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EXAMINING THE USE OF LOGIC IN THE POETRY OF VERONICA FORREST-THOMSON AND REBECCA ELSON

Converging the Conceptual Horizons of Science and Poetry

ABSTRACT

In her seminal doctoral dissertation, *Poetry as Knowledge: The Use of Science by Twentieth-Century Poets* (1971), Veronica Forrest-Thomson posits a sophisticated framework for understanding the epistemic and affective validity of poetic language when juxtaposed with the denotative precision of scientific discourse. She contends that poetry, far from being a mere aesthetic indulgence, possesses an empirical and emotional legitimacy that warrants rigorous examination. Forrest-Thomson's early poetic oeuvre engages deeply with Ludwig Wittgenstein's logical propositions, probing the capacity of poetic language to encapsulate scientific truths and referents. For Forrest-Thomson, poetry that grapples with scientifically observable phenomena transcends mere referentiality, emerging instead as a meta-linguistic exploration of logical structures. In contrast, the Canadian astrophysicist and poet Rebecca Elson employs logical forms within her poetry to illuminate the linguistic contingency of scientific objects and events, suggesting that

their properties are as much a product of discursive construction as are phenomena beyond the scientific domain. The first section examines how poetic language transforms empirical scientific observations into subjects of aesthetic inquiry. By recontextualizing scientific facts within the expressive medium of poetry, poets like Forrest-Thomson and Elson challenge the boundaries between objective referent and subjective interpretation, foregrounding the role of linguistic artistry in shaping epistemological claims. The second section explores the conceptual parallels between shifts in logical thought and the linguistic extension of scientific paradigms within the philosophy of science and investigates how poetry, by adopting logical structures, mirrors and critiques the dynamic evolution of scientific theories.

KEY WORDS: logic, philosophy of science, poetic metaphor, structural evolution of theory, ontological relativity.

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INTRODUCTION

Scientific and poetic languages stake distinct claims to truth, sparking debates among critics about their legitimacy. I. A. Richards in *Science and Poetry* (1926) states that scientific statements are implemented for the “sake of reference,” while statements serving emotive purposes produce “effects in emotion and attitude.”² Such a claim is supported by Carnap in *The Elimination of Metaphysics* (1932) and Popper in *The Logic of Scientific Discovery* (1959), where they observe that poetic utterances “assert nothing”³ and therefore can “never be refuted.”⁴ On the other hand, Attridge argues that the literary event is “an inventive reconfiguration” where “something new comes into being” through the interaction of text and reader.⁵ Science, therefore, aims for empirical precision, while poetry, though not bound to factual reporting, asserts its own truths by forging a linguistic bridge to an external reality beyond the individual mind. This interplay makes poetry’s engagement with logical philosophy vital, as it grapples with defining itself against the backdrop of an external world. Literary theorist Ann Banfield posits that literary language, while fundamentally distinct from logical philosophy, must engage with the scientific world to achieve modernity.⁶ She argues that literature, particularly modernist poetry, cannot afford to ignore scientific paradigms if it seeks to reflect contemporary epistemological shifts. Her analysis draws on the philosophies of Bertrand Russell and G. E. Moore and emphasizes how their logical frameworks influence literary representations of reality.

Logical philosophy, as the study of how language constructs reality, equips poetry with tools to reference the world of science, enabling poetry to weave diverse meaning systems into its fabric. Scientific language conveys observed and theoretical phenomena, while poetic language offers truths that transcend subjective psychology, both relying on logic to depict reality as a linguistic effect. Banfield’s work highlights how modernist writers like Virginia Woolf navigated this terrain, blending literary and philosophical discourses to address the fragmented nature of modern experience. The poetry of Veronica Forrest-Thomson and astronomer-poet Rebecca Elson exemplifies this dynamic, challenging the notion that language merely transmits facts. Forrest-Thomson’s *Poetic Artifice* (1978) advocates for poetry as a self-conscious linguistic construct, prioritizing form over factual content, while Elson’s *A Responsibility to Awe* (2001), hereafter *ARA*, merges cosmic inquiry with poetic wonder, revealing the myth-making inherent in scientific language. Their works

² I. A. Richards, *Science and Poetry* (London: Kegan Paul, Trench, Trübner & Co., 1926), 59.

³ Rudolf Carnap, “The Elimination of Metaphysics Through Logical Analysis of Language,” in *Logical Positivism*, ed. A. J. Ayer (Glencoe: The Free Press, 1959), 76.

⁴ Karl Popper, *The Logic of Scientific Discovery* (London: Hutchinson & Co., 1959), 279.

⁵ Derek Attridge, *The Singularity of Literature* (Routledge, 2004), 45.

⁶ Ann Banfield, *The Phantom Table: Woolf, Fry, Russell and the Epistemology of Modernism* (Cambridge UP, 2000), 54-5.

expose the transactional nature of both discourses, positioning scientific entities—atoms, stars, or equations—as valid subjects for aesthetic exploration.

The epistemic claims of scientific and poetic discourses, though divergent in method, converge in their reliance on language to apprehend an external reality, prompting rigorous debate over their respective truth-value. In his 2002 lecture, “Gödel and the End of Physics,” Stephen Hawking elucidates Kurt Gödel’s theorems of incompleteness, which demonstrate that within any sufficiently complex formal system, certain truths remain unprovable, eluding the system’s internal logic. Hawking extends this insight to physics, arguing that external observations resist complete linguistic mapping, rendering physical theories “self-referencing” and inherently incomplete.⁷ This Gödelian limit finds a poetic parallel in the inconclusive nature of poetic thought experiments, which, unlike scientific inquiry, thrive on ambiguity rather than resolution. Ludwig Wittgenstein, in *Remarks on the Foundations of Mathematics* (1956), hereafter *RFM*, probes this ambiguity with characteristic acuity: “When a poet composes he is making a psychological experiment [...] We mistake the nature of ‘experiment,’—believing that whenever we are keen on knowing the end of a process, it is what we call an ‘experiment.’”⁸ Wittgenstein’s aphorism reframes poetic composition as an open-ended exploration, distinct from the teleological drive of scientific experiments. Poetry’s references to empirical objects—quarks, constellations, or thermodynamic laws—accumulate meanings along an “axis of difference,”⁹ as Derrida might term it, perpetually deferring fixed signification. This indeterminacy, Wittgenstein suggests, is not a flaw but a feature, enabling poetry to engage with scientific reality without being bound by its empirical imperatives. For Forrest-Thomson and Elson, scientific facts—be they stellar spectra or quantum states—become poetic material, exposing the mythopoeic underpinnings of both disciplines. Poetry, in this view, does not merely reflect science but refracts it, revealing facts as linguistic constructs within a shared epistemic narrative.¹⁰

⁷ Stephen Hawking, “Gödel and the End of Physics,” 2002. <https://www.hawking.org.uk/in-words/lectures/godel-and-the-end-of-physics>.

⁸ Ludwig Wittgenstein, *Remarks on the Foundations of Mathematics* (MIT Press, 1967), §76; hereafter *RFM*

⁹ Jacques Derrida, “The Ends of Man,” *Margins of Philosophy*, trans. by Alan Bass (University of Chicago Press, 1972), 109-136.

¹⁰ Karen Barad in “Posthumanist Performativity” (2003) argues that scientific approaches largely depend upon a representational view of the world, where language is meant to serve the function of representing reality as it exists in the form of a pre-linguistic entity. However, recent theorists argue for a more “performative understanding” of language and depend on its cross-applicability across the genres of literary studies, and theatre studies, among others. Barad’s ideas resonate with them and she argues that scientific language should not resort to “geometries of absolute exteriority or interiority,” where discourse and matter are separate realms. Poetic language brings this very inseparability between the language of representation and the represented world into greater focus. Karen Barad, “Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter,” *Signs: Journal of Women in Culture and Society* 28 (3): 801-831.

AESTHETIC REFASHIONING OF SCIENTIFIC FACT

In her doctoral thesis, *Poetry as Knowledge: The Use of Science by Twentieth-Century Poets* (1971), Veronica Forrest-Thomson invokes I. A. Richards' study of metaphor, which seeks to reconcile "our idea of the organization of experience of the world, and the particular verbal organization that confronts us in a poem."¹¹ Richards' framework suggests that poetry, particularly when addressing scientific subjects, navigates the dynamics between empirical observation and linguistic artifice. This interplay becomes a study of logic itself, as poetry probes the mechanisms by which language constructs truth-claims, rather than merely mirroring scientific facts. Ludwig Wittgenstein's *Tractatus Logico-Philosophicus* (1922), provides a foundational lens for this inquiry. In his early writings, Wittgenstein posits that although logical structures underpin language's capacity to depict reality, objective propositions fall short of capturing subjective experience: "The sense of the world must lie outside the world [...] So too it is impossible for there to be propositions of ethics [...] It is clear that ethics cannot be put into words [...] (Ethics and aesthetics are one and the same)."¹² For Wittgenstein, meaning resides in the liminal space between explicit statement and implicit suggestion¹³—a notion that resonates with the inherent incompleteness of scientific observation articulated by Stephen Hawking in his 2002 lecture on Gödel.¹⁴ R. A. Porte further elucidates this epistemic convergence, positioning poetry as a "halfway house between science and 'concrete affairs.'"¹⁵ Porte argues that poetic truths reside "somewhere between 'verifiable facts' and 'generally accepted conventions,'"¹⁶ eschewing direct referentiality for a logic of suggestion. Poetry about science, in this view, does not seek to replicate scientific verifiability but instead interrogates the logical structures underpinning both discourses.

In his seminal work, *The Meaning of Poetic Metaphor* (1967), Marcus B. Hester advances a phenomenological account of poetic language, positing that the poem does not merely denote or refer to external experiences but rather *embodies* them intrinsically through its linguistic structure. Drawing on Ludwig Wittgenstein's

¹¹ Veronica Forrest-Thomson, "Poetry as Knowledge: The Use of Science by Twentieth-Century Poets" (PhD dissertation, Cambridge University, 1971), 19.

¹² Ludwig Wittgenstein, *Tractatus Logico-Philosophicus* (London: Routledge, 2002), §6.41.

¹³ This aspect of his early thought is further modified in *Philosophical Investigations* where explicit meaning—dependent on practical, rule-governed activities—is informed by being embedded in forms of life. He, therefore, goes on to say that meaning always involves public criteria: "But we understand the meaning of a word when we hear it or say it; we grasp it in a flash, and what we grasp in this way is surely something different from the 'use' which is extended in time!" Ludwig Wittgenstein, *Philosophical Investigations*, trans. by G. E. M. Anscombe (London: Blackwell Publishers, 1986), §138.

¹⁴ In his later work, *Remarks on the Foundations of Metaphysics*, Wittgenstein tangentially engages with Gödel's theory of incompleteness, which he argues holds true but does not confirm the existence of unprovable truths.

¹⁵ Rebecca A. Porte, *An Agreement with Reality: The Poetry of Logical Modernism* (PhD dissertation, Michigan University, 2014), 76.

¹⁶ Porte, 77.

philosophy of language, particularly the dictum that meaning resides in use, Hester contends that poetry bridges the inherent gap between word and context in a manner distinct from ordinary discourse. As he elucidates, “The gap between a word and its context, which according to Wittgenstein, is bridged by use, is overcome by the poem in a different way.”¹⁷ This “different way” manifests through sonic and prosodic elements such as rhythm, rhyme, and alliteration, which fuse sense (semantic content) with *sensa* (sensory perceptions) and imagery, thereby engendering a holistic symbol that directly presents an experience rather than symbolically representing one. Hester’s framework aligns with Susanne Langer’s notion of the poem as a “presentational symbol,”¹⁸ developed between 1942 and 1957, wherein metaphorical language unifies disparate realms into an iconic signification that evokes a lived, embodied encounter, integrating both cognitive and perceptual dimensions. This fusion prioritizes sense as inseparable from sensory immediacy, rendering the poem a self-contained vessel of meaning that resists reduction to propositional truth or logical statements.

This embodied poetics stands in stark contrast to the materialist strategies of concrete poetry, which are adopted to a certain degree in Veronica Forrest-Thomson’s early poetry such as “Atomic Disintegration” and “Subatomic Symphony,” from her *Collected Poems* (1976), hereafter *CP*. In these poems, the linguistic signifier resists fusing internal affect with sense, but exists as a tangible, physical entity subject to literal decomposition. Whereas Hester’s model emphasizes an integrative embodiment through auditory and rhythmic orchestration, concrete poetry foregrounds the visual and performative materiality of the text itself, often prioritizing typographical arrangement over verbal semantics to enact meaning through form. However, Gareth Farmer notes that Forrest-Thomson never completely goes over to the camp of concrete poetry because to do so would be “to relinquish the possibility of poetic discursivity.”¹⁹ In Forrest-Thomson’s “Atomic Disintegration,” the word “ATOM” is systematically dismantled across three columnar modalities, namely, “1-visual,” “2-vocal,” and “3-for mass performance,” which mirror the scientific phenomenon of atomic disintegration not descriptively but mimetically.

¹⁷ Marcus B. Hester, *The Meaning of Poetic Metaphor: An Analysis in the Light of Wittgenstein’s Claim that Meaning is Use* (Paris: Mouton & Co., 1967), 68.

¹⁸ Susanne K. Langer, *Philosophy in a New Key* (London: Humphrey Milford, Oxford University Press), 97.

¹⁹ Gareth Farmer, *Veronica Forrest-Thomson: Poet on the Periphery* (Switzerland: Palgrave-Macmillan, 2017), 33.

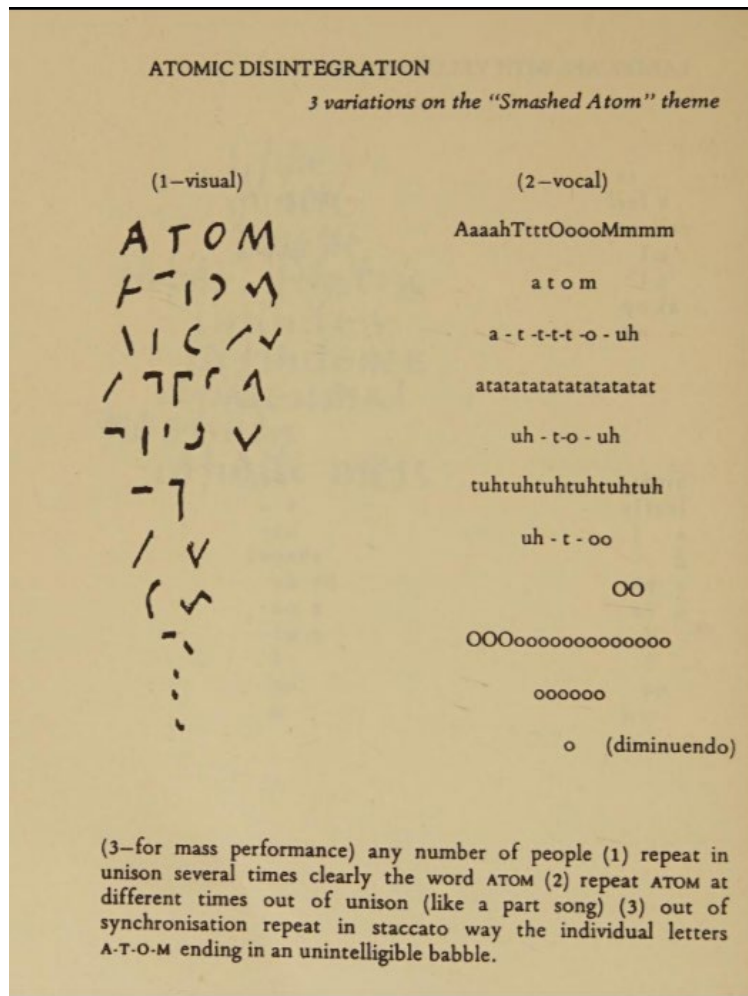


Figure 1. Veronica Forrest-Thomson, "Atomic Disintegration," in *CP* (Exeter: Shearsman Books, 2008), 53.

The graphic signifier devolves into arbitrary line-marks, phonemes fragment into sonic disarray, and the ensemble culminates in a collective vocalization that dissolves semantic coherence into "unintelligible babble."²⁰ This approach of a deconstructive literalism, where the poem becomes a performative object that instantiates the process of atomic disintegration, subverts the traditional metaphor's integrative impulse. However, this evolved form of concrete poetry, as practiced by Forrest-Thomson, represents a radical extension of Hester's thesis. While the poem remains a concrete analogue of its referent, in this case, a smashed atom, the deliberate, controlled experiment for understanding the limits and constructions of semantic meaning makes poetic technique into an epistemological tool for sharing and receiving linguistic knowledge.

Christian Gelder argues that Veronica Forrest-Thomson's lexical, graphic, and phonemic deconstruction of the word "atom," employed to represent the process of atomic disintegration, fundamentally informs and shapes the textual structure of

²⁰ Veronica Forrest-Thomson, *Collected Poems* (London: Allardyce, Barnett, 1976), 53.

language itself.²¹ In a short note written for a poetry reading event held on December 30th, 1967, Veronica Forrest-Thomson writes that she finds the “semantic element almost impossible to exclude and now regards concrete [tangible] more as a means than as an end in itself.”²² Her statement points towards an early awareness that is present in “Atomic Disintegration,” where the letters and their arrangements on the page present themselves as a structural analogy to the nuclear decay process. Although words in the poem are reduced to the smallest dimensions of linguistic matter, which are broken fragments of the letter, and what Steve McCaffrey calls the “proto-semantic,” the poem still makes use of the forcible affect of the letters and their sonorous unification in column 2, which represents the disintegration of the atom at the vocal level. In column 3, Forrest-Thomson asks the readers to recite the word “atom” in a choral manner, such that the communicative function of language devolves into “unintelligible babble.”²³ Unlike Gelder, who argues that the resulting babble is the outcome of breaking down the “semantic content that supposedly holds the word together,” making it “unrecognizable,”²⁴ I argue that the mass performance of the word ‘atom’ actually provides the structural analogy of nuclear decay processes. Denise Riley in *Impersonal Passion* writes that language has a “tangible affect” that stands somewhat apart from an individual speaker’s expressive intentions, allowing it to work “outside of its official content.”²⁵ She further writes that language exerts a “torsion” on its users, meaning it shapes them rather than solely being an instrument they control. In Forrest-Thomson’s poem, the letters of the word “atom” in column 2 are placed in different combinatory relations such that the lines taken together evoke the scientific concept of atomic disintegration (Figure 1). Similarly, in column 3, directions for repeating the word “A-T-O-M” generate a fragmentary echo of the word, which goes against the intended outcome of an “unintelligible babble,” and presents a proto-song that hinges around the repetitive introduction of the duo-syllabic “atom” in this section. The shift toward a proto-semantic form in the poem underscores its departure from the conventional communicative functions of everyday language. This stylistic choice, appearing as an end in itself, provides a commentary on the incommensurability between the conceptual framework of scientific discourse and the linguistic structures of ordinary language.

Newton Garver posits a fundamental distinction between logical functions and the rules of grammar, emphasizing that logic operates by uncovering inherent incompatibilities in the world, which in turn underpin the core logical connectives of conjunction (“and”), disjunction (“or”), and negation (“not”).²⁶ Unlike grammatical rules, which govern the syntactic structure and descriptive capacities of language,

²¹ Christian R. Gelder, “Veronica Forrest-Thomson’s ABC of Atoms: Poetry, Knowledge, Technique,” *The Cambridge Quarterly* 51, no.1 (2022).

²² Gelder, 4.

²³ Forrest-Thomson, *CP*, 53.

²⁴ Gelder, 3.

²⁵ Denise Riley, *Impersonal Passion* (London: Duke UP, 2005), 5.

²⁶ Newton Garver, “Philosophy as Grammar,” *The Cambridge Companion to Wittgenstein* (Cambridge UP, 1996), 146.

logical functions delineate what is conceptually possible or impossible, independent of linguistic form. For example, Garver illustrates this through the incompatibilities in an object's properties: an apple's shape may be round, thereby excluding incompatible alternatives such as triangular or square (a case of logical negation and disjunction), whereas its color might encompass compatible attributes, such as being both green and red in different parts or under varying conditions (exemplifying conjunction). In applying this framework to the poem, the semantic conceptualization of the "atom" emerges not through grammatical description but via a logical relation between its dual properties: as a divisible entity (subject to disintegration) and as one that possesses the property to combine with other atoms to form molecules. Rather than relying on grammar's descriptive mode to delineate the atom's nature and associated processes, such as outlining what an atom is through sequential and syntactical exposition, the poem, through its three columns, constructs a logical representation of these properties' inherent incompatibilities and compatibilities.

In the next poem, "At Work / At Play,"²⁷ the chemical symbols are carefully integrated into the poem's visual and thematic framework, which occasions an aesthetic reinterpretation of scientific knowledge.

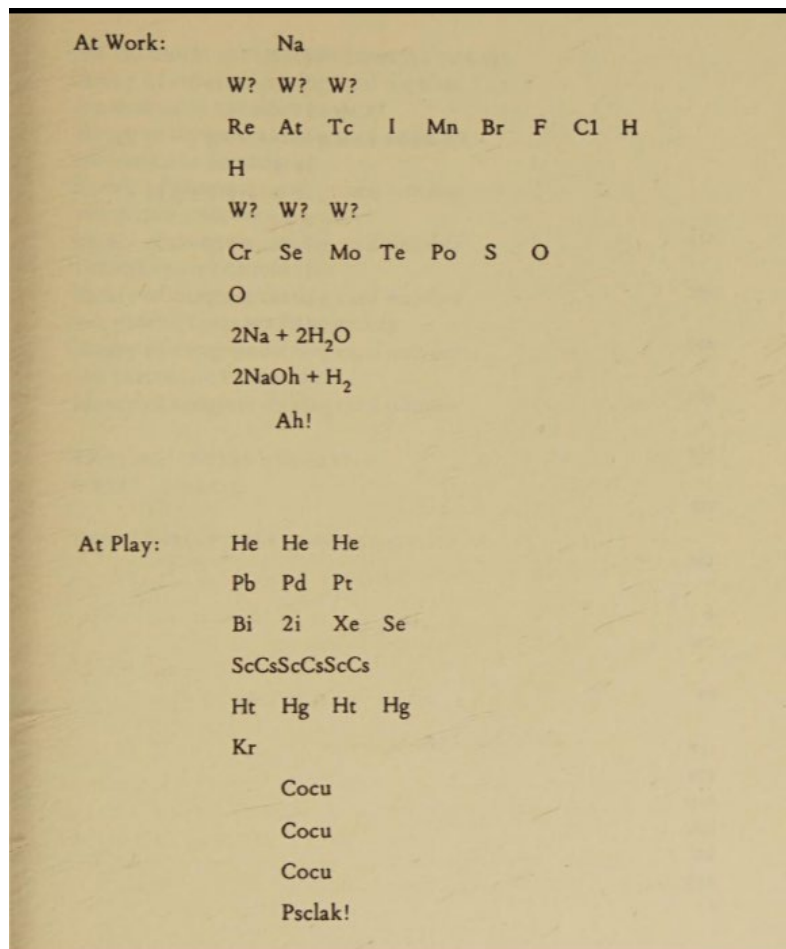


Figure 2. Veronica Forrest-Thomson, "At Work / At Play," in *CP* (Exeter: Shearsman Books, 2008), 54.

²⁷ Forrest-Thomson, *CP*, 54.

Forrest-Thomson uses these symbols to evoke the elemental building blocks of matter, paralleling the way words function as the building blocks of poetry. The arrangement of the symbols on the page, often staggered, spaced, or aligned in ways that disrupt conventional linear reading, creates a visual rhythm that stretches across the poem's thematic oscillation between labour ("At Work") and leisure ("At Play"). The presence of these symbols in the form of equations and in clusters reflects the tension between the structure of lines and the spontaneity of thought, which is a key concern in concrete poetry. The chemical symbols, with their precise scientific denotations, contrast with the fluidity of poetic language, creating a dialogue between the rigidity of scientific notation and the open-endedness of poetic interpretation. The placement of these symbols on the page recreates the interactions between different molecules and maps out chemical reactions, visually reinforcing spatial associations between the words, and the readers are invited to read the poem spatially rather than just semantically. The chemical equation which depicts the formation of sodium hydroxide serves to characterize change and instability, whether it is in matter or language.

In his seminal essay "On the Limits of Chemical Knowledge," Andrea Tontini delineates a fundamental distinction between ordinary language, characterized by its polysemic and context-dependent nature, and the specialized language of chemistry, which he defines as comprising "monosemic symbols organized in accordance with logical rules."²⁸ Tontini advocates for the adoption of these logical rules in chemical equations as a means to achieve precision and predictive power, arguing that such formalism enables the representation of molecular transformations not merely as static descriptions but as "a series of consequential events."²⁹ This emphasis on consequentiality underscores Tontini's case for logical structuring—by adhering to deductive principles similar to those in formal logic, chemical equations can model causal sequences in reactions, thereby facilitating a rigorous understanding of chemical processes and mitigating the ambiguities inherent in natural language.

It is this very element of consequentiality, rooted in the logical rules that Tontini champions, that the poem "At Work / At Play" subverts, thereby challenging the presumed linearity of chemical narratives. Although the poem incorporates the logical frameworks of chemical equations into its structure, the poem does not align itself with the architecture of chemical processes, making itself into a profound inquiry into the unforeseen contingencies that accompany substance transformations. Tontini further bolsters his argument for logical rules by acknowledging their limitations, noting that the synthetic method of formulaic inscription often fails to anticipate the emergent alterations in a reaction precipitated by "the substitution of a certain group for another."³⁰ This admission serves not to undermine the value of logical organization but to refine it, positing that such rules must be dynamically applied to account for empirical variability, thus enhancing the

²⁸ Andrea Tontini, "On the Limits of Chemical Knowledge," *Hyle* 10 (1), 2004: 23-46.

²⁹ Tontini, 26.

³⁰ Tontini, 29.

epistemological boundaries of chemical knowledge. Ultimately, the poem invokes this inherent unpredictability of chemical reactions, as articulated by Tontini, through its juxtaposition of concrete poetry's experimental forms with the ostensibly rigid language of chemistry. In doing so, it illustrates how the adoption of logical rules, while essential for systematic representation, must contend with the irreducible complexities of material change, thereby enriching the discourse on the interplay between scientific formalism and artistic expression.

CONCEPTUAL PARALLELS BETWEEN SHIFTS IN LOGICAL THOUGHT AND SCIENTIFIC PARADIGMS

This section explores the conceptual affinities between Wittgenstein's account of logical transitions in *Remarks on the Foundations of Mathematics* (hereafter, *RFM*), written between 1937-1944 and published in 1956, and *Philosophical Investigations* (hereafter, *PI*), published in 1953; and the linguistic mechanisms underlying paradigm shifts in scientific theories, as articulated by philosophers such as Hilary Putnam and Ernan McMullin. By examining these parallels, it becomes evident that both domains involve performative extensions of meaning, which make use of the semantic and structural components of language rather than rigid and non-negotiable empirical necessities. This framework is further illuminated through poetic engagements with scientific concepts in Veronica Forrest-Thomson's *CP*, and Rebecca Elson's *ARA*, where metaphors and propositions disrupt realist claims, mirroring the non-causal nature of logical and scientific progressions.

Wittgenstein's investigation in *RFM* interrogates the communicative basis of consequentiality in logic, emphasizing that deductive and inductive inferences are not inherently necessitated but performed through linguistic practices. He illustrates this in §12:

From 'all,' if it is meant like this, this must surely follow!—If it is meant like what? Consider how you mean it. Here perhaps a further picture comes to your mind—and that is all you have got.—No, it is not true that it must—but it does follow: we perform this transition. And we say: If this does not follow, then it simply wouldn't be all—and that only sh[o]ws how we react with words in such a situation.³¹

Here, Wittgenstein reveals the contingency of logical entailment: the transition from premise to conclusion in forms like “p entails q” relies on semantic interpretation and a “spatial performance” of meaning rather than through the compulsion of semantic meaning. The sense of “must” or necessity emerges from how language users enact meanings in context, not from an intrinsic logical structure. This performative aspect is echoed in *PI*, where Wittgenstein describes logic as a “spatial and temporal

³¹ Wittgenstein, *RFM* §12.

phenomenon of language,”³² requiring a mapping of interconnections among word meanings through their use rather than their fixed essences. These insights parallel shifts in scientific paradigms, where theoretical advancements involve linguistic stipulations that extend meanings without necessitating compatibility with prior frameworks. Hilary Putnam, in his analysis of scientific terms, distinguishes “observation terms” (e.g., “red”) from “theoretical terms” (e.g., “electron” or “gene”), arguing that conceptual shifts in observables are best understood as “linguistic stipulations” or “extensions of meaning.”³³

For instance, the transition from Werner Heisenberg’s uncertainty principle to Paul Dirac’s prediction of the electron’s magnetic moment leads to changes in the semantic connotations of the electron rather than resulting in a semantic overhaul that causes the term “electron” to lose its continuity. Heisenberg’s uncertainty principle introduced in 1927 as a foundational limit on simultaneously knowing an electron’s position and momentum with arbitrary precision gives way to Paul Dirac’s relativistic quantum equation, developed in 1928, which naturally predicts the electron’s magnetic moment as exactly twice the classical value, or $g=2$, while incorporating spin and antimatter. This results in a spatial extension of ideas rather than mere semantic developments, and one can map this onto a structured framework drawn from conceptual spaces theory. This approach, pioneered by cognitive scientist and philosopher Peter Gärdenfors and extended by collaborators like Frank Zenker, models scientific concepts and theories as geometrical structures in multi-dimensional spaces, where dimensions represent measurable properties or variables, and concepts occupy convex regions within those spaces. For instance, Zenker and Gärdenfors write that “focusing on the dimensions of a theory” results in “conceptual spaces represent[ing] the structure of a scientific conceptual framework as opposed to the structure of a particular theory.”³⁴ Taking the example of Newtonian geometry, they state that, “Newtonian mass can be modeled as a dimension isomorphic to the non-negative part of the real number line.”³⁵ Laws of a theory, however, act as constraints defining allowable regions or trajectories. Shifts between theories are analyzed as modifications to this spatial architecture, such as expanding dimensionality or altering geometrical relations, emphasizing continuity and structural evolution over abrupt redefinitions of terms. This spatial extension of meaning in scientific theories occurs in a similar manner to Wittgenstein’s performative transitions in logic. Subsequently, it appears that both logic and science refute claims to non-negotiable empirical foundations, highlighting structural congruities between them—meanings accrue around entities through linguistic performance, enabling paradigm shifts without absolute entailment.

³² Wittgenstein, *Philosophical Investigations*, 47e.

³³ Hilary Putnam, *Mathematics, Matter and Method: Philosophical Papers, Vol. I* (Cambridge UP, 1979), 224.

³⁴ Frank Zenker and Peter Gardenfors, “Continuity of Theory Structure: A Conceptual Spaces Approach,” *International Studies in the Philosophy of Science*, Vol. 30, No. 4 (2016), 347.

³⁵ *Ibid.*, 347.

Veronica Forrest-Thomson's commentary on Wittgenstein's *RFM* §14 extends this inferential progression of meaning to emotive meanings in poetry. Wittgenstein writes: "This shows you—it might be said—how closely certain gestures, pictures, reactions, are linked with a constantly practiced use. 'The picture forces itself on us....' It is very interesting that pictures do force themselves on us."³⁶ The "force" of pictures suggests an almost involuntary imposition of meaning, where a visual form compels a particular interpretation due to repeated exposure in a shared form of life. In mathematics, which is the context of *RFM*, one finds such a forceful imposition of meaning to persist in the study of diagrams given in proofs. For instance, a drawn triangle compels us to see certain properties, such as the angles summing up to 180 degrees, due to ingrained calculative practices. This reveals a key aspect of Wittgenstein's thought: the "force" with which pictures used in science and mathematics convey meaning is a product of enculturation. The intuitive way with which one arrives at the meaning of diagrams parallels the ways in which mathematical symbols accrue meanings. Wittgenstein suggests that conjuring a mathematical image signified by the word "all" will allude to its meaning of "consequentiality," that is, "*like this, this* must surely follow."³⁷ In Veronica Forrest-Thomson's poem "Subatomic Symphony," the ostensibly unifying concept of "all" subatomic particles, evident in the lines "Subatomic particles / revolve in supersonic whirls,"³⁸ is systematically undermined through subsequent imagery that emphasizes differentiation and specificity. Rather than deriving from an inherent semantic totality, the notion of "all" emerges negatively, defined primarily by its absence or negation: it is precluded by the poem's invocation of discrete, quantifiable entities, such as "showers of neutron" and "jets of electron,"³⁹ which foreground multiplicity and particularity over undifferentiated wholeness. This negative construction operates as a form of apophatic delineation, wherein "all" is not positively affirmed through comprehensive inclusion but is instead constituted through the semantic and spatial relations between the terms such as "showers" and "jets."

Thus, in science and poetry alike, language grapples with the challenge of describing entities that elude direct observation or fixed definition. McMullin highlights this issue in scientific discourse, noting that the term "electrons" no longer refers to "very small localized individualized entities with the standard mechanical properties of mass and momentum."⁴⁰ At the quantum level, the concept of a "particle" shifts dramatically, becoming less a tangible object and more "the expression of a force characteristic of a particular field" far removed from the concrete, massy points of classical mechanics.⁴¹ The word "particle," within scientific language, lacks a stable referent, requiring metaphors to bridge the gap between

³⁶ Wittgenstein, *RFM* §14.

³⁷ Wittgenstein, *RFM* 12e.

³⁸ Forrest-Thomson, *CP*, 30.

³⁹ Forrest-Thomson, *CP*, 31.

⁴⁰ Ernan McMullin, "A Case for Scientific Realism," *Scientific Realism*, ed. by J. Leplin (University of California, 1984), 14.

⁴¹ McMullin, 14.

theoretical constructs and human understanding. Similarly, poetry employs metaphors to evoke entities that are abstract, undefined, or intangible, using language to gesture towards what cannot be directly grasped.

McMullin argues that subatomic particles, as they exist, resist realistic comparison with their scientific descriptions. Instead of being “separate discriminable entities,” they are more akin to “a state of the system.”⁴² Science, therefore, relies on metaphors to articulate these elusive theoretical entities, crafting linguistic constructs that approximate their nature. Poetry mirrors this approach, using metaphors to explore abstract or undefined phenomena. In Veronica Forrest-Thomson’s poem, simile-like comparisons such as “protons throb heavy as a double bass,” “out of tune/ like touch on a drum,”⁴³ and “energy underneath/ spreading like ripples of breath” do not aim to depict subatomic particles with scientific precision.⁴⁴ Instead, these metaphors interrogate the realist claims of science by highlighting the dependence on figurative language to describe what cannot be directly observed. Just as science uses metaphors to make theoretical entities accessible, poetry, too, uses them to evoke sensory or emotional experiences of the abstract, creating a parallel mode of inquiry.

This shared reliance on metaphor aligns with Ludwig Wittgenstein’s observation in *Culture and Value*: “I don’t believe I have ever invented a line of thinking. I have always taken one over from someone else [...] What I invent are new similes.”⁴⁵ For Wittgenstein, similes are not mere embellishments but a method of performing logic, a way to structure thought about the undefined. In Forrest-Thomson’s poem, simile-like constructions bypass realistic analogies to the properties of theoretical atoms, instead functioning as logical propositions. Along with seeking a direct correlation between the poem’s “tonal relations” and the “atomic music” it aims to represent,⁴⁶ as Crangle suggests, or attempting to capture the atom that is “inaudible to the eye” and “invisible to the ear,”⁴⁷ the poem constructs a series of imaginative propositions. These propositions transform electrons into a “planetary suite,” render subatomic sound with a frequency that is “too high” into a “high-speed scream,” and depict an undertone that spreads “like ripples of breath.”⁴⁸ Through these metaphors, the poem offers a range of possibilities for perceiving the world, shifting scales and sensory modes to evoke that which is linguistically undefined.

Rebecca Elson’s poems in *ARA* revisit the notion of poetic propositions as mechanisms for remodeling perceptions of reality, particularly through their engagement with scientific concepts. In “Explaining Relativity,” Elson constructs a new kind of imagery to articulate the theoretical curvature of space, tracing the historical progression of spatial theories from those delineated by “sharp vectors” to

⁴² McMullin, 14.

⁴³ Forrest-Thomson, *CP*, 30.

⁴⁴ Forrest-Thomson, 31.

⁴⁵ Ludwig Wittgenstein, *Culture and Value* (London: Blackwell Publishers, 1980), 19e.

⁴⁶ Gelder, 5.

⁴⁷ Forrest-Thomson, *CP*, 30.

⁴⁸ Forrest-Thomson, 30-31.

those imposed upon “stiff numbered grids.”⁴⁹ She writes:

Forget the clatter of ballistics,
The monologue of falling stones,
The sharp vectors
And the stiff numbered grids.

It’s so much more a thing of pliancy, persuasion,
Where space might cup itself around a planet
Like your palm around a stone.⁵⁰

The poem’s imagistic sequence delineates evolving conceptions of spatial geometry—from the flat, zero-curvature plane of Euclidean geometry to a dynamic, curved manifold influenced by mass and energy—without positing causal linkages between these paradigms. In the third stanza, the corporeal metaphor initially invoked to illustrate curved space, “Where space might cup itself [...] / Like your palm around a stone,” transmutes into the planetary body itself: “Where you, yourself the planet, / Caught up in some geodesic dream, / Might wake to feel it enfold your weight.”⁵¹ This inversion, wherein the explanatory image for planetary positioning in curved space reorients toward the observer’s own embodiment, exemplifies Black’s interaction theory of metaphor, whereby the metaphorical relation “creates the similarity” rather than merely “formulat[ing] some similarity antecedently existing.”⁵² By eschewing direct analogies between poetic imagery and empirical observation, the poem abdicates any didactic function as a mere explication of scientific phenomena.

McMullin, in his advocacy for scientific realism, contends that metaphors in theoretical explanations transcend analogical utility, serving instead as open-ended linguistic constructs with inherent suggestive power:

The language of theoretical explanation is of a quite special sort. It is open-ended and ever capable of further development. It is metaphoric in the sense in which the poetry of the symbolists is metaphoric, not because it uses explicit analogy or because it is imprecise, but because it has resources of suggestion that are the most immediate testimony of its ontological worth.⁵³

Salmon complements this by positing that scientific explanations fundamentally disclose “causal relations,” asserting that “[t]o give scientific explanations is to show how events and statistical regularities fit into the causal structure of the world.”⁵⁴

⁴⁹ Rebecca Elson, *A Responsibility to Awe* (Manchester: Carcanet, 2001), 13.

⁵⁰ Elson, 13.

⁵¹ Elson, 13.

⁵² Max Black, “Metaphor,” *Models and Metaphors: Studies in Language and Philosophy* (Ithaca, N. Y.: Cornell UP, 1962), 285.

⁵³ McMullin, 36.

⁵⁴ Wesley Salmon, “A Third Dogma of Empiricism,” *Basic Problems in Methodology and Linguistics*, ed. by Robert Butts and Jaakko Hintikka (Dordrecht: Reidel, 1977), 162.

Elson's poem, however, reconfigures this causal architecture not through empirical mapping but via adjectival attributions that characterize spatial theories, "sharp vectors" and "stiff numbered grids,"⁵⁵ culminating in a metaphorical leap to Einsteinian curvature, likened to a palm enveloping a stone.

This poetic reconfiguration resonates profoundly with Wilfrid Sellars's epistemological framework in *Empiricism and the Philosophy of Mind*, where he elucidates the inter-subjective status of scientific theories as normative placements within the "logical space of reasons."⁵⁶ Sellars argues: "The essential point is that in characterizing an episode or a state as that of *knowing*, we are not giving an empirical description of that episode or state; we are placing it in the logical space of reasons, of justifying and being able to justify what one says."⁵⁷ For Sellars, scientific knowledge emerges not from brute empirical reportage but from inter-subjective justificatory practices—linguistic and conceptual commitments that confer normative authority upon theoretical claims. Scientific theories, in this view, achieve their inter-subjective validity through communal endorsement within this rational space, where propositions are evaluated not merely for descriptive fidelity but for their coherence and justificatory power.

Elson's poetry parallels this inter-subjectivity by deploying metaphorical propositions that construct a shared perceptual framework for relativity, independent of direct empirical anchorage. Rather than empirically describing spatial curvature as a factual datum, the poem catalogs imagistic statements, "pliancy, persuasion," and the cupping palm, that operate within their own logical economy, inviting readers into a justificatory dialogue about reality's structure. Just as Sellars posits that knowing involves normative positioning in the space of reasons, Elson's metaphors justify a reimagined ontology of space, fostering an inter-subjective apprehension where the reader, "yourself the planet," participates in the geodesic enfolding.⁵⁸ This alignment underscores how both scientific theories and poetic discourse derive their authority from inter-subjective linguistic practices, transforming abstract entities into communal horizons of understanding. In this way, Elson's work not only demurs from explanatory subservience to science but also enacts a Sellarsian critique, where she questions the merely descriptive foundations of knowledge production.

Rebecca Elson's poetry highlights the mediated nature of scientific inquiry, where linguistic and logical constructs bridge perceptual immediacy and theoretical abstraction. Central to this process is the concept of ontological relativity, as articulated by philosophers like Willard Van Orman Quine, wherein the existence and properties of objects are not absolute but relative to the conceptual schemes or

⁵⁵ Elson, *ARA*, 13.

⁵⁶ Wilfrid Sellars, "Empiricism and the Philosophy of Mind," *Knowledge, Mind, and the Given*, ed. by Willem A. de Vries and Timm Triplett (Cambridge: Hackett Publishing Company, 2000), 210.

⁵⁷ *Ibid.*, 248.

⁵⁸ Elson, *ARA*, 13.

languages employed to describe them.⁵⁹ In Elson's work, this relativity underscores how scientific objects, ranging from subatomic particles to cosmic phenomena, are constituted through discursive practices, rendering their ontologies contingent upon human cognition and nomenclature. In her poem "How Science Works," Forrest-Thomson articulates:

Everything collapsing into words, like wave functions, an object
chooses its value when it is named. This is an effect of the mind.
Logic is to language as geometry is to the universe [...]
There is a great rift between the self and the external world. The
self is not part of the universe to be explained.⁶⁰

Here, Elson invokes the quantum mechanical analogy of wave function collapse to illustrate how naming or linguistic designation precipitates the "choice" of an object's value, transforming it from a probabilistic or indeterminate state into a determinate one. This process exemplifies ontological relativity: the object's being is not inherent but emerges as an "effect of the mind," dependent on the observer's interpretive framework. Scientific statements, therefore, are not unmediated reflections of an objective reality but products of cognitive and linguistic intervention, relativizing the ontology of the observed entity to the theoretical apparatus that frames it. Logic, in turn, serves as the enabling mechanism for this ontological reconfiguration. As Elson posits, "Logic is to language as geometry is to the universe," suggesting that logic provides the structural rigor analogous to geometric axioms in spacetime, governing how linguistic propositions construct and validate theoretical entities.

CONCLUSION

The poetry of Veronica Forrest-Thomson and Rebecca Elson illuminates the productive intersections between scientific and poetic discourses, demonstrating how both realms employ linguistic constructs to interrogate and represent reality. Rather than pursuing a straightforward referential mapping between poetic artifice and external phenomena, their works reveal that the articulation of subjective experience depends on logical structures just as scientific phenomena rely on the interpretive "language-games" of theoretical frameworks, as conceptualized by Ludwig Wittgenstein. This convergence underscores a shared reliance on propositional logic, where poetry and science alike construct meaning through self-reflexive systems of signification. In Forrest-Thomson's poetry, which often engages

⁵⁹ Quine, in his essay, "On What There Is" (1948), writes that "To be [assumed as an entity] is, purely and simply, to be the value of a variable." Such a claim states that it is language/theory that commits us to perceive certain objects as values of their variables and that these objects exist relative to the language or theory in which they occur. Willard V. Quine, "On What There Is," *The Review of Metaphysics*, Vol. 2, No. 5 (1948): 21-38.

⁶⁰ Elson, *ARA*, 86.

with scientific experiments such as atomic disintegration, the referential function of language is deliberately relinquished. Instead, her work establishes a parallel between the spatio-temporal dimensions of logical inquiry and the poem's visual and structural embodiment of scientific processes. For instance, a poem like "Subatomic Symphony" appropriates logical similes to interrogate the linguistic framing of empirical facts, transforming the poetic form into a meta-commentary on the perpetual evolution and paradigm shifts in scientific theories. Through such mechanisms, Forrest-Thomson's metaphors legitimize subjectively perceived objects and abstract theoretical entities as valid placeholders within the poetic domain, thereby blurring the boundaries between empirical observation and imaginative reconstruction.

Rebecca Elson's poetry further exemplifies this inter-communicability between scientific and poetic discourses, mediated through logical propositions that treat scientific claims not as immutable empirical truths but as outcomes of deductive and inductive reasoning. In her oeuvre, poems function neither as mere descriptions of scientific entities or phenomena nor as didactic expositions of methodological approaches; rather, they probe how poetic language can reframe and experientialize the scientific worldview. A salient example is her poem "Explaining Relativity," which deploys poetic propositions to dismantle classical Newtonian paradigms and remodel our understanding of reality through a more intuitive, relational lens. By analogizing space-time's curvature to "space might cup itself around a planet / Like your palm around a stone," Elson transforms an abstract relativistic principle into a tactile, embodied metaphor. This poetic remodeling not only humanizes the geodesic paths of general relativity but also propositions the "existence of limits" as a fundamental boundary condition, echoing the logical constraints inherent in both scientific theories and poetic forms. Ultimately, Elson's use of such propositions reconfigures reality as a dynamic interplay of persuasion and constraint, fostering a deeper intersubjective comprehension that bridges the empirical and the aesthetic. ◻

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