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"A Transfinite Syntax": Modernism and Mathematics

> "Surely infiniteness is the most evident thing in the world"[1]
> – George Oppen

In modernist studies, we are familiar with accounts of the impact of turn-of-the-century physics on literature. A list would include the influence of relativity and space-time distortion on representation in the arts and literary culture; the impact of X-rays and nuclear fission on ideas of the material and immaterial; and the influence of electromagnetism on notions of field theory.[2] In similar ways, the impact of post-Darwinian biology on literature has often been traced.[3] In contrast, it has always intrigued me that the turn of the century also saw a revolution in mathematical thinking, less-noticed in terms of its cultural correlatives and less directly related to the physical world.[4] The work of David Hilbert, Richard Dedekind, Georg Cantor, and others in number theory seemed to offer solutions to some of the major problems inherited from the Greeks—the problem of infinitesimals and infinity generally, which calculus had largely suppressed; and the problem of the continuity of the number line (that is, of reconciling continuity with the discrete nature of any point on the line, a problem

[1] George Oppen, *New Collected Poems*, ed. Michael Davidson, intro. Eliot Weinberger (New York: New Directions, 2002), 184. Subsequently referred to in text as *NCP*.

[2] The literature here is too extensive to readily survey: for a useful recent overview see the introduction of Rachel Crossland, *Modernist Physics: Waves, Particles and Relativities in the Writings of Virginia Woolf and D. H. Lawrence* (Oxford: Oxford University Press, 2018).

[3] See for example Margot Norris, *Beasts of the Modern Imagination: Darwin, Nietzsche, Kafka, Ernst, & Lawrence* (Baltimore: Johns Hopkins University Press, 1985); Donald J. Childs, *Modernism and Eugenics: Woolf, Eliot, Yeats, and the Culture of Degeneration* (Cambridge: Cambridge University Press, 2001); Daniel Aureliano Newman, *Modernist Life Histories: Biological Theory and the Experimental Bildungsroman* (Edinburgh: Edinburgh University Press, 2019).

[4] On the (contested) notion of "mathematical modernism," see Jeremy Gray, *Plato's Ghost: The Modernist Transformation of Mathematics* (Princeton: Princeton University Press, 2008).

as old as the refutation of movement in Zeno's paradox but refreshed by Henri Bergson's analysis of motion).

These scientific and mathematical revolutions were in fact closely related. Riemann's non-Euclidian geometry, first elaborated in the 1850s, contributed to a sense of crisis as to the application of mathematics to the real, prompting attempts by Hilbert, Gottlob Frege, Bertrand Russell, and others to provide formal foundations for mathematical truth, rooted in logic and detached from the physical world—as well as eventually stimulating Einstein's rethinking of the nature of physical reality. Through to the 1930s, intensely-debated questions of epistemology and mathematical truth continued to preoccupy both scientists—Ernst Mach, Henri Poincaré, Einstein himself—and philosophers like Ludwig Wittgenstein and Gaston Bachelard, stimulated by complexities such as the existence of two apparently separate mathematical formalizations, involving waves and particles, needed to explain electromagnetic radiation.[5]

Cantor's ideas were founded on controversial premises. One was the mathematization of infinity, a problematic category which (like zero) had often caused controversy. Many mathematicians, including Cantor's own teacher Leopold Kronecker, refused to accept infinity as a proper object for analysis, seeing it as a fiction. Another controversy related to the manipulation of sets themselves, theoretical entities which did not necessarily have defined categories for membership.[6] Moreover, aspects of Cantor's thinking were, like Einstein's theories, seemingly counter-intuitive: for example, his proposal that infinities could be defined by their "mappability" meant that there were as many rational numbers (i.e. all numbers expressible as integers and fractions) between 1 and 2 as on the rational number line in its totality. Cantor's key insight was that the

[5] See for example Albert Einstein, "Geometry and Experience," *Sidelights on Relativity* (New York: E. P. Dutton, 1922). For reflections on Wittgenstein's position, see Ian Hacking's *Why Is There Philosophy of Mathematics At All?* (Cambridge: Cambridge University Press, 2014). An additional complexity is that the empiricist and realist camps in science may have different ontologies informing their epistemology: Ernst Mach, for example, is empiricist in both ontology and epistemology (there are only sense-data and discoverable mathematical relations between them).

[6] For a general account see Ivor Grattan-Guinness, *The Search for Mathematical Roots, 1870-1940: Logics, Set Theories and the Foundations of Mathematics from Cantor through Russell to Gödel* (Princeton: Princeton University Press, 2000).

real numbers (which include the irrational and transcendental numbers, like √2 and *pi*) are non-denumerable, that is, they cannot be put in a one-to-one relation with the natural numbers. Real numbers have a different "cardinality," a measure of the size of finite or infinite sets. This means that some infinities are larger than others. The rational numbers familiar to schoolchildren—infinite integers and fractions carved ever smaller—were shown to be an infinitely tiny subset of the real numbers, including an infinitude of transcendental numbers like *pi* and *e* which go on forever (it is the transcendentals rather than the irrationals which make the reals uncountable). Indeed, the notion of the power set (the set of all subsets of a set) meant that there are an infinite number of exfoliating infinities of different cardinality. Such ideas led some to accuse Cantor (a pious Lutheran) of attempting to supplant God with mathematics.

As I noted, we seem to see few traces of the Cantorian revolution in the general culture. But there were in fact vectors for such a reception: Russell and A. N. Whitehead, A. S. Eddington, and others engaged with Cantor's work, sometimes at a popular level. This, for example, is Whitehead explaining Cantor in his short *Introduction to Mathematics* (1911):

> We can rearrange the fractions in a series like that of the integers, that is, with a first term, and such that each term has an immediate successor and (except the first term) an immediate predecessor. We can show how this can be done.

Now this ordering is mathematically true, though it seems counter-intuitive, given that we can place, between any two fractions, an infinity of smaller fractions. On the other hand, Whitehead adds,

> It can be proved that it is *not* possible to arrange the whole series of real numbers in this way. This curious fact was discovered by Georg Cantor, a German mathematician still living; it is of the utmost importance in the philosophy of mathematical ideas. We are here in fact touching on the fringe of the great problems of the meaning of continuity and of infinity.[7]

[7] A. N. Whitehead, *Introduction to Mathematics* (London: Williams & Norgate, 1911), 59, 60-61.

Russell announced that "Cantor's continuum is free from contradiction," and—at least for a period before some doubts crept in—he celebrated the triumph of Cantor's mathematical foundationalism.[8] Russell was even willing to apply that thinking to narratology, pointing out the Cantorian "paradox of Tristram Shandy," which meant that even though it takes Laurence Sterne's character two years to chronicle the first two days of his life, a seemingly hopeless rate of progress, Tristram will always—given infinite time—catch up with any given day of his life: "This paradoxical but perfectly true proposition depends upon the fact that the number of days in all time is no greater than the number of years."[9] This is part joke, but it might be related allegorically to a "slow" novel like *Ulysses*, in which reading takes longer than the events described and in which some elements of the narrative took decades to be understood.

The question of the cultural influence of mathematics is made more interesting by the fact that in some respects it was moving in a contrasting direction to physics, at least in terms of the gross metaphors that might be extracted from it. While thermodynamics and quantum mechanics were positing a counter-intuitive, discontinuous, and gappy universe, in which basic units could not be subdivided and space was largely a matter of absence, set theory was in contrast demonstrating an unprecedented depth to the number line, using ideas of density, countability, and uncountability to demonstrate that the real number line is formally "complete." Indeed, since Cantor showed that three- or indeed n-dimensional space could be encompassed in the same methodology, space itself became mathematically denser.

Until relatively recently, mathematics and literature has not been a topic on which a great deal has been written, outside of specialities like numerology and a few movements like the Olipo. However, there has been a recent surge in interest in the topic, with accomplished books by Baylee Brits and Nina Engelhardt, and in the writing of a few recent mathematician-novelists, like J. M. Coetzee and David Foster Wallace, around whom work has begun to gather.[10] (Wallace wrote

[8] Bertrand Russell, *The Principles of Mathematics* (1903; London: Allen & Unwin, 1964), 347.

[9] Bertrand Russell, *Mysticism and Logic* (London: Allen & Unwin, 1917), 90-91.

[10] Baylee Brits, *Literary Infinities: Number and Narrative in Modern Fiction* (London: Bloomsbury, 2018); Nina Engelhardt, *Modernism and Mathematics: Modernist*

an accomplished popular-science book on the idea of infinity, *Everything and More*.) As Brits comments, Cantor's mathematics "held signal attraction for twentieth-century writers who were grappling with the limits of expression."[11] This revolution is what W. B. Yeats seems to allude to in *A Vision* (1925), when he writes: "I think of recent mathematical research, and even my ignorance can compare it with that of Newton—so plainly of the 19th Phase—with its objective world intelligible to intellect; and I recognise that the limit itself has become a new dimension."[12] Yeats's annotators link this declaration to his understanding of relativity, but the term "limit" alerts us to an awareness of Cantorian mathematics, of infinities of different cardinality.

In this essay, I will consider the use of mathematics by two modernist American poets. The relations involved are, as with the reception of physics, often philosophical as much as mathematical: numbers can signal a discursive and ideal realm rather than anything more concretely related to poetics; but, as I will also suggest, the connections can also be more direct. I want to engage with two ideas in particular, both alluded to by Whitehead in the passage cited above. Firstly, Cantor's proof that some infinite sets are strictly larger than others, giving rise to the notion of "transfinite numbers." Secondly, the notion of the formal closure of the number line—that is, the formulation of a theory which could deal with continuity—which is related to the uncountability and density of the real numbers, another of Cantor's discoveries (countability in this contexts means the ability to theoretically establish an ordered set of sequential numbers, as can be done for fractions). To put it very crudely, the gappy atomization of the real that was the subject of Bergson's complaint—the "cinematographic" slicing

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Interrelations in Fiction (Edinburgh: Edinburgh University Press, 2018). For other representative work, see Peter Johnson, "'Presences of the Infinite': J. M. Coetzee and Mathematics", PhD dissertation, Royal Holloway, University of London, 2013; Roberto Natalini, "David Foster Wallace and the Mathematics of Infinity," in Marshall Boswell and Stephen J. Burn, eds, *A Companion to David Foster Wallace Studies* (New York: Palgrave, 2013), 43-58; and Matthew Taunton, "2+2=5: The Politics of Number in Writing about the Soviet Union," *Textual Practice* 29 (2015): 1-24. There is also significant recent work on Victorian literature: see for example Andrea K. Henderson, *Algebraic Art: Mathematical Formalism and Victorian Culture* (Oxford: Oxford University Press, 2018).

[11] Brits, *Literary Infinities*, 3.

[12] W. B. Yeats, *A Vision* (London: Macmillan, 1925), 210.

of space and time—was replaced by a filling-in without theoretical limit.[13] What follows is a necessarily tentative exploration of the topic, intended more to open questions than provide definitive answers.

Laura Riding, Infinitude and "Finality"

The two poets whom I will discuss, Laura Riding and George Oppen, shared a concern for poetic truth which led them, in the late 1930s, to cease to write poetry, at least in part because of doubts as to its truth-telling powers—though in Oppen's case the political urgencies of the period also militated against poetry.[14] Oppen returned to it; Riding did not, though she had a late critical engagement with her own past as a poet and with the literary history of the period. The two differ in general orientation: Oppen was associated with the Objectivists early in his career and remained committed to notions of empirical reality, although he was often suspicious of language's ability to formulate the real. Riding's work was more attentive to the possibility of language (and indeed other media, including the novel, letters, and cinema), even as she became increasingly suspicious of poetry's sensuous qualities and formal framework.

Riding's partner from 1926 to 1939 was Robert Graves. Their circle sustained an evolving project which moves from a notion of a specifically poetic truth-telling to a more public but still collective attempt to clarify in prose what is at stake in human relations and the political sphere. In her works before 1930, and some completed much later, Riding often invokes a scientific or mathematical language as a model—positive or negative—for that quest. This is a habit she shares with Graves, who had distinguished Dublin mathematicians in his ancestry and who applies some mathematical terms to poetic form in his *Poetic Unreason* (1925).[15] (The work of both was to be taken up soon after by a young

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[13] On Bergson and the slicing of time, see Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, the Archive* (Cambridge, MA: Harvard University Press, 2002), chapter 6. See also Gregory Dale Adamson, "Science and Philosophy: Two Sides of the Absolute," *Pli* 9 (2000): 53-85.

[14] For a comparison, see Jerome J. McGann, "Laura (Riding) Jackson and the Literal Truth," *Critical Inquiry* 18.3 (1992): 454-73, esp. 456.

[15] Robert's grandfather Charles Graves, Bishop of Limerick, was a professor of mathematics; his great-uncle John Graves is said to have inspired William Hamilton's discovery of quaternions.

mathematics student named William Empson, but that is another story.)[16] Riding's philosophical mathematics, apparent even in an early poem which evokes Euclid, is of a different order to Graves's: more developed and exact; less metaphorical and casual.[17] I will mainly consider two books, *Anarchism is Not Enough* (1928) and the very hard-to-find but distinctively experimental *Though Gently* (1930), as well as a poem from her volume *Poet, A Lying Word* (1933).

Riding's most general tendency is to equate mathematics either with a naïve realism or with a formalism detached from the real, both of which offer simplifications of experience and a spurious mastery. In *Anarchism is Not Enough* "prose is the mathematics of expression," and by this she means that prose brings things into crude relation to each other, whereas poetry is an attempt to "redistribute intelligence by means of the word," to stimulate the mind directly.[18] Virginia Woolf is "mathematical" in her realism, that is to say, she simply maps an equivalence between world and text (*ANE* 46). The "great mathematician and lexicographer" she mocks as "Mr. Doodle-Doodle-Doo" tries to reduce words to number (*ANE* 22). In the commentaries she added in 1974, Riding glosses this as "a standardizing of the sayable in formulas of utterance comparable to the convenience notations of mathematics—the words being as inexpressive […] as numbers" (*ANE* 258). Similarly, Riding's later "Mathematics as an Intellectual Master-Method," published as one of the supplementary essays in her and Schuyler Jackson's quixotic, posthumous *Rational Meaning*, mocks the will-to-power implicit in mathematics, and those whom she sees as in the tradition of Russell and Richards. She cites Nathan A. Court's *Mathematics in Fun and Earnest* (1935), which notes that "The

[16] For a recuperative account, see Marc Jacobs, "Contemporary Misogyny: Laura Riding, William Empson and the Critics—A Survey of Mishistory," *English* 64 (2015): 222-40. Riding's and Graves's dealings with Empson's fellow maths student Jacob Bronowski post-date the mathematical interests here, so cannot be considered an influence. Harry Kemp, who worked as a teacher of mathematics, was another member of the Riding/Graves circle in this period.

[17] "Dimensions," *The Laura (Riding) Jackson Reader*, ed. Elizabeth Friedmann (New York: Persea Books, 2005), 9. Accounts of the Cornell entrance exam suggest that Riding would have had to prepare basic mathematics.

[18] Laura Riding, *Anarchism is Not Enough*, ed. Lisa Samuels (1928; Berkeley: University of California Press, 2001), 13-14. Subsequently referred to in text as *ANE*.

mathematician went so far as to do away with words altogether […] and to replace them by special notations and symbols."[19]

Yet for all that she was suspicious of the mathematical—and to some extent this seems to reflect American educational theory in this period, which stressed its over-specialization and inappropriateness as general mind-training—Riding also uses mathematical discourse to pursue her own aims.[20] *Though Gently* (1930) is a companion-piece to *Anarchism is Not Enough* in its experiment with genre, freely mixing aphoristic philosophy, aesthetics, poetry, and narrative.[21] In terms of its general strategy, it seeks to counter a certain negativity in the earlier book, which had insisted that the poem is nothing, "unreal," because of its refusal of representation or use-value. In the later book, Riding makes larger claims for the poet, and she does so by using number theory.

Though Gently constructs a system based on the inverted T or ⊥ (sometimes called the "up tack" or "eet" character, though in formal logic it is *falsum*, representing a contradiction). For Riding *eet* expresses the ideas of "totality" and "finality"—the latter often applied to Riding herself within the Riding-Graves circle in this period, and an idea which is I think linked to their joint interest in J. W. Dunne's cult quasi-mathematical book *An Experiment with Time* (1927), which is preoccupied with summative points of view offered at the end of a life.[22] Riding commented later that she wrote *Though Gently* with "the matter of

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[19] Laura Riding, "Mathematics as an Intellectual Master-Method," in Laura (Riding) Jackson and Schuyler B. Jackson, *Rational Meaning: A New Foundation for the Definition of Words and Supplementary Essays*, intro. Charles Bernstein (Charlottesville: University Press of Virginia, 1997), 496-503.

[20] The influential American pragmatist and educationist William Heard Kilpatrick (supported by the psychologist Edward L. Thorndike and others) argued that higher mathematics was not readily transferred to other activities; it should be left to educational elites, with the remainder limited to applied arithmetic.

[21] Laura Riding, *Though Gently* (Deja: Seizin, 1930), subsequently referred to in the text as *TG*. This is one of Riding's least available works: it was published in an edition of 300; a few pages appear in Elizabeth Friedman's *The Laura (Riding) Jackson Reader*; the whole text was reprinted in 2001 by Jeffrey Hamilton in an issue of his hard-to-find small magazine *Delmar 8.*

[22] Graves refers to Dunne's *An Experiment with Time*—which went through many editions from 1927—in *The White Goddess*, linking it to his account of "the Muse" (i.e. the position occupied by Riding in this period) in his poem *"*On Portents." Robert Graves,

finality in the total question of human self-determination being greatly with me at that time."[23] Finality is a complicated concept which spills over into later works like *The Telling* (published 1967 but part-written in the 1930s). In *Anarchism is Not Enough*, it involves the idea that history has been "completed," that, as she later put it, Riding's era "was a time in which historical time was at exhaustion-point." [24] In *The Telling*, finality means, more positively, a completion of human self-understanding, founded on the perception that "we have reached the end of the possibility of self-ignorance […] We have come into full possession of the human inheritance." [25] "Telling" here has a double meaning, of course: expressing and accounting. The moment of finality is particularly linked to the emergence of women into self-knowledge.

So, to return to the mathematics in this scheme, where T equals received dogma, approximation, irresponsibility, interpretation, ⊥ is associated with "responsibility," "exactness," and "authentication"—with truth:

> Let the sign ⊥ stand for that which all understand and express differently. ⊥ is the unmistakeable. ⊥ is the exact fulcrum. Let the sign T stand for the interpretive world of leverage. ⊥ is that which is. T is that which is going on. Therefore T is in immediate opposition to ⊥ but in ultimate reference to ⊥. (*TG* 2)

This is the opposition of the absolute, on the one hand, and the worldliness of what can be expressed in ordinary language, on the other, as axiom, as proposition. As Riding moves towards notions of "totality" and evokes mathematics, the formulae take on a Cantorian tone, even as mathematics is initially presented as limited. What I think is referenced here is the mathematics of the real numbers, including discrete intervals:

The White Goddess, ed. Grevel Lindop (London: Faber & Faber, 2010), 570; see also his later essay "Genius," in *Difficult Questions, Easy Answers* (1973). As with all texts important to the couple, they will have read and discussed Dunne's book together. The Graves library at Canellun has the second edition (1929).

[23] Laura (Riding) Jackson, The Word-Play of Gertrude Stein," *Under the Mind's Watch*, ed. John Nolan and Alan J Clark (Bern: Peter Lang, 2004), 205.

[24] Laura Riding, "Appendix I, Three Commentaries," *Anarchism is Not Enough*, 254.

[25] Laura (Riding) Jackson, *The Telling* (1967; London: Athlone, 1972), 15.

> Numbers attempt to arrive at finity through infinity.
>
> According to numbers ⊥ is T+.
>
> Numbers cannot describe totality but only the composition of totality.
>
> The enumeration of four essences does not lead to the discovery of an essential but of a fifth essence.
>
> Numbers are life, imitation, or analogy and they lead only to further numbers.
>
> Numbers are detail. (*TG* 3)

If "[a] detail suspends meaning [and] an essential sustains it against suspension" (*TG* 3), then you have the suggestion that meaning is "suspended" between the realms of number (that is "detail" or mere facticity) and essence. But that is not quite right, since number, or rather sequences of numbers, can move, at the limit, beyond denumeration and towards finality. Riding writes:

> Detail is expressed in number, the essential in degree.
>
> But such degree is expressed numerically, to allow compatibility between detail and the essential. (*TG* 3)

A poetic fragment called "The Sphinx?" follows and continues this line of thought:

> An image of meaning as eternally suspended?
> Devilishly contrived to stand eternally between
> detail and the essential?
> But fancy breaks the Sphinx's false spell:
> For fancy is a vanity of ripeness in detail
> When numbers themselves incline capriciously
> Towards finality rather than suspension. (*TG* 4)

In "finality" (or elsewhere "culmination"), is the suggestion that numbers might produce, as Cantor's real numbers do, the continuum rather than its elements. "Fancy" is the title of the fragment which follows:

> 10 is the finite of 5.
> 5 is the infinite of 1.
> 1 is the repose of 2.
> 2 is the will of 9.

And so on to "6 is the foolishness of numbers" (*TG* 4). The suggestion seems to be that the cupola is a kind of free (capricious) creativity in which all relations might be available because general rather than "detail." There is a gendered element to this claim, as *No Trouble* makes clear in implying that in respect of "conclusiveness" women are ⊥ to man's T:

> A woman's method with a material is to state only as much as may be stated conclusively, a man's to state as much of it as possible without regard to conclusiveness. At any rate this is a just comparison to make whenever comparison exists between a woman's little and a man's much. (*TG* 13)

In the rest of *Though Gently* Riding elaborates, in prose and verse, the notion of finality as it relates to her own poetic stance. Finality is the province of "the person of idea" rather than "the person of ideas" (*TG* 6). Finality is produced by no longer being governed by one's contemporaneity. Thus in a later prose section called "You and I" she writes:

> A poet is one who represents the ultimate idea of ⊥ in the always changing always present interpretive apparatus of T. A poet is the underlying speaking through the overlying. A poet plays finality in the costume of aspect. […] I as poet began as everyone, I plied variously until the world of T in seeming what it was not grew grotesque and shuddered back into itself, and it was ⊥ then where I plied, and I was no longer anyone, but I was I. (*TG* 14)

Dunne's work stresses the difference between an "underlying" reality and our human measuring of it, especially in our seeing time as having "lengths."[26] Riding, as the self-declared poet of finality, moves beyond detail or equivalence;

[26] J. W. Dunne, *An Experiment with Time*, 2nd edn (London: A & C Black, 1929), 116.

she is the set of all sub-sets which gestures towards being. As her character Mrs Hepakitos puts it in a later text, *Description of Life*, "This is how it was possible to speak of 'world': one added up all the somewhat different things together."[27]

We can turn, finally, to Riding's "Scornful or Fond Infinity," a poem which addresses concepts of infinity more fully than any other she wrote—but which (typically) has to be interpreted in the face of considerable syntactic uncertainty. The position described in the poem is close to that of Dunne's "observer at infinity." Dunne writes of a final perspective where all time is detached from perspectivism and indeed embodiment:

> At infinity, again, we shall have a Time which serves to time all movements of or in the various fields of presentation. This time will be "*Absolute Time*," with an absolute past, present, and future. The present moment of this absolute Time must contain all the moments, "past," "present," and "future," of all the subordinate dimensions of Time.[28]

This infinity is not the last moment of time (an expanded time infinitely long) but rather a nested infinity, a point where the infinite regress of observers-observing-observers-observing-observers comes to an end at understanding (and implicitly for Dunne, at death and the soul's liberation). Riding's novel *A Trojan Ending* (1937), adopts the related viewpoint of a "final" time: "[t]he Trojan War is the early end of history as we are the later end."[29] The seriousness of her project is produced by the sense of finality, which is a sense of a completed understanding of the human predicament which must take in even the stories which have been overlooked or unfinished—in the case of the Trojan War, the woman's history associated with Cressida. The statement in her introduction that "I take this age—the people who are alive now—so seriously that I regard it as a final age of time" thus takes on a dimension also present in Riding's letters: a

[27] Laura Riding, *Description of Life* (New York: Targ Editions, 1980), 41.

[28] Dunne, *An Experiment with Time*, 151.

[29] Laura Riding, *A Trojan Ending* (London: Constable, 1937), xvi.

desire for contact; a desire for clarity; a desire for an adequate language: "Did they not walk the same earth, speak languages which are continued in ours?"[30]

"Scornful or Fond Infinity" was originally published as "Unless Infinity is Only Time" in her 1933 volume *Poet, A Lying Word*. It needs to be quoted in full:

> Greater is to lesser
> As many is to one—
> Breaths of breath.
> An infinity of lack describes
> The indescribable moment of enough.
> And this is not comparison,
> Only a proved equality
> Of much and little.
> Nor even singleness
> Impossible to sum,
> Unless infinity but scorn is
> Rather than to add up slowly
> The one and one and one
> That singleness of one makes millionish—
> Unless infinity is only time
> And thinks the moment to outnumber
> Which weightless keeps the scales
> In such eternal balance of
> Unnumbered one against
> The moment upon moment that bears down,
> In mathematical spite
> Or fond amazement, the other way.[31]

The "proved equality / Of much and little" is akin to—in fact my suspicion is that it could even be derived from—Cantor's famous set of "middle thirds" (fig. 1), which is produced by successively removing the middle third of a line. The

[30] Riding, *A Trojan Ending*, xiv-xvii.

[31] Laura (Riding) Jackson, *The Poems of Laura Riding* (1938; Manchester: Carcanet, 1986), 164. Permission to cite "Scornful or Fond Infinity" courtesy of the Division of Rare and Manuscript Collections, Cornell University Library.

result is a set which becomes infinitely small in visual terms (it has "zero measure") yet has the same cardinality as the real numbers, demonstrating (in

Fig. 1. Representation of Cantor's "Middle Third" set.[32]

layman's terms) the equivalence of infinitesimals and expanding number sets, "much and little."

Riding's poem negotiates between the single moment and plenitude. The original title-line, "Unless infinity is only time," suggests Dunne's scorn of the illusory sequence of moments, the one and one and one. In a much later essay Riding wrote critically that "Human beings have turned their humanity into a protection against possibilities of its meaning anything more than I, I, I, on and on in a circular, self-swallowing infinity."[33] Mathematic "spite" or "scorn" seems to be involved in the way mathematics reaches towards impossible-to-comprehend infinitudes; the "fond amazement" (which may gesture towards an older meaning of "fond," foolish) is infinity as "only time" which, to the extent that it is "unnumbered" or "outnumbered," may make the moment "final." The "outnumbered" moment suggests again the reals or trans-finite numbers; the "unnumbered one" is the moment as totality rather than the series of "moment upon moment," and so it is Absolute in Dunn's sense. This is an extremely tentative reading of a typically exacting poem, but what is clear is that the mathematics of infinity is central to its understanding of totality and individuality, breath and breaths, and the possibility of speaking truth—and thus to the positioning of Riding herself as a unique poet at the end of time.

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[32] https://en.wikipedia.org/wiki/Cantor_set#/media/File:Cantor_set_in_seven_iterations.svg.

[33] Laura (Riding) Jackson, "Freedom of Tongue," in *Under the Mind's Watch: Concerning Issues of Language, Literature, Life of Contemporary Bearing*, ed. John Nolan and Alan J. Clark (Oxford: Peter Lang, 2005). 84. The essay is unfinished.

Riding ceased to write poetry—with a few exceptions—in the years after she left Graves, abrogating poetry as too linked to the pleasures of the body, too likely to avoid the responsibility of truth-telling. As Laura (Riding) Jackson she embarked on the various projects with her husband Schuyler Jackson which were to culminate in *Rational Meaning: A New Foundation for the Definition of Words*. In that text, as we have seen, mathematics is mocked as "Intellectual Master-Method," even as the Jacksons attempt to stabilize meaning in a way that recalls the foundation efforts of Hilbert and other turn-of-the-century mathematicians. Her engagement with mathematical symbols was specific to a particular moment, which I have suggested was informed by Dunne's pseudo-mathematical work, and by the idea of "finality" with its relation to limits. While "the sign of the completed creation" is still present in *The Telling*, it is rendered more Platonic, a "memory-form" we all carry as a "common potentiality of imagining back" rather than an intellectual project of completion centred on the poet; a potential for self-accounting rather than a poetic vision.[34]

In her late autobiography *The Person I Am*, (Riding) Jackson wrote with regret of the course of literature after the war, converted into a "mentality of numbers—knowledge. Its people know each other by a one-by-one count more modern in its great petty thoroughness of differentiation than the business absolute of scientific competition."[35] By a "one-by-one count" she seems to have meant that literary production was commoditized and historical, rendered a matter of branding and established points of differentiation rather than of truth, which she defined as the "unity of personal and universal meaning"—again a totality which can only be reached by overcoming all that is momentary and singular in the sequence of existence. In this at least, her views remained consistent.

George Oppen and the Incalculable

I will move on to George Oppen, initially writing at the same time as Riding, then abandoning poetry in the mid-1930s as he became involved in labour organization, only continuing his career in the 1960s when he and Mary Oppen

[34] Laura (Riding) Jackson, *The Telling*, 25, 32-3.

[35] Laura (Riding) Jackson, *The Person I Am* (Nottingham: Trent Editions, 2011), 67, cf. also 33.

returned to New York from Cold War exile in Mexico. If Oppen's fundamental topics include the political and ontological relation between the individual and the mass, the collective and the singular, and at times historical continuity and discontinuity, then even his titles suggest that mathematics provided one point of entry.[36] He begins his career with *Discrete Series* (1934), the title of which he described in mathematical terms as a series ungoverned by a rule or function; his best-known poem is "Of Being Numerous" (1968). Oppen's *Daybooks* show that he was acquainted with some recent mathematical thought, including Gödel's theorem. He also debates mathematics with the poet William Bronk, whose poems are full of technical learning and whose collected essays are entitled *Vectors and Smoothable Curves* (1986). I will attempt to suggest that mathematics as a topic provides us with a way to move beyond an understanding of Oppen as a thoroughgoing empiricist, or at least to align the "concreteness" he insists on with the notion of human thought constructing a world it cannot fully know.

Oppen's reading in Simone Weil—whose rather idiosyncratic response to Cantor's trans-finite mathematics is a related story—is also of interest, and it is perhaps significant that beside a reference to Weil in his *Daybooks* is what seems to be an illustration of Cantor's finding that the set of natural numbers is of the same cardinality as the even numbers:

1 2 3 4 5 6 7 8 - - - - - - -
2 4 6 8 10 12 14 16[37]

[36] Peter Nicholls describes "Of Being Numerous" as "a work informed by a very real sense of crisis, as Oppen tries to understand a generational conflict which threatens to destroy historical continuity." Nicholls, *George Oppen and the Fate of Modernism* (Oxford: Oxford University Press, 2007), 85. On the individual and the masses in Oppen, see also Rachel Blau DuPlessis, "Objectivist Poetics and Political Vision: A Study of Oppen and Pound," in Burton Hatlen, ed., *George Oppen: Man and Poet* (Orono: National Poetry Foundation, 1981), 123-48.

[37] George Oppen, *Selected Prose, Daybooks, and Papers*, ed. Stephen Cope (Berkeley: University of California Press, 2007), 56, and 250, n.11, where Cope refers to this as a "curious inclusion." Subsequently referred to in text as *SPDP*. On Weil and Cantor, see Henry Leroy Finch, *Simone Weil and the Intellect of Grace: An Introduction* (New York: Continuum, 2001), chapter 4. Weil's brother was a mathematician.

This seems to relate to adjoining comments about the "bric-a-brac" of the world and the naturalist Balzac, and a reference to Oppen's poem "Leviathan," with its "preponderance of objects" (*NCP* 89). Objects might be enumerated as either whole or odd numbers; the cardinality is the same. Weil writes in her *Notebooks* (1956) of "[t]he discovery, delimitation and contemplation of the *mysteries* of ordinary, everyday life, in perception, society, the sciences, etc.; and then their enumeration. This would be very useful."[38] But as we know, the real numbers offer a different possibility, beyond enumeration, "out-numbered" as Riding had put it. Or as Oppen wrote in his daybooks, nicely building infinity upon infinity, "I write of things / Endless, endless, / Innumerable" (*SPDP* 186).

In the short meditations and fragments which comprise his *Daybooks*, Oppen's thinking on mathematics takes two general and opposed directions, somewhat akin to Riding's. Firstly (let us call this Position A), there is an anti-formalist insistence that logic, separate from the world, is a delusion or at least simply a relating of semantic elements, and that in contrast the particularity of existence is primary:

> *It is impossible to assume that the world of things could be proved if one had not experienced it—we would not possess the word "is"* ^which means logic & thought, including mathematical logic^ *if ~~we did not exist.~~ we had not experienced existing.* (SPDP 200)

In a note in a typescript entitled "The Romantic Virtue," Oppen writes and then scores out: "Do not talk of the intelligible The mathematicians can take care of that / Talk of what one cannot NOT see."[39] On the other hand (let us call this Position B), in the meditations of Daybook II he repeatedly invokes mathematics as a model for the kind of poetic thinking in which knowledge is constantly extended, as in "<u>the lines being an instrument of thought</u>, one cannot ~~always~~ foresee conclusions, as the mathematician cannot / foresee the result of his work" (*SPDP* 118); or "*the kind of thought which is literary thought, or the kind*

[38] Simone Weil, *The Notebooks of Simone Weil*, trans. Arthur Wills (1956; London: Routledge, 2004), 362.

[39] Nicholls, *George Oppen and the Fate of Modernism*, Appendix B, transcript of "The Romantic Virtue," 202. Cf. *NCP* 185.

of thought which is more than precious literature, as in mathematical thought …" (*SPDP* 131). Or this:

> an explorer or a mathematician also knows what he thinks—but doesn't know what he will find a man applying a method of thought as which is powerful in itself, which is more powerful than the ordinary forms of discourse, doesn't know what he will find, or what he will think[.] (*SPDP* 121)

For Oppen, then, mathematics engenders an ambivalent response, at once sceptical and longing: the scepticism because of an allegiance to existence and matter; the longing because of a commitment to the power of thought to open possibilities beyond the inertness of matter. The notion of the "unforeseen" attached to mathematics is a powerful element of this latter line of thought.

An ambivalence about mathematics can be seen in an uncollected poem from 1963, "Wheelers and Dealers: The Theory of Games." Here Oppen explores the relationship between statistical existence and individuality in a poem which is a comment at once on Quantum Physics, Cold War game theory, and the market economy. "Game" for Oppen is almost always a negative term, indicating a closed system and the operations of power (this was the era of the Rand Corporation's war-games). But as he wrote to his half-sister, "The poem means to acknowledge this abstract way of thought as perfectly contemporary" (*NCP* 418). Here is the poem:

> We might have forseen it,
> The triumph of calculation
> The atom calculated
> By its chances.
> What can I know? What must I do?
> What may I hope?
> And what are my chances?
>
> We ought to be able to survive it.
> *Out of the unknown activities*
> *Of unknown agents*

Mathematical numbers emerge. The last
Invisible world
Of the buyers, the sellers, the planners—

We ought to be able to survive it. (NCP 327-8)[40]

The citation italicized by Oppen within the poem is from Arthur Eddington's "The Theory of Groups" (an early word for sets), part of his *New Pathways in Science* (1935), which Oppen probably read in James R. Newman's four-volume *The World of Mathematics* (1956). Eddington's starting point was Lewis Carroll's "Jabberwocky"; his idea is that from apparent nonsense, even literary nonsense, structure emerges, just as the "basal entities" of physics are unknowable but nevertheless express themselves in mathematical relations. Eddington adds that "[i]n mathematics we describe such knowledge as knowledge of group structure."[41] For Oppen, this is still a point where the individual is challenged by the hiddenness of political and economic actors, as that repeated flat declaration about survival suggests. Nevertheless, in his poem the movement from "unknown" to knowledge is associated with the mathematics of sets.

To some extent, Oppen's ambivalence parallels that of philosophical tradition from Hegel to Heidegger. Its lack of worldliness, its tendency to create axiomatic systems divorced from "existence," made mathematics unpalatable as a model for an expanding knowledge. For Hegel, as Charles Taylor explains, mathematics is "the most dead and external of all domains of thought": "For the mathematical is the domain of understanding, of fixed distinctions and deductions which merely develop their implicit consequences. It lacks the distinctions of qualitative thought, the power to express a qualitative opposition, and hence the speculative."[42] For Heidegger (whom Oppen engaged with seriously), the mathematical, when he does not simply link it to scientific

[40] "Wheelers and Dealers: The Theory of Games" by George Oppen, from *New Collected Poems*, copyright ©2008 by Linda Oppen. Reprinted by permission of New Directions Publishing Corp.

[41] James R. Newman, *The World of Mathematics*, 4 vols (New York: Simon & Schuster, 1956), 1559.

[42] Charles Taylor, *Hegel* (Cambridge: Cambridge University Press, 1975), 513.

rationality, is a similarly constrained form of knowledge, the knowledge of "what we really already know" or the presuppositions of knowledge rather than an unfolding of being.[43] What underlies this debate is, in part, the gap between the older "realist" view of mathematics as a language adequate to and in some senses inherent in the world, on the one hand, and emerging "modernist" understandings of mathematics as a human construction—whether formalist or intuitional—on the other.[44]

Alain Badiou's explicitly post-Cantorian attempts to move beyond this argument are useful here, because his work combines an understanding of mathematics as a system and an insistence on its foundational status. For Badiou, number in its finite sense represents the realm of nineteenth-century reason and the logistics that Oppen's poem considers: the realm of normalized politics and "the simple law of the situation, which is the law of Capital."[45] In contrast, Number (as opposed to uncapitalized "number') "is the place of being qua being," of being in itself; it is not an account of or derived from the real.[46] "Mathematics is ontology" is Badiou's contentious slogan. By that, as A. J. Bartlett and Alex Ling comment, he does not suggest that "being is itself mathematical," since this

> would be to illegitimately conflate ontology, which is simply the *discourse* of being, with the object of this discourse, namely, being itself. Rather mathematics […] is ontology inasmuch as it provides the *minimal and sufficient* structure necessary to articulate multiple multiplicity.[47]

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[43] Martin Heidegger, "Modern Science, Metaphysics and Mathematics," in *Basic Writings from "Being and Time" (1927) to "The Task of Thinking" (1964)*, ed. David Farrell Krell (London: Routledge & Kegan Paul, 1978), 251, 254.

[44] See Grey, *Plato's Ghost*; Englehardt, *Modernism. Fiction and Mathematics*, 4-18.

[45] Alain Badiou, *Number and Numbers*, trans. Robin Mackay (Cambridge: Polity, 2008), 213.

[46] Badiou, *Number and Numbers*, 211.

[47] Translator's introduction, Alain Badiou, *Mathematics of the Transcendental*, ed. and trans. A. J. Bartlett and Alex Ling (London: Bloomsbury, 2014), 4. Cf. Burhanuddin Baki, *Badiou's Being and Event and the Mathematics of Set Theory* (London: Bloomsbury, 2015), 24-5.

The qualification about the "discourse of being" is important; being itself remains fundamentally ungraspable as a totality, even if being qua being can be accounted for by mathematical formulae. The "intellectual revolution" of Cantor's theorem on cardinality as "the law of the quantitative excess of the state of the situation over the situation" motivates Badiou's use of post-Cantorian set theory as a mode of thought adequate to the otherness of being.[48] (In contrast, for Badiou Hegel's thought in its drive towards unity and its refusal of a "bad infinity" refuses to deal with the Other.) This position has some parallels with Oppen's Position B: foundational mathematics constantly opens up new perspectives and knowledge. For the later Badiou this also includes the mathematics of "category theory," which complements set theory's ontology in allowing an account of the logic of the world, of its specific presentation.

This is helpful in relation to Oppen, I think, as we see him thinking about empiricism and ontology in his daybooks in the late 1960s, increasingly invoking mathematics as a model. Oppen came to believe that language itself all too easily participates in that externality which Hegel attributed to mathematics: "Without the word, we can feel as if from the inside. The taste of an apple, the sensation of sunlight—With the word we see, *we see from outside*" (*SPDP* 149). Even the linguistic atomism of "the little words I like so much, like 'tree,' 'hill' and so on," the particulate existence which Oppen often evokes, might be compromised by such doubt.[49] And somewhat paradoxically, it is mathematics that seemed to offer the possibility of the predication which he so desired, that is, of a discourse expressing the ontology of an existence which continues beyond the limits of individual apprehension.[50]

Two issue that preoccupy Oppen in the 1960s can be related to mathematics. Firstly, middleness. A series of notebook entries (from which some of the "Position B" statements above are cited) meditate on order, on being in the "interminable middle" of the sequence of things with "no beginning and no end"

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[48] Alain Badiou, *Being and Event*, trans. Oliver Feltham (London: Continuum, 2005), 502.

[49] Richard Swigg, ed., *Speaking with George Oppen: Interviews with the Poet and Mary Oppen, 1968-1987* (Jefferson, N.C.: McFarland, 2012), 10.

[50] On predication, see Nicholls, *George Oppen and the Fate of Modernism*, 122ff.

(*SPDP* 122), and implicitly on mathematics as a discourse which might master the serial. Notions of the infinite enter Oppen's comments and poems about what he calls "the thought of unendingness" (*SPDP* 123), spurred by Plotinus's statement that "all things must exist for ever in ordered dependence on each other" (*SPDP* 124). Thus we have "Occurrence, a part / Of an infinite series" at the start of "Of Being Numerous" (*NCP* 163). If "Intelligence consists / In permitting / Disorder to enter / Your world / From the world" (*SPDP* 152), then mathematics might represent knowledge of the open series of things. Remember that entry cited earlier: "I write of things / Endless, endless, / Innumerable" (*SPDP* 186). Oppen's reflections on the fact that children cannot accept death and his own sense of mortality are also related to this issue.[51] The "discrete series" of his first volume—which Oppen defined as an "empirically derived" or "empirically true" series, rather than one defined by a mathematical function or "rule"—is displaced by the longing response to the world's (dis)order evident in his daybooks:[52]

> *The failure to believe*
> *In science or mathematics*
> *And failure of emotion—*
> *One is forced to assume that the universe is absolutely self-sufficient.*
> *and cannot be eternally meaningless. Are one's own purposes an ethic?*
> (*SPDP* 122)

The second topic which might be related to the mathematics of the "endless" is less clearly evidenced in Oppen's corpus, at least in terms of his commentary on mathematics: the challenge posed by the "impenetrable" nature of reality. This too is posited as a problem at the beginning of "Of Being Numerous": "the existence of things / An unimaginable pantheon" (*NCP* 163); "the world, if it is matter, / Is impenetrable" (*NCP* 164). If "the mind creates the finite" (*NCP* 199), the infinite density created by the non-denumerability of the real-number line might, beyond the limits of mind, model "substance itself" (a phrase we will return to). "Of Being Numerous" moves, in section 34, towards the unification of these two issues, temporal and spatial infinitude: the evocation of the voices of

[51] See Nicholls, *George Oppen and the Fate of Modernism*, 140-41.

[52] Swigg, ed., *Speaking with George Oppen*, 10; also *SL* 327.

men and women "carried about the sun forever" and the "beautiful particulars" of the world leads directly to the declaration that "Surely infiniteness is the most evident thing in the world" (*NCP* 184).

The issue of mathematical truth came into sharp focus in spring 1967, when the mathematician Sherman Stein sent Oppen his book *The Man-Made Universe*, initiating an exchange which incorporates a crucial passage in his poetry, as well as prompting a number of comments in the daybooks about the impossibility of "autonomous logic." Stein had written that "your question-answer is being answered-questioned in the most avant-garde mathematical circles."[53] Oppen picked up on Stein's paradoxically formalist insistence that mathematics is "concrete" when compared to the "kitchen sink": "We all find ourselves in a world we never made," writes Stein, but "Mathematics, on the other hand, is completely the work of man. Each theorem, each proof, is the product of the human mind. In mathematics all the cards can be put on the table. In this sense, mathematics is concrete, whereas the world is abstract."[54] Oppen replied that he liked this paradoxical sense of concreteness. But he adds that Stein's formulae make mathematics a kind of formal madness which he has always resisted, "mathematics creating itself, alright. The strange, unbounded voice of a Wittgenstein" (*SL* 158).[55] Oppen also commented to Stein, in an exchange a few years later, that "[i]t is as method that math has its importance" (*SL* 183)—again, doubt and admiration co-existing.

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[53] George Oppen, *The Selected Letters of George Oppen*, ed. Rachel Blau DuPlessis (Durham: Duke University Press, 1995), 395, n. 10. Subsequently cited in text as *SL*. As *Of Being Numerous* (both the volume and the main sequence) only received its title in 1968, near its publication date (Nicholls, *George Oppen and the Fate of Modernism*, 84), it is quite possible that Oppen's title was prompted by Stein's book, with its discussion of the "more numerous" status of the real and transfinite numbers.

[54] Sherman K. Stein, *Mathematics: The Man-Made Universe* (San Francisco; W. H. Freeman, 1963), vii.

[55] The comment on Wittgenstein is unglossed, though Oppen's other references to him suggest he has the *Tractatus* in mind, and in particular perhaps—if anything beyond Wittgenstein's often gnomic discourse—his formalist argument against Frege's treatment of numbers as objects. Wittgenstein's later constructivism and hostility to the infinite does not seem to relate to Oppen's comment.

Oppen's trajectory in response to Stein's dizzying suggestion is, I would suggest, towards a position closer to Badiou's ontology, a position which acknowledges a mathematical mastery of infinitudes beyond human counting. In his daybook, he alludes to Stein: "As against the notion of an autonomous logic, of math, as 'the man-made universe.'" Oppen then adds that "[f]undamental ideas cannot be derived from each other," before citing Whitehead's *Process and Reality* on the need for entities (whether philosophical or mathematical) to be related to "the system of the universe" (*SPDP* 181). This is ostensibly to counter Wittgenstein's formalism, but the word "system" is interesting. On the next page of the published version of the daybooks, Oppen writes the cryptic note "*Ontology: a theory of Being*," before alluding to Job ("*Like Job we are answered out of the whirl-wind*"), and in the next entry he stresses that young poets will need "*to learn from the poem: to learn from the language*" (*SPDP* 182). The direction of meditation here is towards the idea that the universe speaks to us. But what, given a distrust of words, is that language that might answer for the "system of the universe"?

One answer is supplied if we return to Stein's letter. Oppen quotes in reply two lines (slightly adjusted) from section 13 of "The Route," the second-longest sequence after the title-sequence in *Of Being Numerous*, then in press (*SL* 159):

> "Substance itself which is the subject of all our planning"
>
> And by this we are carried into the incalculable. (*NCP* 201)

He adds, tellingly, that "[i]t isn't that I mind the incalculable. Maybe there is (and surely there should be) a lift in that last line." These are two lines on which, as Peter Nicholls has shown, he places huge emphasis. In an earlier letter they are "the conditions of my thinking, from that point in time" (*SL* 135). The first line, in quotation marks in the published version, is from Heidegger; the second takes us towards both mathematics and, more politically (in the next section), the nuclear catastrophe only hinted at in "Wheelers and Dealers." Oppen continues, in Section 14:

> These things at the limits of reason, nothing at the limits
> of dream, the dream merely ends, by this we know it is the real
>
> That we confront (*NCP* 202)

There is a backstory here: the line from Heidegger was itself the subject of an important dream, an account of which is included in Oppen's letters under the title "Note to Himself." In the dream, the phrase is dictated to him over the telephone, but Oppen insists he cannot find it in Heidegger. He also writes that "[i]n the note I had written myself I had consciously changed the world 'incalculable' to 'infinite' and in the letter [to Fred Siegle] I changed it back"; and then he adds that in the poem he was writing—that is "The Route"—he changed the phrase again to "unthinkable", though the final draft (that is the version above) restores "incalculable." Finally, in his source translation of Heidegger the word is in fact "immeasurable." Oppen adds, simply, "The poem, with these lines, seemed to me the most important I had written, at least the most important to me" (*SL* 135-6).

As Nicholls comments, given that the text from Heidegger is in fact easily located, this represents a complex set of over-writings. Heidegger writes of "Man" safeguarding "the very substance of his planning," that is stabilizing his world via a narrow, calculating intelligence which even attempts to encompass the "immeasurable." Oppen misremembers for his own purposes, which Nicholls takes to be the placing of "substance" itself, the real, at the centre of the picture.[56] But what seems equally important is that collocation of terms: "incalculable," "infinite," "unthinkable," "immeasurable," as well as that earlier "unbounded." The limit of reason which Oppen imagines in this phrase—the end of "planning" in the infinite—seems to gesture towards a kind of transfinite syntax, in which the mathematical signals a point where human thought is forced towards an ontology which is not simply founded on the things of the world—tree, hill and so on—and in the experience of one life, but on what lies beyond that "limit."

[56] Nicholls, *George Oppen and the Fate of Modernism*, 79-82.

And while that term "transfinite syntax" which I just used may seem like a mystification, it is Oppen's own. In a series of passages from the mid-sixties which he worked over three times in his daybooks, Oppen meditates on how we first learn language impurely (as a babble which he attaches, not without timeworn gendered implications, to the nurse or mother-tongue) and then we are pushed or forced towards something more adequate to the world: "logic—the 'logical' must—Why does it force one's hand?" (*SPDP* 172). The direction of his remarks here is towards an openness to the unknown, beyond the limits of experience. On the one hand there is ontology: "what art means to do is not to communicate experiences, but to communicate the 'realness' of experience" (*SPDP* 173); and on the other hand the extension of knowledge, as the poem, as we read ourselves and experience what is right and wrong in it, forces us "toward a concept which you hold, and have never experienced" (*SPDP* 174). Mathematics is one name for that truth which is outside ourselves, infinite in scope, but which forces itself upon us. Oppen invokes Isaac Newton as expressing truths which the earth-bound scientist could never experience ("OUT THERE"), and then continues:

> The words must be true, the syntax must work! And words—something one has learned as an infant, something the nurse used—! They can be constructed like number into *necessary truth*?
>
> Of the transcendental truth some things come—well, floating down in fragments like leaves of a tree—. As, numbers, which seem to act on necessary truth. *Do words? Do we lack a transfinite syntax*? (*SPDP* 174)

A "transfinite syntax" is a poetic openness to truth, negotiating in the "incalculable," which I have suggested includes both the endlessness of existence and the "impenetrable" physicality of the world (*NCP* 164).

The fact that Oppen repeatedly uses the word "forced" to describe the operations of poetic logic is perhaps adventitious, as Badiou also uses the term "forcing" (derived from Paul J. Cohen's set theory) to describe the way that the unforeseen or "unrecognizable" must be made to belong to a situation. As Jonathan Barker comments, "force is the historical power of *producing* something new, or of forcing truth to *be* true (truthful), in a new situation." Forcing also works at the

level of the subject: as Badiou puts it, the subject "forces veracity at the point of the indiscernable." [57] Badiou's examples of forcing tend to be poetic, derived from Mallarmé and other poets: it is writing which, in loose parallel with the transfinite, creates a knowledge which is only retrospectively validated. [58] In Cohen's account of the "extension" of a set, "The crucial idea will be the preferential treatment of the universal quantifier [∀: 'for all …'] over the existential quantifier [∃: 'there exists …']." [59] Oppen's transfinite syntax similarly imagines the final triumph of expansion and inclusivity over particularity, while the symbology of ∃ and ∀ might also return us to Riding's more arcane T and ⊥.

To be sure, "transfinite syntax" is working here as an ideal, at best a possible model for the construction of truth. Oppen asks whether in language we *lack* a transfinite syntax. It is not easy to see what in practice the phrase could mean in his poetry of the late 1960s and early 1970s. But we might consider a number of poems in *Seascape: Needle's Eye* (1972) in which those twin issues of open series and the density of the real are often present. Infinitude binds and gives a logic to the "fragments" which float down in his late poems, indicated for example in "West":

> The rare poetic
> Of veracity that huge art whose geometric
> Light seems not its own in that most dense world West
> and East
> Have denied have hated have wandered in *precariousness* (*NCP* 215)

Or we could consider the open logic of "Song: The Winds of Downhill" in the same volume, which opens "'out of poverty / to begin // again'" and moves out beyond the "residential / lots," imagining a speaker whose language is a series of

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[57] Jason Barker, *Alain Badiou: A Critical Introduction* (London: Pluto, 2002), 107; Badiou, *Being and Event*, 411.

[58] See Andrew Gibson, *Beckett and Badiou: The Pathos of Intermittency* (Oxford: Oxford University Press, 2007), 66-7.

[59] Paul Cohen, *Set Theory and the Continuum Hypothesis*, cited in Peter Hallward's useful summary of "Forcing" in Alain Badiou, *Ethics: An Essay on the Understanding of Evil*, trans. and ed. Peter Hallward (London: Verso, 2001), 87-8.

basic operators: "Who / So poor the words / *would with and* take on substantial / meaning" (*NCP* 220). Or again, "Anniversary Poem" with its fear of passing time but assertion of the depth of the world:

> Scope. Mere size, a kind of redemption
>
> Exposed still and jagged on the San Francisco hills
> Time and depth before us, paradise of the real, we
> know what it is
>
> To find new depth, not time, since we cannot, but depth (*NCP* 226-7)

Many of these poems refer to the world-view of children. In the daybooks, Oppen writes of childrens' imagination of "*the necessary things of eternity, permanence*," leading immediately to this reflection: "a constant depth, or forget about it. That is to say, if one does not need poetry, forget about it" (*SPDP* 170). That poetic "depth" is modelled in the power of the transfinite: endless, unbounded, uncountable, incalculable, immeasurable.

Few poets in the twentieth century have achieved the intensity of mathematical engagement of the two paired here, though we can look to writers like Beckett and Coetzee for comparable responses. One cannot say that Riding and Oppen unequivocally saw mathematics as the answer to their intense desire for an adequate language—in fact they often rejected just that claim, which had been crudely made by the Italian Futurists and implicitly by Pound in the first excitements of modernism. But they did recognise in the recent revolutionary activity of mathematics a story of intellectual ambition, and a possibility of reaching beyond that which is singular and limited towards larger assemblages of knowledge which ultimately model the uncountable density and open temporality of the real: Riding's "ripeness" and "enough"; Oppen's "depth." In both cases this is more a direction of movement, even a kind of longing, than an achieved poetic aim. For Riding, to think infinity is to return knowledge to the "unnumbered one" who is the poet of "finality." For Oppen a "transfinite syntax" means that rather than surviving numerousness we might, in a philosophical poetry reflecting on the density of the real, hope to account for being itself. Oppen's final fate was Alzheimer's disease and a late syntax of gaps

and silences; Riding's was a baroque, prolix, argumentative idiolect which to many readers and recipients of her letters seemed at odds with her desire for transparency—as if finality could only be imposed by a perverse kind of "forcing" in which all objections were already answered. In that respect the promise of mathematics remained mostly intensely located in the period of modernist excitement in which Cantor, Russell, Gödel, and others were intensely debating foundations, with the more specialized mathematics of the post-war world requiring a different stance, and perhaps a more expert engagement.