructor of gender performatives" whose work "amounts to a double positive and a double negative at once"[354] and as a nominal moniker for the concept of Western civilization that the film evokes through the series of "Greek motifs suffusing *The 39 Steps* (Mnemosyne, Muses, 'Annabella,' Palladium),"[355] this question becomes unanswerable because of the impossibility of definitive interpretation. Cohen explains, "To ask, here, 'How old is 'Mae West'?' turns out to have a more deranging resonance, which accounts for Mr. Memory's silence. One could translate the question, for example, as, How long, in the West, has 'woman' had to be a female female impersonator? How old is this charade, and what else would there be, if the entire system of gender differencing appears to depend on it?"[356] In addition, I would note that the impossibility of determining the proper interpretation of this question is due to the underlying associative multidirectionality of the concepts. Within the sonic illogic of mnemonic recall, it is impossible to differentiate the most likely primary meaning of the question, as it would be with normal language expression, because mnemonics is a metareferential system that relies purely on associative links. Like the seemingly straightforward questions that generated Mr. Memory's questions clarifications "Cup? Waterloo, football, or tea?" and "Miss Winnie who, sir?", the question "How old is Mae West?" is both socially transgressive and indeterminately nonsensical.

Fittingly for a film structured by recurrence, Hitchcock doubly invokes this dynamic in in the other consistently repeated question of the scene— "What causes pip in poultry?"—a query that likewise offers a corollary social transgression and expression of sonic (rather than existential) nonsensicality. When first posed by an old man in the audience, this question receives a stiff check

[354] Tom Cohen, *Hitchcock's Cryptonymies: War Machines*, vol. 2 (Minneapolis: U of Minnesota Press, 2005), 69.

[355] Cohen, 2:70.

[356] Cohen, 2:69.

from the man's condescending wife for downwardly betraying a class boundary: "Don't make yourself so common," she barks. Mr. Memory deliberately ignores the man's question because it is for him unanswerable, as it does not involve the recall of dates or numbers (which is assumably the extent of his skills, as it was for Datas). Like the socially inappropriate and existentially unanswerable query about Mae West's age, the man's poultry question both runs afoul of the boundaries of appropriate social behavior and operates in the realm of the unknown. Hitchcock accentuates the tragicomic absurdity of the man's repeated question as the crowd's fighting intensifies with a shot of him fighting against the surging masses by clinging to a pillar while attempting to shout his question—a sonically nonsensical utterance that eventually devolves into the alliterative, onomatopoeic stammerings "pip, pip" and "po, po." The dark absurdity of this futile spectacle is underscored by the intense sincerity with which he attempts to ask his mundane question, a nonsensical expression that echoes the nonsensically mundane yet tearful episodes of several characters in Carroll's *The Hunting of the Snark*.

The audience's adoption of Mr. Memory's mnemonic recall dehumanizes the crowd, working it up into a brawling pandemonium that vehemently froths with the expression of irresolvable associative sonic nonsense until violent climaxing in the firing of the gun. As William Rothman notes, Hitchcock invokes the specter of fascism in this scene by having the announcer ventriloquize Mr. Memory, who is rendered mute when the crowd goes wild; he subsequently plays the part of a puppet by clumsily mimicking the motions of the orchestral conductor while he helplessly watches the surging crowd.[357] The eighteenth-century Scottish Common Sense fear that the psychological breakdown of mental hierarchies produced by mnemonic recall would be linked to a social destabilization of British class order manifests itself in this scene. Hitchcock

[357] Rothman, *The Murderous Gaze*, 121.

unsympathetically portrays this communal breakdown into fascistic chaos through the clownish, circus-like rendition of Mr. Memory's showtune plays as the crowd pushes to the door, and the birds' eye shot that forecloses the representation of individual expressions of panic. This objectifying, vaudevillian mood immediately shifts when Hannay leaves the building, where the close-up of his and Annabella's faces as they are pressed together in the crowd reasserts the theme of humanity through her (feigned) expression of primal sexual desire.

The film continues to represent Hannay's entrapment through expressions of sonic nonsensicality, as evidenced next by Hannay's journey aboard the Highland express train. Hitchcock overlays the charwoman's screaming discovery of Annabella Smith's body with the train whistle departing Paddington Station "in one of the most famous match-on-action cuts in cinema."[358] As William Rothman notes, "One effect of this surreal overlapping of sound and image […] is to deny the reality of the separation between these places."[359] In the context of the murder, the sonic and therefore spatial collapse between the London flat and the train represents the narrative enactment of an all-encompassing surveillance system. Hitchcock emphasizes the suffocating oppression of this observational apparatus through Hannay's interactions with his fellow passengers, who, just like the fascistic music hall audience, traffic in sonic nonsense and dark associative humor. Firstly, the compartment is staged like the set-up to a slapstick joke (two travelling lingerie salesmen, a clergyman, and a murderer enter a train compartment. One man pulls out a corset…). Hitchcock associates the two salesmen with absurdity and sonic nonsense, this time in the context of misogynistic sexualized banter. Unconscionably, one of the men pulls out a full lingerie outfit on the

[358] Miller, "39 Steps to 'The Borders of the Possible': Alfred Hitchcock, Amateur Observer and the New Cultural History," 326.

[359] Rothman, *The Murderous Gaze*, 133–34.

train in front of the minister, who ogles the lacy bra as he gets off the train. Later on, Hitchcock links the men to sonic nonsense and puns—specifically to Victorian nonsense poetry—by having them trade dirty limericks in the style of Edward Lear. One of the men begins, "There was a young lady of Ongar…" but is cut off by the porter before he can finish.

The most pronounced connection between sonic nonsense and surveillance comes when one of the salesmen procures a newspaper at Waverley Station in Edinburgh and reads the article on Annabella Smith's death aloud to the train car. After his companion yawns "these sex dramas don't appeal to me"—a humorously ironic claim, given his salacious public lingerie display moments before—the man skips to the Derby results, and afterwards jumps back to the murder, reading, "At seven o'clock this morning, the charwoman Elizabeth Briggs—" before suddenly spying an advertisement for "The new Bodyline rubber panty corset, on sale today. McCutcheon Brothers, Princess Street. The Bodyline. One and three cheaper than our Streamline." (23:00). While the juxtapositions between the lingerie, the murder, the Derby, the murder, and the lingerie seem shockingly incoherent when suddenly brought up on the train, they directly recall the events of the previous evening. The discussion of the Derby results points back to the several questions Mr. Memory answered about the races, and the lingerie likewise echoes the sexual pretext under which Annabella Smith came home with Hannay. As with the *MW-WM* of Mae West/Winnipeg Montreal and *in-ni* of Winnie, the precisely palindromic order of the events the salesman reads here evokes Mr. Memory's perfect recall; the inherently disjointed nature of the subjects (only connected through Hannay's personal memories at this point) echoes the randomness of the questions posed at the mnemonic performance and the associative structure of artificial remembering more broadly. The man's final jump to the "Bodyline" advertisement—a portmanteau word, just like a *memoria technica* mnemonic—conjoins the previous mention of Annabella Smith's dead body with the trainline

journey that Hannay is currently on, highlighting through nonsensical sonic collapse the oppressive spatial collapse between the London flat and the train car. Hitchcock emphasizes this reassertion of the powerful surveillance mechanism that is closing in on Hannay through startling eye-level shot of the salesman's piercingly direct stare as he slowly hands Hannay the paper. Just as with mnemonics, sonic nonsense play has miraculously provided the salesmen with a panoptic knowledge of Hannay's identity and previous crime.

After Hannay daringly escapes from the train via the Firth of Forth—another sing-song alliterative name—he travels to Alt-na-Shellach, spending the night at a crofter's house along the way. There he embraces the associative sonic nonsense logic associated with espionage, pursuit, and surveillance by furthering the creation of alliterative patterns of *h* and *p* (letters that of course echo the two protagonists' names). This shift is initially tied to his undercover role of scouting out Professor Jordan's house under the guise of a travelling mechanic. The name he assumes, Hammond looking, not only alliteratively linked to his real surname, but also to the film's earlier invocations of *h*. The first instance occurs indirectly at Mr. Memory's performance in the unanswered question about Hawley Harvey Crippen. This a fitting reference for Hannay, who is shortly to be accused of murdering a female lover in his flat (and like the unanswerable question about Mae West's age, Mr. Memory cannot give the date of Crippen's hanging because Hannay's fate has not yet been decided). *H* reappears in the haddock that Hannay serves Annabella Smith; fittingly, in a repetition of this domestic dinner scene at the crofter's house, Hannay as Hammond eats herring. A hymnbook saves his life when it stops Professor Jordan's bullet ("Hymns that have helped me," Hannay later remarks). Herrings reappear during Hannay's impromptu political speech at the Assembly Hall, where the first suggested topic of discussion from a woman in the audience is "herring fisheries." The culmination of the *h* alliteration occurs when Hannay forces Pamela to sign the Argyll Arms

guestbook with the ridiculously nonsensical name Mr. and Mrs. Henry Hopkins, The Hollyhocks, Hammersmith. Just as Hannay embraces this *h* alliteration when he assumes the role of a spy, his performative assumption of the role of a typecast murderer towards Pamela after his attempts to convince her of his story's truthfulness fail is facilitated through an embrace of alliteration. Previously, *p* alliteration had been associated with 'pips in poultry,' Portland Place, Pamela, Professor Jordan, and Pamela's spectacled double Pat (and subsequently the scene of another murder, the Palladium)—all entities connected to violence, surveillance, and murder. Hannay's embrace of this alliterative nonsense illogic in threatening Pamela with a pocket pipe—doubled in Hitchcock's framing of the inn keeper's pipe above Hannay's pocket 'gun' as he threatens, "You can guess what's in this pocked, come on!"—signals his concomitant performative adoption of the murderer role.

However, Hannay's attempts to convincingly perform these various roles fail, illuminating the deficiencies of sonic nonsense, and by extension the mechanical illogic of mnemonic recall with which it is associated. Professor Jordan immediately recognizes him as Hannay; the spies follow him and Pamela despite his elaborately alliterative false names; Pamela is not scared into docile submission by the pipe pocket (at least not for very long). Even the crofter's wife, Margaret, sees through Hannay's half-baked disguise as Hammond the car mechanic, recognizing Hannay as the Portland Place murderer in the very act of dining upon the herring. The film contrasts mechanical mnemonic recall—represented through scenic and symbolic echoes of Annabella's murder replete with alliterative nonsense, and tied to the larger apparatuses of inescapable surveillance, control, and totalitarianism—with Hannay's natural memory experiences, which are both catalyzed by, and catalyze, wholesome and genuine human connection that offers a utopic counterpoint to the politics of suspicion and totalitarian that *The 39 Steps* associates with mnemonic recall.

Hitchcock stresses genuine natural remembering's powerful ability to elicit warm communal connection during Hannay's speech at the political rally, which forms a counterpoint to Mr. Memory's first mnemonics exhibition. After marching as part of a Salvation Army parade playing anther hymn that helps him ("We Shall Win"), Hannay enters the Assembly Hall and is immediately mistaken for the next speaker and ushered onstage. Whereas Mr. Memory's mechanical artificial recall destabilized the audience and provoked the outbreak of a fascistic mob mentality, Hannay's heartfelt speech—drawn from his genuine recollection of the previous few days' hardships—unifies the crowd behind the utopian desire for communal belonging and anti-totalitarianism. Before Hannay takes the stage, the audience behaves much like the music-hall crowd did to Mr. Memory's announcer, heckling and rudely shouting down the two men who introduce him. Like Mr. Memory, Hannay invites the crowd to call out suggestions of topics to discuss. When the discussion turns to the question of social inequities, Hannay transforms the class anger of the crowd into communitarian enthusiasm by giving a rousing speech against totalitarianism and class antagonism:

> I've known what it means to feel lonely and helpless, to have the whole world against me – and those are things that no man or woman ought to feel. And I ask your candidate and all those who love their fellowmen to set themselves resolutely to make this world a happier place to live in. A world where no nation plots against nation, where no neighbor plots against neighbor, where there is no persecution or hunting down, where everybody gets a square deal and a sporting chance, and where people try to help and not to hinder. A world from which suspicion and cruelty and fear have been forever banished. That is the sort of world I want! Is that the sort of world you want? (52:34)

Unlike Mr. Memory's artificial recall, which foments fascistic violence and causes the crowd to fight against one another, Hannay's democratically unites his audience in fervent unanimous support for a common utopic and humanistic cause. Ina Rae Hark notes that the camera work in the scene deepens this sense of equality: "He engages in an equal exchange of gazes with his audience […]. The shot/reverse shot alternation sutures the respective views of the speaker and spectators without including both in one frame, where placement would inevitably lead to subordination of one to the other."[360] Rather than fleeing like the music-hall crowd did, they eagerly swarm the stage, cheering and rushing to shake hands. If elsewhere in the film, Hannay is symbolically incapacitated by the cuffs, here his assertion that he has worked with his hands like the common man, and his communal act of shaking hands with the crowd, signifies his regaining of agency through this sincere expression of natural remembering and feeling. Linked to the dual ideals of Christian charity for the poor and militarism through the Salvation Army parade, genuine recall becomes crucial means of fostering connection between individuals and offers a powerful antidote to the shadowy forces of surveillance and totalitarian persecution on the rise at home and abroad.

Unlike the Hannay of Buchan's novel, whose successive flashes of passive recall empower his progression throughout the narrative, Hannay's primary memory experience in *The 39 Steps* is one of failure—a continual deferral of total recall, stymied by the incursion of the disconnected snippet of sonic nonsense into his mind. Hannay's most challenging experience of remembering manifests in his persistent inability to remember where he heard the catchy strain of music (Mr. Memory's showtune) that becomes stuck in his head in Scotland.[361] Hitchcock puns on the

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[360] Ina Rae Hark, "Keeping Your Amateur Standing: Audience Participation and Good Citizenship in Hitchcock's Political Films," *Cinema Journal* 29, no. 2 (1990): 19.

[361] In Buchan's novel, Hannay proves his identity to the Foreign Office Permanent Secretary by whistling "Annie Laurie."

persistence of these oppressive musical 'bars' in Hannay's mind through the repetition of his signature //// visual motif representing imprisonment, which reappears every time Hannay narrowly escapes (for example, in the shadows of the two inspectors who just miss the Highland Express train, in the bars of a chair at the crofter's house, and in Professor Jordan's staircase just before he shoots Hannay).[362] In his critique of artificial memory systems, Coleridge had warned that mnemonics were isolated soundbites that destroyed organic poetic unity by failing to refer back to a unified whole. Hannay's isolated passive remembrance of the tune, which repeatedly fails to bring him insight, exemplifies this phenomenon.

However, Hannay is able to successfully reject the consummate automatization of this mnemonic mental experience that previously transformed Mr. Memory and his British working-class crowd into inhuman automata susceptible to totalitarian control by foreign powers by forging an emotional bond with Pamela that progresses from mutual trust to romantic love. Hannay's reassertion of his humanity through this act enables him to essentially rewind and undo the spies' depraved actions. Notably, Hannay only begins to remember the tune when Pamela helps him to escape kidnapping by Professor Jordan's henchmen. After she notices that they are not taking the road to Inverary—where the false 'policemen' are supposedly escorting them—Hannay realizes that they spies and asks to see their warrant. They hit him, confirming his belief, and suddenly he begins to whistle Mr. Memory's tune for the first time. Charles Silas observes, "In spite of the fact that he has been among the spies before, it isn't until he is with Pamela that he begins the process of unraveling the mystery of their '39 steps' organization. The reappearance of this little music hall tune symbolizes the beginning of what proves to be Hannay's final awakening. It is vitally important that

[362] Rothman, *The Murderous Gaze*, 143, 151.

the first appearance of it should be with Pamela—as if she were responsible for his memory."[363] More specifically, although he has also encountered Pamela twice before, this scene marks the first time that Hannay successfully relies on her for help, as he acknowledges that he would not have recognized the wrong road. This cooperation (although at first unwilling on her part) generates a partnership that culminates in Hannay's remembrance of the tune's significance at the Palladium, which can only occur after he has successful rewound the entire episode beginning with Annabella Smith's murder. Each time the tune springs into his memory, his interactions with Pamela counteract it by reversing an important stage of the violence caused by the 39 Steps.

The recursion begins when the spy hits Hannay, an act of violence that recalls the fighting and gunshot that begins the stampede in the music-hall theater. Immediately afterwards, Hannay and Pamela escape through a flock of sheep, with him dragging her and with the handcuffs attached. To 'behave like sheep' is an idiom describing "a group of people that all behave in the same way or all behave as they are told, and cannot or will not act independently," referring in this case to the fascistic music-hall mob; the lost flock also signals the figural Christian loss of spiritual direction.[364] Their escape across the moor reverses and flips Hannay and Annabella's push of the theater: here, Hannay leads Pamela instead, and the dangerous sexual aura surrounding the encounter (evoked by the cuffs) is dispelled by Hannay's impeccable politeness, as when he graciously offers Pamela his handkerchief and references her "future husband." He whistles as they enter the inn, and again when they reach the room. There Pamela lays on the bed, which Hannay calls the "operating table," in a room with a 'murderer' who regales her with a fantastical *Thousand and One Nights* tale about his

[363] Charles L. P. Silet, "Through a Woman's Eyes: Sexuality and Memory in *The 39 Steps*," in *A Hitchcock Reader*, ed. Marshall Deutelbaum and Leland Poague (Ames, IA: Iowa State UP, 2009), 115.

[364] "Be (like) Sheep," in *Cambridge Advanced Learner's Dictionary & Thesaurus* (Cambridge UP, n.d.), accessed July 24, 2023.

uncle murdering his three wives. But although Hannay vigorously moves her nail file in a motion that mimics stabbing while whistling as they lay on the bed together, she unperturbedly falls asleep (unlike Scheherazade) and is not penetrated, phallically or literally (unlike Annabella). She awakens, removes her handcuffs, and leaves the bed. Importantly, her ability to fully enact the reversal between them is made possible through a revisionist act of remembering. Charles Silet observes that after Pamela overhears the spies telephoning, which confirms Hannay's story, she "returns to her room a changed woman, […] as if having suddenly seen all of Hannay's previous actions anew, in a new light, an act of memory, the precedent for which we have already seen in Hannay's memorial envisioning of Annabella after her murder. […] She then settles herself on the bench at the foot of the bed, thus reversing the sleeping arrangement of Hannay and Annabella earlier."[365]

Hannay finally recognizes the tune's full significance after Pamela joins him at the start of Mr. Memory's Palladium performance, where he is sitting in the same place as he was in the music hall. Now that the entirety of the "sex drama" with Annabella Smith (to use the lingerie salesman's phrase) has been rehearsed, the performance—both Hannay's and Mr. Memory's—can begin. Whereas Mr. Memory's act is theatrical, Hannay's is metareferentially cinematic: lights, camera, action. Announced by a tracking shot of light bouncing off various reflective surfaces in Piccadilly Circus as Hannay travels on the bus to the Palladium theater—both a filmic reference and a visual representation of Hannay and Pamela's positive distortion of memory, which has brought light to darkness—Hannay becomes akin to a cinematic director when he puts himself behind the lens by borrowing a woman's opera glasses to observe Professor Jordan. As William Rothman puts it, "Hitchcock allows these opera glasses to be the camera. By making this instrument available to Hannay, and by arranging for the accident that the Professor should unwittingly show his hand at

[365] Silet, "Through a Woman's Eyes: Sexuality and Memory in *The 39 Steps*," 119.

the right moment, Hitchcock extends his own power to Hannay."[366] The orchestra's opening number commences both Mr. Memory's performance and the beginning of Hannay's own drama (in which his successful performance of remembering plays the central part). Mechanically whistling the tune in sync with the band, Hannay suddenly remembers where he first heard the tune, finally illuminates the full sequence of events and offers the missing piece of the puzzle: "Do you hear that tune? That's the damn thing I couldn't get out of my head. Now I know where I heard it before. Of course—that music hall—Annabella Smi—."

Hannay realizes the completion of his revisionist recall when he interrupts Mr. Memory's performance to reveal the secret of the plot.[367] Standing to the right of the stage, exactly where he was sitting in the other theater, he suddenly cries, "What are the 39 Steps? Come on, answer! What are the 39 Steps?" As Paul Matthew St. Pierre describes, "Hitchcock shoots Mr. Memory from behind against the massive audience, from which Hannay's question emerges, in contrast to the close-up shots at the start of the film. The device of music hall performative as a surveillance apparatus and a military strategy is apparent."[368] The close-up Dutch-angle shot of Memory's face and the //// shadows on the curtain-folds behind him emphasizes the reversal of the entrapment. The situation has gone askew; Hannay rather than the 39 Steps is now in command. Mr. Memory looks dazed and physically wavers for a minute, slightly raising his eyebrow. Then, staring mechanically ahead, he replies in his slightly monotonous voice, "The 39 Steps is an organization of spies, collecting information on behalf of the foreign office of—" before breaking off abruptly as he falls to the ground, shot by Professor Jordan.

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[366] Rothman, *The Murderous Gaze*, 169.

[367] Paul Matthew St. Pierre, *Music Hall Mimesis in British Film, 1895–1960: On the Halls on the Screen* (Madison and Teaneck: Farleigh Dickinson UP, 2009), 63.

[368] St. Pierre, 63.

This shot, which subsequently kills Mr. Memory, ironically provides the final reversal to the mechanical and fascistic transformations produced by the co-opting of mnemonic recall by these foreign adversaries. A counterpoint to the shot fired by Annabella Smith, which fully tips the music-hall crowd over into a fascistic mob frenzy voiced through the violent expression of sonic nonsense, Professor' Jordan's shot simultaneously reverses the totalitarian surveillance dynamic back from Hannay onto himself and rehumanizes Mr. Memory in the sole sense that it renders him vincible. Hannay's drama ends as Professor Jordan attempts to escape by jumping down from his box onto the stage, setting aside his role as onlooker and assuming Mr. Memory's performative place. Hitchcock employs another birds' eye shot to depict the dark circle of police closing in on him as the curtains close. With this action, Hannay resumes his rightful identity; he no longer has to assume disguised personas or play the role of murderer.

The final scene of the film fully lays out the threat represented by Mr. Memory, whom the final scene represents as an autonomic mnemonic war machine whose perfect mechanical recall has been weaponized against the British people as an instrument of totalitarian surveillance and violent fascistic nonsense. Many critics have addressed Hitchcock's unambiguous representation of Mr. Memory as a militarized memory machine. Slavoj Žižek describes Mr. Memory as "a personification of pure automatism," stating that through him "Memory embodies a pure asexual gapless knowledge, a signifying chain that works absolutely automatically."[369] Tom Cohen likewise argues that Mr. Memory is "a much darker sort of machine, one that at once generates and destroys in advance concepts like the symbolic: he is pure anteriority, and nothing but the machine, to begin with, of recirculation without interpretation. Yet by virtue of repetition it is the same 'facts' which

[369] Slavoj Žižek, "The Hitchcockian Blot," in *Alfred Hitchcock: Centenary Essays*, ed. Richard Allen and Sam Ishii-Gonzales (London: BFI, 1999), 132–33.

become the facticity of hollow signs."[370] Cohen argues that he offers a "technological sublime" that "involves the active evacuation of any interiorizing model of consciousness."[371]

The extent of his complete automatization is made clear by his death in the final scene, which emphasizes his fundamental mechanicity rather than his humanity. He initially appears to have experienced a miraculous resurrection—like Hannay did after the hymnbook stopped Professor Jordan's bullet—but then he collapses to the ground just off the stage. Just as Hannay has been saved by the reassertion of the real above the performative, Mr. Memory cannot exist outside of the performance. Hannay, Pamela, and the police officers crowd around him, and Hannay asks, "Mr. Memory, what was the secret formula you were taking out of the country?" Just as before, Mr. Memory breaks Hannah's gaze and looks detachedly ahead, then recalls:

> The first feature of the new engine is its greatly increased ratio of compression, represented by r minus 1/r to the power of gamma, where r represents the ratio of compression and gamma...Seen in end elevation, the axis of the two lines of cylinders...Angle of 65 degrees. Dimensions of cylinders are as follows...This device renders the engine completely silent. Am I right sir? […] Thank you, sir, thank you. I'm glad it's off my mind at last.

Hitchcock underscores the nonsensicality of this moment through a devastating final pun. Seen directly over Mr. Memory's should via a large gap in the otherwise tight circle, the brightly lit line of chorus girls performs precisely synchronized high-kicks, knee pops, and arm waves. The synchronized chorus line limbs, reduced to a series of dismembered arms and legs by the over-the-

[370] Cohen, "Hitchcock and The Death of (Mr.) Memory," 53.

[371] Cohen, 54.

shoulder, semi-obstructed camera angle, underscores the automatized mechanicity of Memory's mind. Their arms and legs move in concert like a series of levers and gears powering a machine. Tom Cohen deftly notices a final tragically ironic pun here: the disembodied feet of the girls kicking behind him recall his celebrated memory *feats*; a joke a woman actually makes to the announcer in the film's opening scene ("Think of the strain involved by his prodigious feats! They aren't as big as yours, cully! I'm referring to his feats of memory!") (1:29:44). [372] Just as the narrative literalizes Hannay as *han(d)-nay* through the handcuffs, Mr. Memory is unable to successfully 'climb' or master or rise above the metaphorical thirty-nine steps. The darkly nonsensical *peg* pun from his very first reply to Hannay, "Miss Winnie who, sir?," and the ensuing association with leglessness foreshadows Mr. Memory's death as he succumbs to The 39 Steps. The final scene of the disembodied legs functions both as a representation of the mechanical workings of Memory's mind as he recalls for the last time; and concurrently as a cruelly ironic, almost Shakespearean symbol of belated superabundance of that which he lacked.

As Mr. Memory's body falls limp and the policemen encircle him, the camera pulls back to focus on the dangling steel handcuff on Hannay's right hand as he and Pamela stand slightly behind the encircled figure, tenderly reaching for one another. The sudden reemergence of the handcuff is surprising and unsettling; we had forgotten it was still restraining him. Even as he and Pamela clasp hands, the handcuff is still visible. As the shot fades to black, the shining handcuff lingers, giving off quick flashes of light. This is the last image we see as the film ends. Most critics—including Richard Allen, Stuart Y. McDougal, William Rothman, Charles Silet, and Slavoj Žižek—have interpreted *The 39 Steps* as fundamentally a comedic romance and have focused on the ending as offering a satisfying marriage-plot resolution that affirms Hannay and Pamela's union once the political plot (the

[372] Cohen, 54.

McGuffin) has been dispensed with. Also focusing on the final shot's meaning with respect to their future together, Yacowar more tepidly argues that Pamela's and Hannay's entwining hands symbolize "a temporary balance" that "stops short of total assurance" because it "is a momentary consolation, still carrying signs of mismatch—a lonely handcuff still Hannay's mark of the outsider, the glove promising a world of civility, elegance, and comfort that the entire film has undercut."[373] In contrast to these marriage-plot interpretations, Tom Cohen has primarily examined the breakdown of symbols produced by Mr. Memory's mechanical autotomy. He gives the much bleaker estimation: "all the end gives us is two dismembered hands, one white, one black (gloved), with a dangling cuff or zero in between—a clutch entirely tentative and cut off."[374]

I suggest a different final reading, one focused around the surprisingly under-analyzed detail of the airplane engine design that Mr. Memory mnemonically steals. Most scholars have interpreted the ending of the film as shifting from the political to the personal and have not examined the detail of the airplane plans in great detail, perhaps because Hitchcock intimated that this detail was a mere pretense when he identified the plans as the film's McGuffin. But Mr. Memory's recitation of the engineering plans as the chorus girls' limbs move like the gears and cylinders of the airplane engine design that he is concurrently reciting aloud suggests that just as the airplane engine represents a lucrative new military advancement because its undetectability will enable total enemy surveillance and domination of Britan's skies, Mr. Memory's equally invisible mnemonic technology offers complete control of the British public, the metaphoric 'ground' or democratic foundation of British society. Brightly lit up by the white stage lights in contrast to the shadows and dark suits offstage, the chorus line recalls the memory overlay of Annabella Smith's

[373] Maurice Yacowar, *Hitchcock's British Films*, 2nd ed. (Detroit: Wayne State UP, 1977), 154.

[374] Cohen, "Hitchcock and The Death of (Mr.) Memory," 53.

pallid face onto scenes of the present that Hannay envisions immediately after her death. But here the conflation is not one of past and present, but the collapsing of the present with a darkly prophetic vision of the impending future. The upward shot of the appendages flying upward and downwards as the viewer's gaze is directed down the chorus line mirror the front-line experience of helplessly watching a bomb explode, perhaps from inside a trench. This scene invokes the specter of modern battlefield destruction on a scale unlike anything that had previously occurred.

In this context, I suggest that the final unsettling shot of the dangling handcuff brings us back to the possibility of violence and militarization. In the military context with which the film ends, the flashes of steel in the darkness conjure the wartime fear of a German spy plane silently encircling the British landscape at night—an infinitely more advanced version of the autogiro that surveils Hannay as he attempts to flee through the Highlands moors earlier in the film. Ina Rae Hark notes that the secret plans are "no doubt meant to suggest the frenzied efforts, then culminating in England, to develop the Hurricane and Spitfire fighters."[375] The choice of a silent aircraft engine as the secret information evokes the deep British fears about their inferior air capabilities, which had lagged well behind the capabilities of the other combatants during the Great War. As military historian William Fisher has demonstrated, throughout the First World War, "the Germans led in the attack for the conquest of the night."[376] Britain did not even have a Royal Flying Corps squadron "specifically dedicated to night bombardment" in until 1917, and even then the night squadrons were only equipped with "hand-me-down aircraft no longer fit for day use."[377] The psychological

[375] Hark, "Keeping Your Amateur Standing: Audience Participation and Good Citizenship in Hitchcock's Political Films," 18.

[376] William E. Fischer Jr., *The Development of Military Night Aviation to 1919* (Maxwell Air Force Base, Alabama: Air UP, 1998), 16.

[377] Fischer Jr., 51.

impact of Germany's nighttime air superiority went well beyond the physical damage caused by their bombing raids: as Fischer stresses, "Night bombing had a great effect on morale. What could be more terrifying than bombardment by an unseen enemy against whom there was no defense?"[378]

Earlier in the scene, Hitchcock bleakly emphasized the unspeakable destruction of modern warfare, which the Great War showed to be on a scale unimaginable in previous conflicts, by evoking the conclusion of the Victorian era of pre-modern military conflict through two questions put to Mr. Memory immediately before Hannay's fateful question: "When did Florence Nightingale die?" and "When did General Gordon die?" These questions, which both involve the deaths of two heroes from previous British conflicts, the Crimean War (1853–1856) and the Taiping Rebellion (1850–1864), remind the viewer that this style of international conflict has long since become an antiquarian historical curiosity. As the Great War illustrated, modern twentieth-century warfare harnesses the sheer, raw power of technology on a scale never before imagined. Hitchcock's film warns that the enemy has already developed means of infiltrating not just the British territorial homeland, but the upper echelons of Britain's social structure, its most popular cultural pastimes, and most destructively the very *minds* of the John Bull public. Hannay's final discovery of the truth by watching the movements of Professor Jordan and Mr. Memory through the binoculars relies on the techniques of military surveillance, warning that the next conflict has already begun.

But the final gesture of Hannay's still-cuffed hand slowly reaching for Pamela's elegantly gloved one provides no final reassurance that the Hannay—the British everyman and resurrected utopic savior, whose colonial background provides a virtuous internationalist counterpoint (from the standpoint of British imperialism) to the evil Germanic forces represented by the 39 Steps—will successful be able to recapture the Old World civility and graceful domestic bliss represented by the

[378] Fischer Jr., 32.

evening glove, his restrained hand grasps at in the darkness. After all, the chorus girls' dismembered legs and feet gruesomely complement the film's opening and closing shots of Hannay's disembodied torso (the latter alongside Pamela's), evoking the unsettling image of their potential destruction in an impending total war. Hitchcock ultimately puts the final impetus for whether or not such a scene will come to pass on the film's audience. As Tom Cohen has noted, the cuffs in *The 39 Steps*, like bicycles and other circular objects throughout Hitchcock's oeuvre, symbolize the camera. The final shot of the gleaming cuffs thereby signals a final recursive turn (a 'turn' was also Edwardian slang for a music-hall performer) outward of the camera outward to the viewer. If the opening of the film begins with the viewer observing a spectaclized shift from darkness into the flashing lights of the MUSIC HALL letters, shortly followed by an experience of double voyeurism in which we watch the music-hall audience watch a performance; then the closing shot turns the camera back onto us.

Yet the ending of *The 39 Steps* does not just update the Victorian conception of mnemonics for the 1930s, developing an older idea of the threat of psychological technology for display as a sign of the times. In Hitchcock's representation of Mr. Memory as the ultimate mechanical war machine we also see the principles that would shortly inform the emergence of the field of cybernetics. Hassan and Thomas explain that Norbert Weiner, the MIT logician and scientist who founded cybernetics, "saw computers as machines that mirrored what humans were in their essence"[379]; while J.C.R. Licklider, a pioneer of the internet, "suggests that computing may also reflect our human essence. […] Both theorists view humans as fundamentally *processors of information* in a world whose reality becomes apparent only through the interface with numbers."[380] This logic is on display in Mr. Memory's death scene, where his most vulnerable and most human moment is also the one in which

[379] Hassan and Thomas, introduction to *The New Media Reader*, xix.

[380] Hassan and Thomas, xxi.

he is most like a machine. Tom Cohen describes Mr. Memory's final revelation as a "second McGuffin" that is "even strange, since it stimulates an absolute revelation—that of the secret formula for the silent warplane, which Hannay tells the dying Memory he got right even though Hannay can have no way of knowing, especially since Memory discloses only a string of numbers and letters, wholly ungrammatical and untranslatable."[381] Hannay's seamless communication with Mr. Memory is an act of death-bed charity, but it is also the dawning of a new, uniquely modern relationship between computers and humans that would have been unthinkable *vis-à-vis* the 'old media' of the nineteenth and early twentieth centuries, like telegraphs, trains, cars, or even new silent aeroplanes. From early internet search engines like Ask Jeeves, which was modelled around the conceit of asking P. G. Wodehouse's Edwardian valet character to retrieve answers—thereby shaping the fundamentally transforming the form of internet searches, which had previously been predominantly structured around Boolean keyword searching[382]—to the recent advent of ChatGPT, which returns answers by first broadly defining the subject before providing a specific answer (the format utilized by Data the Memory Man, the 'Living Encyclopedia' who had "a mind like the British Museum Library"[383]), today's emerging technological relationships between human and machine bear the distinct imprint of the Edwardian music hall, that last refuge of the world of Victorian mnemonics.

[381] Cohen, "Hitchcock and The Death of (Mr.) Memory," 51.

[382] Jeeves first appeared in the 1916 *Strand* short story "Extricating Young Gussie."

[383] "£1,000 for Head," *The Daily Mirror*, October 6, 1932.

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