

Induction, Deduction and Visual-Spatial Perception: The *Finnegans Wake* Intelligence Test

Abstract

Finnegans Wake makes intense demands on its readers' intellectual energies, and I propose that the text brings our cognitive reasoning capacities to the foreground by putting them to work. In this, the *Wake* resembles an intelligence test, calling upon abilities of deduction, induction and visual-spatial perception. Using deduction, readers draw upon existing linguistic paradigms in order to make sense of Joyce's neologisms, while induction involves identifying patterns created by the text itself. Moreover, "characters" such as HCE are often denoted only by the appearance of these letters, activating pattern-recognition skills. Nevertheless, identifying these references is not the end-point of studying the *Wake*, since dissecting Joyce's text into an inventory of allusions would dissolve its artistry. Instead, discerning familiar elements in Joycean innovations is a fluid and ongoing process, where the manifestation of one's own cognitive processes constitutes an aesthetic effect.

I. Introduction

This essay argues that the extreme density of *Finnegans Wake* calls for readers to exercise their cognitive reasoning capacities in a manner that resembles completing an intelligence test.¹ In order to navigate Joyce's writing, readers are invited to fill in gaps, to extrapolate from incomplete information, to apply pattern-recognition skills in identifying recurring motifs, to draw upon existing paradigms of knowledge, and to identify patterns created by the text itself. As Derek Attridge remarks, "the enormous difference between *Finnegans Wake* and other literary works is, perhaps, a difference in degree, not in kind."² The high "degree" of puns and polysemy disrupts automatic comprehension, creating a cognitive defamiliarisation; slowed down by the text's density, readers can actually observe their minds at work. Nevertheless, *Finnegans Wake* does not contain a single set of answers; the variety of its content makes it possible for different readers to apply these cognitive reasoning mechanisms to different elements, tracing distinct pathways through the text. The *Wake* measures the abstract operation of these mechanisms rather than specific knowledge, frequently confirming readers' identifications through the revelation of further pattern.

A *Finnegans Wake* intelligence test might look something like this:

1. *Finnegans Wake* is to "Wimmegame's fake" (FW 375.16–17) as "mishe mishe" (FW 3.9) is to "_____"

Answer: Mishy Mushy (FW 277.11)

2. "Jesterday" (FW 570.9) is to "yesterday" as "echoating" (FW 404.7) is to "_____"

Answer: floating

Alternatively: "Jesterday" is to "jest" as "echoating" is to "_____"

Answer: echo

3. Take the statement: "The abnihilisation of the etym by the grisning of the grosning of the grinder of the grunder." (FW 353.22–3)

a) Find two common terms in the underlined section.

Answers: “gr_sning” and “gr_nder”

b) Find one common term in the underlined section.

Answer: “gr_”

4. “Joyclid” (FW 302.12) = _____ + _____

Answers: Joyce, Euclid.

5. Take the statement: “He is consistently blown to Adams” (FW 313.12). State possible references for “Adams.”

Answers: Atoms, Biblical Adam

These answers do not “complete” the text; rather, primary comprehension precedes literary analysis. Once such references are identified, a critic can go on to consider the relationship between them, such as the extent to which “Wimmegame’s fake” suggests that the *Wake* is a game or hoax, or the relationship between physics and religion in the combination of atoms and Adam. At the same time, there is something aesthetically fascinating in the way that the *Wake*, like a linguistic X-ray, reveals the processes involved in comprehension. Viewing the text as an intelligence test elucidates the mechanics of these processes, and contributes to the existing body of research on the relationship between *Finnegans Wake* and the brain.

II. *Finnegans Wake* and the Brain

The field of cognitive poetics has its roots in early twentieth century aesthetic theories of defamiliarisation, as developed by Viktor Shklovsky. In 1917, Shklovsky remarked that “art removes objects from the automatism of perception,” leading to the reception of familiar ideas in a fresh and strange light.³ Art exists, posits Shklovsky, so that one may “recover the sensation of life,” to “make the stone *stony*” (12). Reuven Tsur, a key figure in formalising

the field, follows Shklovsky in focusing on the ways in which art inhibits cognitive processes to aesthetic ends. He comments:

one major assumption of cognitive poetics is that the poetry exploits, for aesthetic purposes, cognitive (including linguistic) processes that were initially evolved for nonaesthetic purposes.⁴

Cognitive poetics applies aesthetic principles to cognitive processes, suggesting that these processes are disrupted and reorganized by literature. Peter Stockwell suggests that cognitive poetics might, at times, “seem to be no more than recasting old ideas with new labels,” but he “would argue (along cognitive linguistic lines) that new labels force us to conceptualise things differently.”⁵ Similarly, this paper does not so much indicate new ways of reading *Finnegans Wake* as set existing modes of sense-making in a context of cognitive reasoning capacities; using these labels illuminates the ways in which the *Wake* manifests neurological processes.

There is already a significant body of research on *Finnegans Wake* and the brain. Dirk Van Hulle, in his introduction to *James Joyce’s “Work in Progress”* (2016), considers Joyce in terms of the extended mind thesis.⁶ Thomas Jackson Rice in *Joyce, Chaos and Complexity* (1997) draws upon contemporary theories of consciousness to discuss the parallel distributed processing structure of the brain, in comparison with the serial organisation of the mind, comparing *Finnegans Wake* to the former and conventional narrative to the latter.⁷ Tim Conley postulates that the complex processes involved in reading the *Wake* mean that “reading becomes – like consciousness – a work in progress.”⁸ In *Joyce’s Mistakes*, he discusses *Finnegans Wake* as a “sort of literary Turing Test, a trial-and-error routine by which humanity, or humanness, can be differentiated from an artificial construct,” since the *Wake*’s heterogeneous language resists algorithmic formalisation.⁹ This article draws out another aspect of the *Wake* as test; Conley considers *Finnegans Wake* as an opportunity to

“test one’s own humanity” (*Mistakes* 147), while I illuminate how it tests one’s cognitive capacities.

The cognitive abilities I consider will be defined according to contemporary intelligence theories, which represent the most advanced state of knowledge on the subject. Just as Shklovsky’s defamiliarisation aims to make “the stone *stony*,” the purpose of intelligence tests is to “make plain the critical cognitive processes that are typically less transparent in more authentic, everyday tasks.”¹⁰ In 1923, Edwin Boring famously defined intelligence as “intelligence is what intelligence tests measure” – which has the same teasing circularity as William Tindall’s “*Finnegans Wake* is about *Finnegans Wake*.”¹¹ Still, Boring’s remark summarises the premise of psychometric theories, which devise tests to measure defined abilities rather than searching for the cognitive mechanisms behind these abilities.

Charles Spearman was one of the first to develop a theory of intelligence based on psychometrics; in 1904, he conducted his own tests and measured correlations between them.¹² He observed that multiple tests of mental ability were positively correlated, meaning that people who did well in some tests were likely to do well in all of them, and vice versa.¹³ This led Spearman to conclude that “all branches of intellectual activity have in common one fundamental function.”¹⁴ Spearman called this function “g” and developed a “two factor” theory of intelligence, stating that each test was influenced by “g” and its own specific factor “s.” In the 1940s, Raymond Cattell identified further distinctions, proposing a discrepancy between fluid and crystallized intelligence.¹⁵ Fluid intelligence is the “purely general ability to discriminate and perceive relations between any fundaments,” involving “inductive reasoning, deductive reasoning, understanding relations among stimuli, comprehending implications, and drawing inferences.”¹⁶ On the other hand, crystallized intelligence is “related to experience in a culture, and exposure to formal schooling; ... the knowledge acquired through experience with one’s environment.”¹⁷

The culmination of this research is the Cattell-Horn-Carroll (CHC) model of intelligence, a “systematic synthesis of hundreds of studies spanning more than a century of empirical investigations of cognitive abilities.”¹⁸ The model is recognised as the most “comprehensive and empirically supported psychometric theory of the structure of cognitive abilities to date,” and is used extensively in the development of intelligence tests.¹⁹ When considering the *Wake* in light of intelligence theories, the CHC provides a reliable representation of the field as it is currently known. The most recent version lists sixteen broad cognitive abilities which contain over eighty narrow abilities.²⁰

My study applies three broad abilities to *Finnegans Wake*: Visual-Spatial (Gv), General Fluid (Gf), and General Crystallized (Gc) intelligence. In terms of the *Wake*, crystallized intelligence refers to the knowledge which would aid in recognising the text’s allusions, as detailed by several extensive studies.²¹ Fluid intelligence describes the means through which these connections are made. It must be acknowledged that these are case studies rather than coverage. Multiple other abilities could be applied to the text, including auditory processing (Ga): “the ability to detect and process meaningful non-verbal information in sound.”²² Given the aural qualities of the *Wake*, this would provide a potential direction for developing this research. Nevertheless, due to the constraints of space, I consider the three categories mentioned above as illustrative examples of how *Finnegans Wake* reveals the operation of its readers’ cognitive reasoning mechanisms.

III. Visual-Spatial Perception

Visual perception or processing (Gv) is the ability to generate and think with “visual patterns and stimuli.”²³ That the structure of *Finnegans Wake* lends itself to a visual, spatial kind of apprehension has frequently been observed; writing on the *Wake*, Donald Theall suggests that poetic communication “stresses the diagrammatic and the designed” and Hilary Clark’s

analysis draws upon a vocabulary of “system” and “nodes.”²⁴ Margot Norris also emphasises how “throughout *Finnegans Wake*, at all levels of construction, Joyce makes structure meaningful, makes it communicate quite independently of content.”²⁵ One of the narrow abilities defined by Gv is spatial scanning (SS), which is the “ability to accurately and quickly survey a spatial field or pattern and identify a path through the visual field or pattern.”²⁶ The HCE and ALP acronyms in the *Wake* work in such a mode, as readers become attuned to spotting combinations of these letters. In the “spatial field” of the *Wake*’s “naïf alphabetters” (FW 107.9), identifying the pattern of HCE or ALP provides a means of navigating the obscurity of the language, leading towards the revelation of further motifs. The term “motif” is particularly apt here because it refers to a visual image or design as well as a recurring literary idea: something spatial as well as conceptual.

The process of noting HCE and ALP combinations is not semantic but formal, based on connecting a figural pattern. The letters have no meaning in themselves, but act as capsules for a range of content from “Howth Castle and Environs” (FW 3.3) to “harmonic condenser enginium” (FW 310.1) to “essizcoloured holmgrewnworsteds costume” (FW 611.35). Sometimes the function of the acronym is more obvious than others: the jumbled HCE initials in “essizcoloured holmgrewnworsteds costume” are more easily missed than the capitalised “Hush! Caution! Echoland!” (FW 13.5), altering the text’s level of difficulty. Occasionally, the initials enact content in form. When “Housefather calls enthrateningly” (FW 246.6), HCE can be identified with the housefather, allowing the cluster to be rephrased as “HCE Calls Enthratteningly.” This is called a recursive acronym, a term coined by Douglas Hofstadter with the example “GOD,” meaning “GOD Over Djinn.”²⁷ HCE is similarly indissoluble, as each “H,” “C” or “E” letter can be expanded to stand for a “HCE” persona: Hce Che Ech, Hcechech Chehceech Echchehce and so on in infinite permutations.

The origins of HCE are identified in Part I Chapter 2, which describes the “genesis of Harold or Humphrey Chimpden’s occupational agnomen” (*FW* 30.2–3): “[t]he great fact emerges that after that historic date all holographs so far exhumed initialled by Haromphrey bear the sigla H. C. E.” (*FW* 32.13–14). The initials come to stand for a consistent principle amongst the protean fluctuations of Joyce’s “character” – for a formal, diagrammatic stability immune from semantic ambiguities. Without these initials, HCE would have no definition at all; “harmonic condenser enginium” and “Housefather calls enthrreateningly” are only related to HCE through the acronym, not through content of their own. Joyce, then, invites readers to exercise a capacity of pattern-recognition in order to spot these initials, which is distinct from the comprehension of their content.

Another way of thinking about diagrammatic reasoning in *Finnegans Wake* is through the “use-mention” distinction in language, and the example of quotations. The mathematician Willard Quine discusses how discrimination between one name and another is a “visual operation of an elementary kind.”²⁸ Quine points out that “a quotation is not a *description* but a *hieroglyph*; it designates its object not by describing it in terms of other objects, but by picturing it” (26). In *Finnegans Wake*, both HCE and many other motifs function as “quotations,” their significance in the first instance being not their semantic content but their formal fact. For instance, if the word “egg” was observed in a conventional piece of writing, the quotation-style recognition of “egg” as a word would happen automatically and a reader would pass straight to its semantic function. In the sentence “the egg cracked,” a typical reading would not pick out “egg” as a hieroglyph but progress immediately to understanding what happened to the egg. However, when “egg” appears in Part III Chapter 3, with an interrogator commenting “I scent eggoarchicism” (*FW* 525.10), the quotation of “egg” as a unit is likely to be recognised before its semantic meaning is considered. “Egg” is recognised because, along with Humpty Dumpty, it has been established as a motif in the last few

hundred pages. It becomes a conceptual hieroglyph, dense with associations gathered over the course of the text, and this identification logically precedes an understanding of the specific semantic relation of this “egg” in relation to “ego,” “scent,” and “anarchy.” At work here is the same principle as the HCE acronym: the *fact* of the initials is perceived before their denoted content, and this process of identifying motifs involves visual-spatial reasoning. In the dense world of *Finnegans Wake*, readers become attuned to spotting any kind of pattern they can, formally as well as semantically. The progression from formal recognition to semantic understanding is slowed down, defamiliarized, revealing the primary cognitive capacities at work.

IV. Fluid Intelligence: Induction and Deduction

The core processes involved in fluid intelligence are inductive, deductive, and quantitative reasoning. Deductive reasoning is also known as General Sequential Reasoning and “rule application.”²⁹ This describes the use of established grammar and vocabulary paradigms in comprehending the *Wake*, which invites readers to fill in gaps and recognise words that appear in distorted or incomplete forms. As put by Susan Shaw Sailer, Joyce “eras[es] the margins of a word so that the word becomes multiple in its suggestiveness,” using “enough of a word to make it recognizable but changing it enough so as to deny its referentiality.”³⁰ All meanings remain in potential; the standard words that a Joycean neologism hints towards do not, once deduced, replace their idiosyncratic originals, but interact with them. Alison Rieke notes that

nonsense writing may invert them or rearrange their parts with a calculated intent to disrupt, but it is finally dependent on sensible systems. In fact, this writing absorbs systems and then manipulates them to its own ends.³¹

The language of *Finnegans Wake* evokes such systems in the very act of deviating from them. For instance, Joyce's "entomophilust" (*FW* 107.13) recalls "entomologist," where Joyce uses parts of the standard word ("entomo") and includes structural similarities (the suffix "philust" resembles "logist," as both are disyllabic and end with "st"). Joyce gives enough information to enable extrapolation, and so, with the application of existing vocabulary paradigms through deductive reasoning, "entomologist" can be perceived in "entomophilust." There is additional deduction to perform in identifying the semantic units "lust" and "phil," where "phil" implies the Greek "philia," a suffix meaning love or affection. "Entomologist" then bears resemblance with "etymologist," who is fittingly the person with the most appropriate skills to identify the roots of "phil" and "logist." The combination of these deductions suggests that an "entomophilust" is one that loves, even lusts, after insects.

Contextual features further define the pool of vocabulary that can be drawn upon for deduction. The "entomophilust" appears in a paragraph beginning "[t]he proteiform graph itself is a polyhedron of scripture" (*FW* 107.8), which follows a long list of titles for ALP's "untitled mamafesta" (*FW* 104.4). The section suggests a pseudo-scholarly analysis of the manifesto, replete with academic jargon. The analysis contends that

to the hardily curiosing entomophilust then [the manifesto] has shown a very sexmosaic of nymphosis in which the eternal chimerahunter Oriolopos, now frond of sugars, then life of saults. (*FW* 107.14)

In the context of studying a letter, "entomophilust" suggests the further extrapolation of "philologist" and accentuates "etymologist." Alternatively, drawing out "philust" creates a constellation of sexual references with "sexmosaic" and "Oriolopos," which recalls Oedipus. The word itself does not have a particularly high resemblance to Oedipus, but the likeness is brought out by the context, which implies a parody of excessive Freudian interpretations that see sexual references everywhere.

As outlined above, the deduction of familiar referentials in Joyce's unfamiliar words is not the final goal of reading the *Wake*, but a starting point. When readers discover these elements, they can explore how they fit together, progressing from primary comprehension to literary criticism as in Stockwell's discussion of cognitive poetics.³² Here, the "logist" of "entomologist" is a Greek suffix that suggests knowledge of a theme, offering a contrast with "philust" implying love and then lust for a theme. This is not only a teasing pun; Joyce is setting up a dichotomy between knowing about a subject and loving a subject. Love could be required for knowledge, but it is also affective rather than rational, and its physicality is amplified in the shift from "phil" to "lust": love becomes lust. Lust for knowledge recalls the theme of Adam and Eve which has been recurring since the beginning of the *Wake*: "riverrun, past Eve and Adam's" (*FW* 3.1). The *Wake* has such a densely connected network of motifs that this process of extrapolation might have no end. Each association leads onto another, and perhaps the entire text could be unfolded through the chain of associations drawn out from a single word.

While deductive reasoning involves the application of familiar paradigms to the *Wake*, inductive reasoning requires the discernment of patterns from within the work itself. Inductive reasoning is at the core of fluid intelligence, and a key feature of reading the *Wake*. Patterns discerned at the beginning of the text can be applied to subsequent parts, as encapsulated by the concentration of motifs on the first page which continually recur throughout the rest of the text. One such instance is the line "nor avoice from afire bellowsed mishe mishe to tauftauf thuartpeatrick" (*FW* 3.9–10). Here the "mishe mishe" might not be immediately comprehensible, but through analysing the words one can deduce the German "mischen" meaning to mix or mingle, the phrase "I am Irish" and the Hebrew meaning of "as soon as." Applying an algorithm that seeks adjacent words beginning with "m" and containing "sh" among their letters identifies many subsequent variations on the term: "Misha

Misha" (FW 249.29), "Mishy Mushy" (FW 277.11), "MacShine MacShane" (FW 437.33), "meesh, meesh" (FW 457.25), "Mushame, Mushame!" (FW 481.26) and "Mushe, mushe of a mixness" (FW 505.20). However, this formal principle leaves out "msch! msch!" (FW 459.3–4) and "mishmash" (FW 466.12). Like many of Joyce's motifs, the resemblances can almost be identified by a formal rule (M_sh_ M_sh_) but there are always slight exceptions, connected through the spectrum of resemblances rather than a fixed instruction.

There are countless similar examples in the *Wake*, such as the "Tip" (FW 8.8) which recurs as "Dip" (FW 334.8), "tep" (FW 273.20), "Top" (FW 303.13), "dib" (FW 311.32), "dab" (FW 311.32) and "Bett and Tipp" (FW 342.30). Here, "tep" and "dab" have no common letters, but they are connected through the spectrum of resemblances comprising onomatopoeic, three-letter words that "tap" into the narrative. Inductive reasoning is the discernment of an abstract principle connecting these variant instances, allowing them to gather associations as the text goes on; "dab" would not imply "tip" or "tap" without the cluster of associations built up before it, just as the later "mushe mushe" recalls past appearances of "mishe mishe." The structure is encapsulated by Michael Gillespie's identification of *Finnegans Wake* as "locally unpredictable, globally stable," using James Gleick's description of chaotic systems.³³ Each "local" appearance of the motifs is distinct while "global" principles, discerned through inductive reasoning, hold them together.

When a reader observes a motif such as "mishe mishe" repeating, they learn the specific rule that this particular theme will repeat. However, when multiple motifs such as "mishe mishe," Shaun and Shem, "tip" and so on repeat, one learns a general rule of recurrence. Inductive reasoning in the *Wake* does not only discern individual rules, but sets of rules: rules of rules. As well as spotting particular recurring motifs (eggs, tips, mishe mishes), readers become attuned to identifying recurrence itself, which conditions their perception of the text. In Part I Chapter 6, there is a long quiz question beginning "what secondtonone

myther rector ... was the first to ...” (FW 126.10–11). The succeeding clauses list things that the “rector” was first to do. One of these clauses is “wanamade singsigns to soundsense an yit he wanna git all his flesch nuemaidd motts truly prural and plusible” (FW 138.7–9). Another is “made Man with juts that jerk and minted money mong maney” (FW 138.28–9). Faintly perceptible in this passage, interspersed enough that the relation is not immediately obvious, are “mott” in the first extract and “juts” in the second. These monosyllables recall Mutt and Jute, the Neanderthal figures of Part I Chapter 1. The “mott” and “jut” interspersions are less explicit than other thematic recurrences; if the text were not so concerned with thematic recurrence in general, they could be dismissed as coincidence. As it is, the recurrence of recurrences sets a pattern of interpretation for *Finnegans Wake*.

V. Crystallized Intelligence and Individual Differences

A key question that arises here is whether inductive and deductive reasoning processes can be generalised across readers. Each reader will have a distinct pool of knowledge with which they approach the *Wake*, making each response different; in other words, readers come to the *Wake* with different types and levels of crystallized intelligence. This will affect their reasoning capacities, which depend to some extent on existing knowledge. One cannot use deduction or induction to recognise patterns of river names, if one does not have a knowledge of these river names. This is a major point of contention in intelligence tests themselves; some content may be more familiar to individuals of particular backgrounds and ethnicities, negatively affecting their ability to respond to questions. Cecil R. Reynolds summarises typical criticisms of such tests: “items ask for information that minority or disadvantaged children have not had equal opportunity to learn”; “minority children are inappropriately penalized for giving answers that would be correct in their own culture but not that of the test

maker.”³⁴ This creates issues of bias and cultural specificity which the development of non-verbal tests has aimed to address.

In a similar vein, knowledge of Joyce’s personal life, Ireland, Catholicism, the historical context of the early twentieth century and various languages defines the given terms with which readers of *Finnegans Wake* can reason, and a reader with no knowledge of these domains will have many more gaps to fill than a reader with the knowledge. On one hand, this knowledge can be supplemented by a guide, such as Campbell and Robinson’s *Skeleton Key*. Such a work might act as a kind of cheat sheet, negating the validity of the *Wake* as test. However, cognitive reasoning capacities can still be exercised in the process of mapping the allusions identified by Campbell and Robinson to their Wakean manifestations, and I wish to reinforce that performing this process of mapping is more significant than the question as to whether readers already possess knowledge of the references.

It is worth considering how individual differences affect an understanding of the *Wake*, and one way of examining this issue is by comparing critical interpretations. For instance, Donald and Joan Theall, writing from the perspective of communication theory, and Andrzej Duszenko, writing from the perspective of quantum physics, comment on the same passage in *Finnegans Wake*, but draw out different elements, illustrating how the same cognitive processes can be applied to different content. The passage considered is from Book II Chapter 3:

[*The abnihilisation of the etym by the grisning of the grosning of the grinder of the grunder of the first lord of Hurtreford expolodotonates through Parsuralia ... Similar scenatas are projectilised from Hullulullu, Bawlawayo, empyreal Raum and mordern Atems. ...*] (FW 353.22–29)

This parenthetical episode is embedded within a television screening of Butt and Taff in Earwicker’s pub. The Thealls suggest that the chapter foresees developing trends in

technological progress; the “abnihilation of the etym” is a consequence of television, where old technologies of writing (encapsulated by the term “etymology”) are replaced by new digital media.³⁵ The phrase, they remark,

weaves together references to war, to the destructive transformation of the natural world and to the transmutation of language, and more particularly of writing, in our super-mechanized world. (60)

Their analysis highlights the annihilation of writing through communication technologies. Out of all the potential implications of “etym,” they foreground “etymology,” with the atom as a supporting concept. Conversely, Duszenko views *Finnegans Wake* in light of the “new science” of quantum physics, commenting:

The passage refers to the first successful splitting of the atom by Lord Rutherford in 1919. ... Imperial Rome is empirical space, and the modern atoms are divisible, as opposed to the original Greek concept of *atomos*: uncut.³⁶

Duszenko foregrounds an analogy between physics and language rather than technology and language. He draws out “atomos” by deftly applying the word’s two potential referents to each other: “etym” recalls “atom,” and the “etymology” of “atom” is the Ancient Greek “atomos.” Duszenko goes on to probe “etym” further, additionally unravelling “Adam – another first principle, and the symbol of man, the subject of creation and annihilation” (275).

Duszenko’s key analogy is that “both the writer and the scientists were attempting to penetrate what had hitherto been considered the smallest indivisible unit – semantically in language, and physically in matter” (274). In contrast, the Thealls’ central thesis is that “the design of the language ... parallels the phenomenon of electrification which will eventually through automation produce a super-mechanized technocratic society” (59). Consequently, each critic connects the phrase to different parts of the chapter. The Thealls link “etym” to the electrical units implied in switching on the television: “guranium satin” (*FW* 349.9), “bitts”

(FW 349.11), “syncopanc pulses” (FW 349.10–11) (60). However, Duszenko emphasises the combinations of “atom” and “Adam,” citing intra-textual references such as “atam” (FW 333.25), “from atoms and ifs” (FW 455.17) and “the sameold gamebold adomic structure” (FW 615.6) (275).

At the same time, both critical perspectives have drawn upon existing vocabulary and conceptual paradigms in order to deduce words surrounding Joyce’s “etym”: “atom,” “Adam,” “atomos,” “etymologies.” Both additionally suggest that cutting “etymology” to “etym” evokes a tiny linguistic unit equivalent to material atoms.³⁷ Moreover, both use inductive reasoning in order to identify a thematic cohesion across the text more widely which supports their close-reading of this passage. Different critics might emphasise different aspects of the same passage of the *Wake*, while using similar cognitive strategies of deduction and induction to arrive at these references.

The same principle applies on a more informal level of reading. The *Wake*’s miscellaneous breadth of material, spanning academic debates, popular culture and general knowledge, can yield moments of spontaneous identification between text and reader. Along these lines, Derek Attridge describes the “momentary pleasure” he experienced in recognizing (through deduction) the South African river “Umsindusi” or “Dusi,” by which he grew up, in Joyce’s “bakereen’s dusind” (FW 212.20).³⁸ This pleasure, continues Attridge, was undiminished by his awareness that the recognition was likely a coincidence rather than intended allusion (121). Similarly, while analysing *Finnegans Wake* for this article I happened to be organising an eczema appointment. Then I turned to the study hour chapter of *Finnegans Wake*, which I discuss in the following section, and glimpsed the word “eczema” on the opening page (FW 260, footnote 1). Like Attridge’s example, this coincidence has been engineered by the *Wake*: the extreme density of information increases the chances of such random alignments. The text acts as a kind of intelligence itself, having passed a

threshold of pattern which creates the illusion of organising itself in response to its reader's own thoughts. As put by Conley, the *Wake* “demonstrate[s] an associative capability at once independent of authorial ‘intention’ or presence and interactive with a reader's own associations” (*Mistakes* 143).

The “test” provided by the *Wake*, then, can hold different content for different readers, as each mind activates distinct points of recognition. However, the interest lies less in *what* one knows, and more in *how* one makes these connections; readers discover different references depending on their existing pool of knowledge, while using similar reasoning processes in order to arrive at these references.

VI. The *Finnegans Wake* Intelligence Test

The discussion so far has focused on cognitive reasoning mechanisms rather than the tests devised to measure them, but historically psychometric intelligence tests preceded the intelligence theories of cognitive psychology. While the Cattell-Horn-Carroll model was first fully integrated in 1997, the major intelligence tests in current use, such as the Stanford-Binet and Wechsler scales, have their origins much earlier. The Binet scale was first published in 1905 and the Wechsler-Bellevue in 1939 – incidentally, the same year as *Finnegans Wake*. However, their twenty-first century revisions have been influenced by the CHC model, illustrating the increasing dialogue between test and theory. A key battery of tests in current use is the Wechsler Adult Intelligence Scale (WAIS), which has achieved “almost monopoly status in the field of individual adult intelligence testing.”³⁹ The scale has been revised four times since 1939, the most recent being the 2008 WAIS-IV. Here, fluid intelligence is measured by the Matrix Reasoning test, crystallised intelligence by Vocabulary, Similarities, Information and Comprehension tests, and Visual-Spatial perception by Block Design, Object-Assembly, Picture Arrangement and Picture Completion tests.

The Similarities test, defined by Wechsler in 1939 and still in use today, lists words side by side and asks subjects to perceive common elements. For instance, the common element between “orange” and “banana” is fruit, or “coat” and “dress” is clothing. Slightly more difficult examples include “wood” and “alcohol,” or “praise” and “punishment.”⁴⁰ Although the test measures crystallized intelligence, Wechsler points out that sheer word knowledge is a minor factor:

more important is the individual’s ability to perceive the common elements of the terms he is asked to compare and, at higher levels, his ability to bring them under a single concept. (73)

Wechsler’s test aims to distinguish between identifying superficial and more essential similarities; that oranges and bananas are alike because they are edible is one similarity, but the label of “fruit” is more specific because it is a subset of edible things. In an alternative case of apples and pears, “fruit with pips” (as a subset of “fruit”) would be an even more specific common denominator.

Embedded Similarities tests can be identified in *Finnegans Wake*. In the first chapter, a paragraph suggests the opening of a book – or, perhaps, an examination paper:

So, how idlers’ wind turning pages on pages, as innocens with anaclete play popeye antipop, the leaves of the living in the boke of the deeds, annals of themselves timing the cycles of events grand and national, bring fassilwise to pass how. (FW 13.29–32)

The opening image of wind (or, simultaneously, a winding motion) turning the pages of a book sets the scene for the succeeding clauses. On the first imaginary page, there are “innosens” and “anaclete.” In terms of fluid intelligence, deduction allows readers to see the standard “innocence” in the Wakean “innosens,” and the motif of Anna Livia Plurabelle derived from inductive reasoning helps identify the character’s presence in “anaclete.” The implicit Similarities test of crystallized intelligence is this: what is the common factor

between the terms “innosens” and “anaclete”? Answer: they both refer to popes. As a Similarities test, the question measures the ability to perceive connections, but if viewed alternatively as Wechsler’s Information test, the question could measure historical knowledge of popes.

The pages turned by the wind illustrate a plethora of images: Popes Innocent and Anacletus playing “antipope” against each other, the fictional comic-strip character of Popeye, the presence of Anna Livia in Anaclete, the grand narrative theme of innocence (HCE’s guilt, Adam and Eve) implicit in Innosens, within which is embedded “no sens” and the idea of “nonsense,” a key stylistic aspect of *Finnegans Wake*. One of the non-verbal tests in the Wechsler scale, present from 1939 to 1997 but dropped in 2008, was the Picture Arrangement test. This consists of “a series of pictures which, when placed in the right sequence, tell a little story.”⁴¹ Episodes in *Finnegans Wake* provide similar sequences of “pictures,” except that they are organised spatially rather than temporally. A spatial version of the “Picture Arrangement” task implicit in the *Wake* might resemble a series of cubes with differently painted faces. If the cubes of Joyce’s phrase are turned to Pope Innocent, Pope Anacletus, and antipope, one forms a “little story” of a historical event. Yet turning the cubes to innocence, Anna Livia, playing and Popeye creates the story of a mother-figure playing with her children. Both stories are present in the same cubes: contained by the same words.

The pages turn again in the next clause: “the leaves of the living in the boke of the deeds.” A recent addition to the Wechsler intelligence scale is the Matrices Reasoning subtest, which was added in the WAIS-III (1997).⁴² A simple example of this test is a white triangle with a shaded triangle next to it, and then a white circle with a question mark next to it. One must choose which shape replaces the question mark, with the answer being a shaded circle. A verbal version of this test would be phrased: “a is to b as c is to _.” A Joycean version could be: “boke is to book as deeds is to dead.” The relationship between “A and B”

as one unit, and “C and D” as another, is that a similar Wakean deduction is performed in both sets. The third word “boke” resembles a word connected with the first word “leaves,” and the fourth word “deed” resembles a word connected with the second word “living.” In test form: what connects “leaves” and “boke”? Answer: Book. What connects “living” and “deeds”? Answer: Dead. One must recognise that “book” figurally or aurally resembles “boke” as well as being semantically related to “leaves,” combining verbal and non-verbal aspects of the test. The network of connections is confirmed by an implicit mark scheme; if one deduces “dead” from “deeds,” they can be marked as correct because “dead” matches with “living.” Correctness is indicated by the revelation of further pattern, and the two answers of “book” and “dead” are further confirmed by their link with the Egyptian Book of the Dead, a recurring theme of *Finnegans Wake* identified through the inductive reasoning performed so far.⁴³

To conclude this section, it is worth briefly considering how the themes of testing and examination are depicted *within* the *Wake*: Part II Chapter 2, formatted as a kind of textbook with footnotes and marginal comments, weaves abstract philosophical questions through the plot of children studying. The narrative seems to transition from lecturing to questioning, and Campbell and Robinson summarise the principal references as the medieval studies of the Trivium (including Grammar, Logic and Rhetoric) and the Quadrivium (Arithmetic, Music, Geometry, Astronomy), as well as the “esoteric doctrines of the Kabbala.”⁴⁴ Opening with an allegorical review of the process of creation, the chapter’s progression is marked by parodically dense headings in the right-hand margins: “Imaginable Itinerary through the particular universal” (*FW* 260.7–11), “constitution of the constitutionable as constitutional” (*FW* 261.23–27), “probapossible prolegomena to ideareal history” (*FW* 262.3–7), “gnosis of precreate determination, agnosis of postcreate determinism” (*FW* 262.20–25), and so on.

Navigating this chapter calls upon the processes discussed above: one's crystallised intelligence in specific knowledge of allusions, and fluid intelligence in connecting these references to their *Wakean* manifestations. The opening paragraph contains a list of places comprising the names of famous scholars; "Long Livius Lane," "Mezzofanti Mall," "Lavatory Square" (FW 260.9–10) reference a Roman historian, a linguist, and a physiognomist respectively. The act of recognising these references involves drawing upon existing knowledge of Livy, Mezzofanti and Lavater – while also observing the typically Joycean pun on the latter's name with its likeness to lavatory. Still, such external allusions are frequently combined with internal references. The exclamation "elementator joyclid, son of a Butt!" (FW 302.12–13) invites inductive reasoning in identifying the "Butt and Taff" motif, while deductive reasoning is used to recognise "Euclid" and "son of a bitch."

One particular phrase in this chapter comes close to the style of an intelligence test: "A is for Anna like L is for liv" (FW 293.28–29). Again, this is an internal reference: "A" refers to Anna when "L" refers to liv only in the schema of associations constructed by the *Wake*, through the recurring motif of Anna Livia Plurabelle. The idea of testing is also foregrounded at the end of the chapter, which articulates a series of disjointed questions: "What Morals, if any, can be drawn from Diarmuid and Grania? Do you approve of our Existing Parliamentary System?" (FW 306.27–30), "When is a Pun not a Pun?" (FW 307.2–3), "Should Ladies learn Music or Mathematics? Glory be to Saint Patrick! What is to be found in a Dustheap, The Value of Circumstantial Evidence, Should Spelling?" (FW 307.21–25). Recalling Conley, these are nonsensical questions, testing creativity rather than content. Their whimsicality acts as a "Turing Test" by evading straightforward and conventional answers, soliciting a less formalisable – and perhaps more literary – kind of response.

Accordingly, the "intelligence test" *within* the *Wake* acts in the same spirit of the intelligence test that constitutes the *Wake*. The text does not test knowledge so much as

strategy and spontaneity. Resolving *Finnegans Wake* into an inventory of allusions would dissolve its artistry; the beauty and fascination exerted by Joyce's writing is in how these elements are merged together, and the effect of this complexity on the mind that encounters it. The aim is not to "decode" the *Wake*, but to perceive the coded and decoded versions of its language simultaneously, weaving between collective texture and dissected components. Conley similarly comments: "More than a database, the *Wake* is ... data in digestion. Information is accessible only in process" (*Mistakes* 143). This principle distinguishes the intelligence test from other forms of examination; reading the *Wake* as a specific subject examination paper would emphasise factual knowledge, but reading it as an intelligence test highlights the processes through which knowledge is accessed and manipulated.

VII. Conclusion

While the extent to which they achieve this is subject to debate, the primary quality that intelligence tests aim to assess is the capacity to learn. Both Paul Kline and David Wechsler mention "ability to learn" in their definitions of intelligence, and Vernon Lee similarly suggests that "intelligence is specially fitted to deal with Change."⁴⁵ Intelligence is most clearly manifested when a subject can "understand and deal with novel situations" and "develop solutions to relatively novel problems."⁴⁶ The *Wake* is not a conventional novel, but it is certainly novel, testing its subject's ability to navigate unfamiliar territory. It is a test of manifestation rather than evaluation, performing a defamiliarisation which renders its subject's cognitive reasoning processes visible. By impeding cognition of its design, *Finnegans Wake* reveals the design of cognition.

NOTES

¹ James Joyce, *Finnegans Wake*, ed. Robbert-Jan Henkes, Erik Bindervoet and Finn Fordham (Oxford: Oxford University Press, 2012). Further references will be cited parenthetically in the text by *FW* and the page and line numbers.

² Derek Attridge, *Peculiar Language: Literature as Difference from the Renaissance to James Joyce* (London: Methuen, 1988), p. 203.

³ Viktor Shklovsky, “Art as Technique,” in *Russian Formalist Criticism: Four Essays*, trans. Lee T. Lemon and Marion J. Reis (Lincoln, NE: Univ. of Nebraska Press, 1965), pp. 13, 22. Further references will be cited parenthetically in the text.

⁴ Reuven Tsur, *Toward a Theory of Cognitive Poetics* (London: North-Holland, 1992), p. 4.

⁵ Peter Stockwell, *Cognitive Poetics: An Introduction* (London: Routledge, 2002), p. 6. Further references will be cited parenthetically in the text.

⁶ Dirk Van Hulle, *James Joyce’s “Work in Progress”: Pre-Book Publications of Finnegans Wake Fragments* (London: Routledge, 2016), p. 6.

⁷ Thomas Jackson Rice, *Joyce, Chaos, and Complexity* (Urbana: Univ. of Illinois Press, 1997), p. 119.

⁸ Tim Conley, “‘Cog It out’: Joyce on the Brain,” *Joyce Studies Annual* (2014), 34.

⁹ Tim Conley, *Joyce’s Mistakes: Problems of Intention, Irony, and Interpretation* (Toronto: Univ. of Toronto Press, 2016), p. 147. Further references will be cited parenthetically in the text as *Mistakes*.

¹⁰ David F. Lohman, “Reasoning Abilities,” *Cognition and Intelligence: Identifying the Mechanisms of the Mind*, ed. Robert J. Sternberg and Jean E. Pretz (Cambridge: Cambridge Univ. Press, 2004), p. 226.

-
- ¹¹ Paul Kline, *Intelligence: The Psychometric View* (East Sussex: Routledge, 1991), p. 2; William Tindall, *A Reader's Guide to James Joyce* (Syracuse, NY: Syracuse Univ. Press, 1995), p. 237.
- ¹² Michael K. Gardner, "Theories of Intelligence," in *The Oxford Handbook of School Psychology*, ed. Melissa A. Bray and Thomas J. Kehle (Oxford: Oxford Univ. Press, 2012), p. 80.
- ¹³ W. Joel Schneider and Kevin S. McGrew, "The Cattell-Horn-Carroll Model of Intelligence," in *Contemporary Intellectual Assessment: Theories, Tests, and Issues*, ed. D. Flanagan and P. Harrison, (New York: Guilford, 2012), p. 103.
- ¹⁴ Gardner, "Theories of Intelligence," p. 80.
- ¹⁵ See Raymond B Cattell, "The Measurement of Adult Intelligence," *Psychological Bulletin* 40, no. 3 (1943), 153–92.
- ¹⁶ Cattell, "Adult Intelligence," p. 83.
- ¹⁷ Gardner, "Theories of Intelligence," p. 83.
- ¹⁸ Schneider and McGrew, "Cattell-Horn-Carroll," p. 100.
- ¹⁹ Dawn P. Flanagan and Shauna G. Dixon, "The Cattell-Horn-Carroll Theory of Cognitive Abilities," in *Encyclopedia of Special Education*, ed. Cecil R. Reynolds, Kimberly J. Vannest and Elaine Fletcher-Janzen (Hoboken, NJ: John Wiley & Sons, 2014), p. 457.
- ²⁰ Flanagan and Dixon, "Cattell-Horn-Carroll Theory," p. 459.
- ²¹ See James S. Atherton, *The Books at the Wake: A Study of Literary Allusions in James Joyce's Finnegans Wake* (New York: Paul P. Appel, 1979); Roland McHugh, *Annotations to Finnegans Wake* (London: Johns Hopkins Press, 1991); Joseph Campbell and Henry Morton Robinson, *A Skeleton Key to Finnegans Wake: Unlocking James Joyce's Masterwork*, ed. Edmund L. Epstein (Novato, CA: New World Library, 2005).
- ²² Schneider and McGrew, "The Cattell-Horn-Carroll Model of Intelligence," p. 131.

²³ Flanagan and Dixon, “Cattell-Horn-Carroll Theory,” p. 464.

²⁴ Donald F. Theall, “The Hieroglyphs of Engined Egyprians: Machines, Media, and Modes of Communication in *Finnegans Wake*,” *Joyce Studies Annual* 2 (1991), 134; Hilary Clark, “Networking in ‘Finnegans Wake’,” *James Joyce Quarterly* 27, no. 4 (1990), 746.

²⁵ Margot Norris, *The Decentered Universe of Finnegans Wake: A Structuralist Analysis* (London: Johns Hopkins Univ. Press, 1976), p. 139.

²⁶ Flanagan and Dixon, “Cattell-Horn-Carroll Theory,” p. 465.

²⁷ Douglas Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid* (London: Penguin, 1980), pp. 103–26.

²⁸ Willard Van Orman Quine, *Mathematical Logic* (Cambridge, MA: Harvard Univ. Press, 1981), p. 23. Further references will be cited parenthetically in the text.

²⁹ Schneider and McGrew, “The Cattell-Horn-Carroll Model of Intelligence,” p. 112.

³⁰ Susan Shaw Sailer, *On the Void of To Be: Incoherence and Trope in Finnegans Wake* (Michigan: Univ. of Michigan Press, 1993), p. 63.

³¹ Alison Rieke, *The Senses of Nonsense* (Iowa City: Univ. of Iowa Press, 1992), p. 5.

³² Peter Stockwell remarks that cognitive poetics must involve critical theory and literary philosophy in addition to the “science of cognition” in order to avoid a “trivial” application which treats literature as simply data (5–6). He proposes a solution to these potential limitations by identifying a distinction between “interpretation,” which he associates with the initial experience of a text, and “reading” as the more analytically informed stage of criticism. Here, cognitive poetics “models the process by which intuitive interpretations are formed into expressible meanings” (8), tracking the progress from primary comprehension to literary reading.

³³ Michael Patrick Gillespie, "Reading On the Edge of Chaos: *Finnegans Wake* and the Burden of Linearity," *Journal of Modern Literature* 22, no. 2 (Winter 1998/1999), p. 371.

See also James Gleick, *Chaos* (London: Vintage, 1998), p. 48.

³⁴ Cecil R. Reynolds, "Test Bias and the Assessment of Intelligence and Personality," in *International Handbook of Personality and Intelligence*, ed. Donald H. Saklofske and Moshe Zeidner (New York: Springer Science + Business Media, 1995), p. 553.

³⁵ Donald Theall and Joan Theall, "Marshall McLuhan and James Joyce: Beyond Media," *Canadian Journal of Communication* 14, no. 4 (1989), 60. Further references will be cited parenthetically in the text.

³⁶ Andrzej Duszenko, "The Joyce of Science: Quantum Physics in 'Finnegans Wake,'" *Irish University Review* 24, no. 2 (1994), pp. 274–5. Further references will be cited parenthetically in the text.

³⁷ For the Thealls' articulation of this idea, see "Beyond Media," p. 60.

³⁸ Derek Attridge, *Joyce Effects* (Cambridge: Cambridge Univ. Press, 2009), p. 121. Further references will be cited parenthetically in the text.

³⁹ Corwin Boake, "From the Binet–Simon to the Wechsler–Bellevue: Tracing the History of Intelligence Testing," *Journal of Clinical and Experimental Neuropsychology* 24, no. 3 (2002), 401.

⁴⁰ David Wechsler, *The Measurement and Appraisal of Adult Intelligence* (Baltimore: Williams & Wilkins, 1958), p. 73. Further references will be cited parenthetically in the text.

⁴¹ Wechsler, *Adult Intelligence*, p. 74.

⁴² Boake, "History of Intelligence Testing," p. 400.

⁴³ For more on the Egyptian Book of the Dead in *Finnegans Wake*, see Atherton, *The Books at the Wake*, pp. 191–200.

⁴⁴ Campbell and Robinson, *Skeleton Key*, p. 163.

⁴⁵ Kline, *Intelligence*, p. 1; Wechsler, *Adult Intelligence*, p. 4; Vernon Lee, *Proteus, or The Future of Intelligence* (London: Kegan Paul, 1925), p. 20.

⁴⁶ Kline, *Intelligence*, p. 1; Earl Hunt, “Information Processing and Intelligence,” in *Cognition and Intelligence: Identifying the Mechanisms of the Mind*, ed. Robert J. Sternberg and Jean E. Pretz (Cambridge: Cambridge Univ. Press, 2004), p. 6.