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Raining & Midnight: The Limits of Representation

Samuel Beckett participates in a cultural anxiety about the limits of representation, an anxiety manifested not only in literature, but also in mathematics, neurology, physics, psychology, and elsewhere. This anxiety became acute during the first half of the twentieth century as various discourses deployed strategies that exploited this heightened awareness of the intrinsic incompleteness and inconsistency of systematic knowledge. Whatever their disciplinary differences, they nonetheless shared the sense that recognising these limits was an opportunity to understand discourse both from within narrow disciplinary practices and from without in a larger logical and philosophical framework that made the aspiration toward completeness quaint and naïve. They situated the mind as a sort of boundary phenomenon between the deployment of discourses and an extra-linguistic reality. This potentially infinite deployment, like the index of indexes in Borges's 'Library of Babel', points to the dynamic interplay that paradoxically relates language and its objects while itself becoming a subject of analysis. At the core of this sensibility was a recognition that language might always fail to re-present its objects, but that those objects were nonetheless real and expressible as a function of the naming process. An important corollary was that these gaps were not only a token for the interplay of word and world, but were also an opportunity to illuminate the gap itself. In short,

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symbol systems seemed to stand as a different order of phenomena than whatever they proposed to represent, and the result was a burst of innovative work across a variety of disciplines.

In Samuel Beckett's work, this widespread cultural anxiety about the limits of representation appears through a notion of language as a progressively approximate measurement of an unnamable reality. His version of the problematic manifests itself through a variety of disciplinary languages: philosophy and psychology; phrenology and neurology; astrology and astronomy; and mathematics. If his strategy is to express the unnamable, his tactics are to illustrate it by deploying sequences of failed representational systems. Among these, mathematics provides succinct iconic structures that embody the problematic of connecting words to things. Such structures are reminiscent of what W. J. T. Mitchell termed hypericons, that is, visual paradigms that, 'In their strongest forms . . . don't merely serve as illustrations to theory; they picture theory' (Mitchell, 49). Mitchell's interplay of 'picture' as verb and as noun reveals the dynamism of representational acts and representational processes. In Beckett's work, a hypericon emerges from his deployment of disciplinary languages that bespeak a broad cultural anxiety about the relation between phenomena and the linguistic systems that represent them. It is a structural figure of the cultural context that gave standing to these issues, but in Beckett's case, it is also a structural figure that represents the transformation of idiosyncratic, private materials into sharable, public languages accessible by readers. This doubled direction of the hypericon thus comes from two directions: the cultural context and the idiosyncratic psychological processes of creativity; it is their intersection that manifests his texts. To shift critical metaphors for a moment, we can say that his texts are the hologram emergent in their intersection.

First among the features of this hypericon is the image of an asymptote, that is, a straight line that another, curved line approaches as we move along the curve. For example, in the graph of $1/x$, the X and Y axes are the asymptotes, and the two curved lines approach them. The approach of the curved lines can be as close as desired, but the two remain separate. In a literal sense, the asymptote is a-symptomatic of the curve. Just as the curve infinitely approaches its 'limit', so also was language understood to progressively approximate its objects. In one sense,

this gap suggests the inherent expressive failure of language – that it cannot reach through to what it hopes to re-present. But such a reading of the limit or the gap becomes richer if we remember that limits, asymptotes, measurements, and discontinuities had offered Newton, Leibniz, and many other mathematicians an opportunity to formalise the relation between curved lines and straight lines by defining a functional relationship that mediates their difference. The resultant calculus enabled them to resolve the gap that had loomed so large in the history of mathematics. The mathematical notion of the limit codifies the paradox of articulating an absence. Invoking the notion of a limit as it is understood in mathematics, provides an instance of a larger structural pattern of reference in Beckett's work: a hyperconic structure that bespeaks the *limit* of language as a complex and paradoxical opportunity.

The opportunity lies in the fact that the seemingly incommensurability of such lines can be expressed as a function. Just as a curved line may have its relationship to its limit expressed as a function, so also do language and its unnamable objects exist *in* a functional relationship. This is the nature of the calculus. 'The doctrine of the Limit', is Newton's term for bringing such seemingly antithetical forms into commensurability, and in *Murphy*, the essay Neary gives to Miss Counihan adopts that phrase for its title (Beckett, 1957a, 50). Beckett's willingness to deploy his mathematical knowledge – both technical and historical – crystallises the anxiety about differences between representational systems and their objects. Aggregating Beckett's work with other disciplines illustrates the general crisis in representation that has afflicted Western culture, a crisis distributed throughout its prominent discourses. The anxiety of representation – and the strategies that contain the threats implicit in those anxieties – is embedded in Beckett's use of the congruence among these discourses to gain expressive power. Rather than a catastrophe, the notion of the limit carries with it the crucial understanding of what mathematicians call 'the paradox of the limit': 'entities in any given sequence generally possess multiple properties, and an entity that possesses the limiting value of one of those properties doesn't necessarily possess the limit value of ALL those properties (many of which may not even converge)' (Mathpages, 2006). The paradox invites analogies to the 'limit' of representation, that is, that language might have properties apart

from re-presentation that require different frameworks of analysis. Beckett insists on such complexity through his allusions to historical figures such as the mathematician John Craig, an obscure friend and colleague of Newton. In *Molloy*, Jacques Moran asks a series of 'questions of a theological nature' including, 'The algebraic theology of Craig. What is one to think of this?' (Beckett, 1955, 166–67). Craig's work was designed to measure the rate of decay of faith in the Gospels so that—in accordance with Luke 18:8—he could predict the Apocalypse. To measure the decay in the rate of belief so that it names some point in time is again the image of a function and its limit. Craig's oddity—to our own sensibility—is that his innovative work is motivated by a religious question. The mathematics are nevertheless sophisticated and probably influence Newton, but Craig's work anchors what seem to be purely mathematical issues in the episteme of the late 1700s. His work, as Nash notes, is an index to the century's emergent concerns with credibility, probability, and belief.¹ In a similar fashion, Beckett deploys allusions that range across bits of arcane knowledge in a way that illustrate his own era's concern with representation. Beckett's work submerges these iconic structures into his language, but the residua of highly specific knowledge continually disconcert our reading; they create an underlying sense that some systemisation is at work below the surface. The moments where specific knowledge erupts create an imperfection in the transparency of language, and this slight opacity locates representation not only in a historical moment but also *as* a recursive process. However central the mathematical image, it is but one iteration of a larger iconic structure for concerns with the limits of language. As the Mandarin says in *Dream of Fair to Middling Women*, 'you simplify and dramatise the whole thing with your literary mathematics' (Beckett, 1992, 48).

The historical sensibility to which such icons speak is the common ground of Beckett and his readers, but it is equally true that readers of his texts engage that ground in ways that are not identical to the ways it arises through Beckett's creative processes. This difference is itself crucial to recognising the nature of his texts, for not only do they re-present a central epistemological feature of the culture, but *for Beckett* they simultaneously perform the private, pre-conscious processes of creativity, and their public expression. Thus, his work occupies at least three mediational (functional)

positions: between symbolic systems and their objects, between author and text, and ultimately between reader and text. The notion of authorship is sustained through its imbrication in the larger iconic structure of the gap, but it is in no way separable. His work becomes a new kind of calculus for reconciling the varieties of representation to a larger and unnamable reality. This congruence between the idiosyncratic and the cultural signals an underlying, inarticulable structure (the-underlying-pattern-shared-by-each-embodiment-of-the-pattern). This cognitive/cultural hypericon organises the disparate concerns with representation that characterise both his cognitive style and the episteme within which it achieves its presence. Through a process of undoing that spreads across his career,² he transforms each iteration of order into an interrogation of the limits of representation. To trace the emergence of these concerns and their transformation away from the personal is to glimpse the growth of his work. Beckett thus both participates in and comments upon this key feature of the historical moment into which he was born. The 'Ever tried. Ever failed. No matter. Try again. Fail again. Fail Better,' of *Worstward Ho* encapsulates the process of approaching the limit of representation (Beckett, 1984g, 1). The full stops that end each sentence suggest an infinite series, a series that can be integrated – in the sense of a mathematical integration – that measures the space between each use of language and the unnamable which it seeks.

Beckett's keen sense of the crisis of representation affecting his own historical moment is evident in his letter to Axel Kaun in 1937 (Beckett, 1984a), a letter written while he was at work on *Murphy*, itself a work whose first drafts are intensely concerned with mathematics. In his letter, Beckett refers to the mathematician whose work had radically reconfigured the ground of mathematics only a few years earlier: Kurt Gödel. In his reference to 'that mad (?) mathematician who used a different principle of measurement at each step of his calculation,' (Beckett, 1984a, 172) Beckett suggests the logician's method. Gödel's first theorem demonstrated that axiomatic systems would necessarily have true statements that could be neither proven nor disproven; his second theorem demonstrated that such systems would necessarily be inconsistent. While mathematicians often assert that his work addresses a purely mathematical problem, it nevertheless is read metaphorically. This

seems inevitable because it led to the collapse of the mathematical aspiration for a wholly formal language that does not require what is termed 'natural' language, that is, for a system that did not have to reach outside of itself. Just as Craig's work bespeaks the epistemological anxieties of the late eighteenth century, so also does Gödel's work bespeak a sustained attempt of his own era to demonstrate that systematic languages might be without gaps, and a more general anxiety about the consequences of such gaps.

To the dominant mathematics of the 1930s, the value of the question to which Gödel addresses himself lies in the belief that an internally complete mathematical map would be the mark of either of two positions: 1) the purely syntactic orderliness of mathematics: one that need not refer to any experiential world; this is the position of Frege, Russell, and Hilbert; or 2) the emergence of mathematics alongside concrete, human experience. Goldstein argues that these two dominant alternatives of the late eighteenth and early twentieth centuries did not consider the aprioricity of mathematics to constitute an important question, but Gödel offered his theorems as proofs that served exactly that idea. His demonstration of incompleteness does not signal an disorderly cosmos, rather it argues that there are arithmetic truths that lie outside of the formalised systems; as Goldstein notes, 'the criteria for semantic truth could be separated from the criteria for provability'; this was an argument for mathematical Platonism. Her careful discussion of the cultural framework and the meta-mathematical significance of Gödel's work emphasises that it did *not* argue for the absence of any extrinsic order to the world (Goldstein, 51). Rather, Gödel was consciously demonstrating the defects in a mathematical project begun by Frege, modulated in the work of Russell and Whitehead, and enshrined by Hilbert as essential for converting mathematics into a profoundly isolated system whose orderliness lay in its internal consistency and completeness. Similarly, his work also directly addressed questions about the *a priori* nature of mathematics challenged by the Vienna Circle. Paradoxically, by demonstrating that a foundational system—arithmetic—was *not* consistent and complete, the argument that mathematics was simply a closed, self-referential system could be challenged and opened to meta-mathematical claims about epistemological questions. Gödel's work, among other things, argues for essential

differences between human thought and mathematics. My purpose is not to review Gödel's work, but to note that it has become imbricated in a variety of discourses about representation, the nature of the mind, and the nature of language. Goldstein notes:

The structure of Gödel's proof, the use it makes of ancient paradox [the liar's paradox], speaks at some level, if only metaphorically, to the paradoxes in the tale that the twentieth century told itself about some of its greatest intellectual achievements—including, of course, Gödel's incompleteness theorems. Perhaps someday a historian of ideas will explain the subjectivist turn taken by so many of the last century's most influential thinkers, including not only philosophers but hard-core scientists, such as Heisenberg and Bohr. (Goldstein, 51)

At the least, his work participated in a major consideration of three possible features of symbolic systems: as isolated, internally ordered syntactic systems; as accompaniments of experience in the material world, or as the *a priori* realities of the Ideal. Whatever the immensely complex issues of these various schools and disciplines—and I recognise that these sentences grotesquely simplify immensely beautiful and intricate knowledge—Beckett was drawn to the key meta-mathematician/logician whose work describes the limits of mathematical representation through an elegant demonstration that arithmetic systems—axiomatic systems—were inevitably inconsistent and incomplete.

Depending on one's aspirations for non-mathematical language, this is either a great catastrophe or an opening to an infinite world of possibility, where the goal is not even to perform the 'comedy of exhaustive enumeration' as Beckett styles it in *Proust* (Beckett, 1957b, 71), but rather to simultaneously deploy a paradoxical stance that combines the assertion of meaning with its cancellation. This double position addresses the problem of representational completeness in Joyce's work for which Beckett seeks an interim alternative.³ He addresses that issue in his letter to Axel Kaun: 'for the time being we must be satisfied with little. At first it can only be a matter of somehow finding a method by which we can

represent this mocking attitude towards the word, through words. In this dissonance between the means and their use it will perhaps become possible to feel a whisper of that final music or that silence that underlies ALL' (Beckett, 1984a, 172). As he goes on to distance himself from Joyce's 'Apotheosis of the word,' he suggests that the solution lies in acting like 'that mad (?) mathematician who used a different principle of measurement at each step of his calculation.' The reference seems to be to Gödel's method, as has been seen; his theorems rely on a system that creates specialised numbers for the symbols and the functions that relate them. This second numbering enabled him to move back and forth between the logic of statements and the codes by which they were represented,⁴ that is, they enable 'a different principle of measurement at each step of [the] calculation,' much as Beckett notes. His interest in this contemporary work is similar to his other interests in the obscure proto-calculus of John Craig, Pythagoras, Hypasos, number theory (in *Watt*), and other mathematical matters. Each of these is part of a more general hope for complete and consistent mappings of the world with words, and each embeds a representational failure: Craig was interested in the loss of belief in the gospels; Pythagoras feared the gaps in the number line represented by the irrational numbers, and Gödel identified the incompleteness and inconsistency of axiomatic systems. The arguments about the pertinence of these theorems in other discourses are important as evidence of an anxiety about the limits of representation. The desire to resolve such arguments seems irrelevant. All share an interest in the gap between the aspirations of systematic language and its object: the unnamable. That gap is iconic, an emblem of the limit and the functions it plays in the generation of novel responses to the threat of an inarticulable void.

Other mathematical issues appear throughout Beckett's work as icons for the representational gaps in systematic languages. Most frequently, these allusions appear in his references to the Pythagoreans, and especially to their nemesis: the irrational numbers, a species of which π is an example. For an artist concerned with the limits of representation, the Pythagoreans are especially useful because they asserted that the world was literally 'number' and could be represented through the use of the 'rational' numbers—that is, numbers that can be expressed as ratios of

integers. For example, they supposed that any point on a line could be named as the ratio of two whole numbers. Numbers were portrayed by a series of dots (called Monads), and the complex ratios used to describe geometric figures served to demonstrate that reality is, at its most fundamental level, mathematical (Guthrie, 1962). Their great claim – that the world *is* number – was vulnerable to the discovery of a point on the number line that could not be named as the ratio of integers. Such numbers are frequent; the great irony of the Pythagorean Theorem (the sum of the squares of a right triangle are equal to the square of the hypotenuse: $A^2 + B^2 = C^2$) lies in the fact that it routinely generates numbers that are *not* ratios of integers. For example, a right triangle with sides one-unit long has a hypotenuse $\sqrt{2}$ units long. Numbers such as $\sqrt{2}$ contradict the mathematical aspiration toward a completely representational system because they cannot be expressed as a ratio of integers, and hence their status as what is called an ‘ir-rational’ number. These numbers exist in what is called a ‘surd relationship’ to the integers, that is, they are silent about each other. To the Pythagoreans, this appeared as a discontinuity in their naming system, a gap that might be the mark of world beyond the representational power of number. Such numbers are, in fact, a new order of naming precipitated by the limited representational power of the prior naming system. The irrationals represent a sort of mathematical aphasia.

Beckett’s references to the Pythagoreans recognise this moment in mathematical history where an incommensurability produced a catastrophe. In *Murphy*, where the mind is a ‘matrix of surds,’ (Beckett, 1957a, 112) we hear of ‘Hypasos the Akousmatic,’ who was ‘drowned for revealing the incommensurability of side and diagonal’ (Beckett, 1957a, 47). Indeed, Hypasos was murdered by the Pythagoreans for revealing that side and diagonal might be incommensurable; he spoke the secret of the gap. The irrational numbers such as π , thus obtain values beyond their mathematical ones, values that reveal the limits of cognitive structures and the consequences of those limits beyond the systems wherein they originated. The punning value of the ‘irrationals’ to a writer steeped in the psychoanalytic psychology of the early twentieth century seems inescapable, especially when the creative process is generally recognised as beginning in extra-linguistic processes.

Beckett's own psychoanalytic treatment would draw on such notions.

In 'Dante... Bruno . Vico . . Joyce,' π stands as the central metaphor for Joyce's project: 'There is no difference, says Bruno, between the smallest possible chord and the smallest possible arc, no difference between the infinite circle and the straight line... Consequently, transmutations are circular' (Beckett, 1984b, 21). To praise Joyce's ability for a 'savage economy of hieroglyphics' (Beckett, 1984b, 28), Beckett invokes π , for it is π that relates the chord and its arc. The irrational connects the incommensurable relation of the arc intercepted by a chord, just as Joyce's method connects form and content, and Beckett asserts that the method is to amass the iterations of the ordering impulse that have been deployed in the past. Within two years, Beckett resurrects the image in *Proust*. He begins by noting that the 'Proustian equation is never simple.' Proust 'accepts regretfully the sacred rule and compass of literary geometry because[h]e is aware of the concessions required... by literary convention' (Beckett, 1957b, 1-2). The shift from the Pythagorean obsession with number to the Euclidian interest in rule and compass reflects a crisis of incommensurability. This division within mathematics between algebra and geometry is generally understood to be resolved by the development of the calculus, but Cartesian geometry also seems to offer 'a way of reducing any problem in geometry to a corresponding problem in algebra' (Davis and Hersh, 5). Klein is even more blunt about this; 'coordinate geometry,' he notes, 'should be called algebraic geometry' (Klein, 123). Descartes' importance as a mathematician is, in part that he addresses the schism between the two, a schism whose origins lie, in part, on the representational failures of particular types of numbers.

Beckett's work is permeated with allusions to the irrational numbers and the Pythagoreans. These allusions range from the implicit irrational relation between the square and the circle within which it can be inscribed – the quincunxes of *Mercier and Camier* – to the geometric figure of *Les Deux Besoins* described as, 'Signature de Pythagore, divine figure dont la construction dépend d'un irrationnel, à savoir l'incommensurabilité de la diagonale de carré avec le côté, sujet sans nombre et sans personne.' The story of Hypasos's murder again appears as the consequence of revealing

their existence (Beckett, 1984c, 56). Other allusions include Molloy's description of generating a decimal approximation of π : 'the true division begins, of twenty-two by seven for example, and the pages fill with the true ciphers at last' (Beckett, 1955, 64). This rough computation underlies his journey through the woods where he controls the tendency to travel in circles when lost; he says that with 'every three or four jerks I altered course, which permitted me describe, if not a circle, at least a great polygon, perfection is not of this world' (Beckett, 1955, 90). The ubiquity of such allusions signals an ongoing concern with the adequacy of mapping the world with words. The 'hairbreadth departure' of language from its objects lamented by Watt recalls the incommensurability lamented by the Pythagoreans.⁵ Using their mathematics preserves the interval between language and its objects. It bespeaks an unresolved relationship, albeit one whose absences generate new solutions that in turn prove inadequate, ad infinitum. Beckett terms this strategy the 'Comedy of exhaustive enumeration' in *Proust* (Beckett, 1957b, 71), and it is evident in the exhaustive strategies for stone sucking in *Molloy* or in the exhaustive logical enumerations in *Watt*; but it is also evident as early as *Whoroscope* where the footnotes name Descartes' method for proving God's existence as a proof 'by exhaustion' (Beckett, 1977, 14). The term also refers to the method of calculating areas under curves that preceded the calculus. Indeed, Descartes anticipated the calculus by proposing strategies termed 'exhaustive enumeration' to calculate the area beneath a curve. The term operates in both the philosophical and the mathematical realms.

Descartes' dual status as a philosopher and as a mathematician provides an emblem for their simultaneous deployments in Beckett's work. *Whoroscope* (1930) is built almost entirely around a biography of Descartes. In the poem, Beckett literalises minute details of the philosopher's life; his preference for eggs laid 8–10 days earlier dominates, but the poem includes *Wasteland*-like footnotes—added at the behest of Richard Aldington—that serve to connect the reader to what the poem has obscured. The notes and the poem stand as two different orders of language, two orders whose logics are as incommensurable to each other as side and diagonal. These notes reveal the origins of images whose partial erasure precipitates the poem. In *More Kicks than*

Pricks, the Occasionalist allusions expand beyond Descartes to include Belacqua's horror at the wedding gift of two clocks. Belacqua's horror may be their suggestion of Geulincx's image of two clocks as a metaphor for mind and body. The metaphor describes them as identical clocks set to a common time, and thus seemingly connected. But their connection is illusory rather than essential.⁶ Belacqua's horror seems to be a horror of the problematic (non)relation between body and mind that is central to Geulincx. Marriage, the mind-body dualism, and the pair of clocks all participate in a question about the possibility of knowing another. This knowing ranges from its sexual meaning to the coordinating action of the soul in Occasionalist philosophy. It is useful to think of the mind-body duality as congruent not only with Belacqua's anxiety about the pair of clocks, but also conceptually congruent with the question of representational limits, especially the intrinsic separation of language from its unnamable objects. In Beckett's strategic use of Geulincx and Descartes, we see that the variety of allusions—mathematical, philosophical, and as we shall see, neurological and psychological—simultaneously hide and reveal not only his notions of language, but also of the author (Uhlmann, 1994).⁷

In Beckett's work, the notion of duality continually multiplies, and in their aggregated form evolves new metaphoric values that share an interest in the problematic relation of language and its objects. We see this evolution in *Murphy* (1938), where the narrator invokes Geulincx's '*Ubi nihil vales, ibi nihil velis*,' (Beckett, 1957a, 178) to explain Murphy's commitment to a wholly interior life, that is, to the mind imagined as 'a large hollow sphere, hermetically closed to the universe without' (Beckett, 1957a, 107). This outer world appears to be a fierce competitor with the inner one he treasures; he is 'content to accept this partial congruence of the world of his mind with the world of his body as due to some process of supernatural determination. The problem was of little interest' (Beckett, 1957a, 109). Of course, even if Murphy is indifferent, the problem of mind-body connections is among the many interests that fill the novel, interests that are as mindful of the body and physical realities as they are of the mind.

The material world manifests itself simultaneously with Murphy's solipsistic desires through detailed references to pairs

of sciences: astronomy and astrology, neurology and phrenology, and to psychology and philosophy. Each pair seeks in its own way to describe and explain a common set of phenomena: celestial phenomena, the brain, and, for want of a better term, metaphysics. Their various shared interests point away from Murphy's solipsism; there are communities of (conflicting) explanations about the external world. But each set of mutually exclusive systems points to the difference between systematic languages and the objects they hope to represent. One of the most exhaustively literalised pairs is, as Sighle Kennedy demonstrates, astronomy and astrology. Her documentation of the allusions provides a model for others interested in Beckett's scientific acumen, and Kennedy frames her argument in Beckett's declaration to her that two notions shape the novel. The first is the '*Ubi nihil valet; ibi nihil velis,*' of Geulincx, and the second is the 'Naught is more real than nothing,' of Democritus (Kennedy, 17). To make sense of the novel, says Beckett, these contradictory notions—one Idealist and the other materialist—must operate simultaneously. The simultaneous operation of the paired sciences performs this paradoxical stance. Astronomy may have its roots in astrology, but it abandons the mapping of celestial phenomena onto human life. The more recent science is materialist, where the older one asks a less differentiated question about the celestial sphere. Their systems compete to explain the world, and they do so in mutually exclusive ways. Thus the competing time systems of geocentric and heliocentric systems are incorporated into the novel on a re-configured principle of 'identified contraries,' a term Beckett had used to praise Joyce's fusion of opposites. In his own work, as we shall see, the fusion is continuously deferred, and the deferral becomes the occasion of the text. In this odd coupling of sciences, Beckett historicises the impulse to represent celestial phenomena, and as he does, the various explanations become isomorphic. They are iterations of the representational impulse, an impulse we recognise in the congruencies of their maps. The 'real' becomes immune to the touch of language, but the failure of symbolic languages also points to the power of the unnamable celestial world to elicit language.

The novel's other pairings appear through an array of medical terminology, symptoms, and historical figures. While these allusions embody the body just as the philosophy embodies the mind,

they also include the exact clinical signs of pineal gland tumors. The material appears early in the text with the claim that Murphy's 'conarium [pineal gland] had shrunk to nothing' (Beckett, 1957a, 6). Within the heterogeneous mix of precise philosophical, astronomical, astrological, and mathematical allusions, Beckett provides these symptoms as a joke that refers to Descartes' claims for the pineal gland. This small neurological structure coordinated mind and body by housing the soul (Descartes, 275). Descartes noted that the pineal sits at the center of the 'organ of H,' that is, the juncture of the four ventricles of the brain. He further claims that the conarium performs feats of metaphysical plumbing by acting as a sort of check valve that regulates the fluid interchange of mind and body. The joke – giving Murphy a diseased mind-body connection – draws on Beckett's detailed knowledge of neurology, and it is part of the same fabric of medical expertise that shapes other allusions to disease, particularly to Parkinson's disease. Exactly as the pairing of astronomy and astrology point to a linguistic process, so also does the pairing of Occasionalist allusion and neurological syndromes point to that same place.⁸ When we recognise the pervasive use of specific, disciplinary knowledge – Wurzburgian psychology,⁹ Gestalt psychology, aphasiology, and certainly others – we recognise that texts arise from a specific cultural fabric. But however detailed Beckett's knowledge of such disciplinary knowledge, his interest is in the incompleteness of these systems, not in the systems themselves. The iterations are balanced around functional capacities of the mind, functions that are, de facto without content; but the operation of these functions on the domain of previous meanings, generates new meanings... that immediately enter the domain from whence they came. The instantiations of meaning paradoxically point to nothing, or as it is famously phrased in *Three Dialogues*, 'The expression that there is nothing to express, nothing with which to express, nothing from which to express, no power to express, no desire to express, together with the obligation to express' (Beckett, 1984d, 139).

In a different context Brian Rotman notes that the zero emerges in the thirteenth century through several 'isomorphic' appearances, and in each case (mathematics, painting, and finance), 'the sign introduced is a sign about signs, a meta-sign, whose meaning is to indicate, via a syntax which arrives with it, the absence of certain

other signs' (Rotman, 1). Analogically, the paired discourses of *Murphy* suggest a cognitive zero, a static balance-point between the contraries of competing linguistic systems such as astronomy and astrology, phrenology and neurology, and neurology and philosophy. Rotman emphasises that the zero undercuts the sense that a 'field of entities' exists prior to 'the meta-sign which both initiates the signifying system and participates within it as a constituent sign' (Rotman, 27). In sentences that seem suited to Beckett's use of cancellation, undoing, and counter-pointed disciplinary knowledge, he further notes: 'the simple picture of an independent reality of objects providing a pre-existing field of referents for signs conceived after them, in a naming, point, ostending, or referring relation to them, cannot be sustained' (Rotman, 27). Referents and signs are simultaneous; they mutually create each other in a continuous process, but the precipitation of a particular moment of this ongoing process creates an artifact – a text – that achieves a spurious sense of an independent, pre-existing referent. This historic status is counterfeit because the text requires its own signifiers to exist at all. Even as it is called into existence, it is newly shaped by the inseparable bond of referents and signs. This ceaseless flow emerges out of the most fundamental functional capacities of the mind. The past century focused on its wordlessness – its function¹⁰ – to master the anxiety of the inherently flawed nature of representation. Beckett is among those who emphasise this functional notion of the mind.

Beckett addresses the function of time and of sequence in *Proust* by focusing on the absences that separate the appearances of a character. He notes that these periods are bridged by 'involuntary memory.' The temporal gaps that Proust creates in his novel are reminiscent of the aphasic surds in the number line that confronted the Pythagoreans, the incommensurability of competing scientific systems, and the problematic reconciliation of curve and asymptote. The silences/voids/gaps/zeros generate endless streams of partial solutions whose defects perpetuate the creation of new naming systems. In *Proust*, Beckett establishes the gap between subject and object, a gap produced by the action of time which produces an 'unceasing modification of his personality, whose permanent reality, if any can only be apprehended as a retrospective hypothesis' (Beckett, 1957b, 4);

the seemingly incommensurable relation of these identities can be bridged, says Beckett, through a function – Proust’s ‘involuntary memory’ – which bridges the temporal gaps between the present tense subject and the past tense object. The essay marks an important turn in his thinking. What is new in Beckett’s transition between the two essays is his focus interest in the mechanics that relate subject and object. He insists on the real as hermetic and impenetrable. Between the hermeticism of the real and the ordering function of the human mind lie endless varieties of systematic explanations. This functional notion of the mind reflects the introduction of codes (scientific, philosophical, etc.) that create a meta-code that signals the simultaneous absence and potential of additional codes. ‘Things’ and ‘signs’ become simultaneous when nothingness, that is, the *function* of the mind becomes central. In *Molloy*, Molloy styles it thus:

And even my sense of identity was wrapped in a namelessness often hard to penetrate. . . . Yes, even then, when already all was fading, waves and particles, there could be no things but nameless things, no names but thingless names. . . . All I know is what the words know, and the dead things, and that makes a handsome little sum, with a beginning, a middle and an end as in the well-built phrase and the long sonata of the dead. And truly it little matters what I say, this or that or any other thing. Saying is inventing. Wrong. Very rightly wrong. You invent nothing. You think you are inventing, you think you are escaping, and all you do is stammer out your lesson, the remnants of a pensum one day got by heart and long forgotten, life without tears, as it is wept. (Beckett, 1955, 41)

This self-conscious staging of the act of writing recognises two selves: one is the ‘I’ of the text, and the other is an absent and unknowable author. Rotman argues that as characters move between these positions, they become a ‘textual meta-subject, an agency able to convey, via a written text, the illusion that there exists a self, a thing’ anterior to written depictions of that self’ (Rotman, 45). It is this evanescent meta-subject that enables readers to engage Beckett’s texts, and thus they offer ‘the possibility of

becoming, via a thought experiment, the artist' (Rotman, 19). The self that is precipitated in the act of articulation is cast forward to become an articulated object. As in the liar's paradox or Gödel's method, it serves as a third position from which we can articulate the paradox of an unnamable realm that is necessarily extant in the incompleteness of our systematic strategies and their embodiments.

Beckett facilitates and intensifies the readers' thought experiment by extending the scientific allusions to include traditional narratives about psychological experience, particularly narratives that privilege the icon of the mother, in this case May Beckett. The transition is seamless; it appears, for example in the extension of the neurological imagery of *Murphy* to include detailed symptoms of Parkinson's disease, the progressively debilitating disease which was to cause his mother's death.¹¹ Beckett's exhaustive allusions to the disease are almost entirely embodied in Cooper, a detective-like figure whose most remarkable characteristic is his inability to sit (Beckett, 1957a, 54, 118, 119, 254, 274). We are told his 'acathisia was deep-seated and of long standing' (Beckett, 1957a, 119). 'Acathisia' is a clinical term which describes the inability to stay still, an inability manifests itself in the characteristic pacing that besets the victim of Parkinson's disease. Cooper's acathisia is described in some detail; his feet 'spurn the ground behind him in a spring-heeled manner, as though he longed to run,' and he has a 'curious hunted walk' that tends to accelerate so that he cannot help gaining on those he follows afoot (Beckett, 1957a, 26, 54, 151), that is, the festinating gait of Parkinson's disease.¹² The disease is also characterised by the loss of expressive vitality in the face, what is termed 'leaden facies.' Beckett describes Cooper as having a 'leaden face' and as being 'gray faced' (Beckett, 1957a, 26, 54); further, his face, 'did not seem to move a muscle' (Beckett, 1957a, 205). The symptomatic behaviors that show Beckett's familiarity with the disease also include the characteristic pill-rolling tremor of Parkinson's disease which is evident in the play of Cooper's 'middle fingers up and down the seams of his shabby mole-skins,' a repetitive action that draws the comment of Wylie and the offer of whiskey, to 'help the needle off the crack' (Beckett, 1957a, 119). Even the repetitive speech of Parkinson's is apparent: 'I do be turned off, I do be turned off,' he says 'over and over again'

(Beckett, 1957a, 119). The symptoms are pathognomonic, and the vocabulary is drawn from neurology, the same discourse that serves the odd literalisation of Descartes through symptoms of pineal gland tumors. But here, Cooper's role is to carry messages between hopelessly separated characters. Just as the nervous system mediates the connection of mind and body, so also does Cooper attempt to connect the characters.

Cooper's embodiment of May Beckett's debilitating disease evokes other narratives about mothers, particularly narratives about psycho-sexual development. Among Cooper's tasks is that of reconciling resolving erotic conflicts. This is most obvious in the contrast between Celia and Miss Counihan, each engaged to Murphy (Beckett, 1957a, 16, 49). Celia, a prostitute, is kind, sexual, and called by her Christian name; Miss Counihan is an unattractive and cold representative of the respectable world. She is addressed with 'Miss,' and Beckett never reveals her Christian name. Murphy cannot marry both, that is, no integration of respectability and sexuality is available to him. Neary, his mentor (Beckett, 1957a, 3), is a bigamist, and it is a subtler form of bigamy that integrates the idea of a sexual woman with the image of a nurturing woman. It seems that Celia and Miss Counihan reflect incompatible attitudes toward women. Their severely contrasting characters connect to Murphy in almost identical ways: through marriage proposals, paternal characters, and the detective work of Cooper who embodies May Beckett's disease. These relationships and the medical allusions to May Beckett's medical history simultaneously extend the neuro-philosophical element of the book while evoking a dominant meta-narrative of the era: psychoanalysis.

Although these highly specific allusions provide access to an author who is somehow prior to the text, they need not be understood as such. The characters and allusions appear through literary conventions, including strategic doublings—both by division and by multiplication—that seem to promise contact with the 'I' of Samuel Beckett. When we naturalise such narratives, the materials seemingly provide an identity that is prior to the obscured identity in the text. There seems to be a de-codable self available to the reader. But just as the other iterations of systematic knowledge are partial, so also is the psychological made partial by the simultaneous deployment of other psychologies, sciences, and philosophies.

Within the discourse of psychoanalysis, the material seems complete, but when set among equally confident systems, it serves a stance outside of itself, one that insists on the asymptotic relation of the real to the curve of language. Beckett exploits the naturalised status of psychological narratives in one of his most condensed examinations of the problematic gap between these two: *Footfalls*.

Although *Footfalls* is written forty years after *Murphy*, it also draws upon May Beckett and her illness, but with an intense focus on the limit of psychological systemising. By suggesting itself as a symptom of an underlying discourse—psychoanalytic narratives of maternal relations—the play can simultaneously deploy and erase the claim that it can be de-coded in that system's terms. The play structures the iterations of its characters so that first it invites a sense of contact with the author, but it then makes such a reading incomplete. The play presents a middle-aged woman named 'May' through her conversation with her elderly off-stage mother named, 'V.' May not only bears Beckett's mother's name, but also seems to have the major symptoms of Parkinson's disease.¹³ V remembers that the floor where May paces had been carpeted, but that May had found the motion 'not enough,' and had to 'hear the feet, however faint they fall' (Beckett, 1984e, 241). Beckett's precise stage directions impart a stereotypic air to her gait, a repetitive and patterned walk that imitates the acathic pacing of Parkinson's disease. The pacing continues in the play's second and third movements, but here May alternately stands frozen in place. V's comment, 'how still she stands, how stark, with her face to the wall, [Pause] How outwardly unmoved,' (Beckett, 1984e, 241) emphasises May's physical motions, and refers to the difficulty with initiating movement usual to the disease. May comments about herself that, 'Some nights she would halt, as one frozen by some shudder of the mind, and stand stark still till she could move again. But many also were the nights when she paced without pause...' (Beckett, 1984e, 242). This concisely summarises the contrasting rigidity and acathisia that beset those suffering from Parkinson's disease. Beckett's stage directions call for 'low and slow' voices, the speech pattern typical of Parkinson's disease, and V's comment about May's 'outwardly unmoved' appearance amplifies the directions to dimly light May's face. The obscured face recreates the dulled facial expression of the disease.

The Parkinsonian imagery gains biographical lure through their discussion of their ages. V is 89 or 90, and May is in her forties, Beckett's age when his mother died. V's invisibility (she is off-stage throughout) suggests that she may be alive as a memory—May's memory—and thus incorporated into her offspring. Although similar to the Parkinson's allusions in *Murphy*, these allusions are more direct, and invite biographical responses.

May's first words are to her mother, an elderly woman in the throes of her own vague illness. V's bed-ridden condition emerges from May's offer of injections, bed pans, and sponge baths. The offer to turn V suggests that she suffers from bed sores. The dramatic mother, V, is ill, but it is May who does the nursing. May Beckett, the author's sick mother, is changed into a nurturing child. The name of the character and the transformation compel a biographical reading: May stands in for Beckett as she worries about V, that is, the author stands identified with his mother through her namesake's concern with yet another sick mother. Although the overt illness of V is separated from the dramatic figure of May, Beckett's mother is preserved in both the allusions to Parkinson's disease and in V, an imago who is mysteriously off-stage and enfeebled. The relationships between the child and parent turn on questions of illness, decay, and nurturance. To this point, the biographical impulse works smoothly. But the sequence of transformations and identifications expands when May and V are themselves fused through such simple devices as indeterminate pronouns, and this begins to undermine such readings. For example, the play's second movement begins with V's monologue about May. When V quotes snatches of May's speech, the 'I' of V's voice merges with 'I' of May's quoted words. V becomes an actress within the play, a character playing the part of another character. This miniature version of a play-within-a-play effectively absorbs May into the off-stage voice. Similarly, when May proposes a sequel to V's words, she speaks of herself in the third person, merging her stage presence with V's off-stage voice. Through such simple devices, Beckett exploits dramatic conventions to suggest that the two women are really one. The flexible pronouns, the person of the speakers, and the interplay of on-stage and off-stage mothers conflate the women. Even the topological paradox of the Möbius strip evident in the figure-8

pattern May paces (1984e, 25) suggests the relationship of May and V: that their separation only appears real, and they are but a single form that will infinitely mutate. The endless revolving of identities also connects to the pattern May paces, for it is equally represented as the sign of infinity. Even the physical motions of the play acquire multiple meanings. Through such dualities, the play acquires two directions, one that goes forward toward the story of Amy and Mrs. Winter, and another that wants to claim an origin in Beckett's life.

When May speaks of Amy, the off-stage mother becomes incorporated into the text as Mrs. Winter. This recapitulates the fate of May Beckett within *Footfalls*, for she is incorporated within a play when Beckett creates a character speaking of an elderly and ill mother. May speaks through Amy (a version of herself) of a child and mother, just as Samuel Beckett speaks of himself through a mother and child relation. In both transformations the child becomes the mother. Just as *Footfalls* seems to re-create Beckett's relation to his mother, so the story of Amy re-casts the story of May and V. May and V, and Amy and Mrs. Winter have the same relationship: mature child and elderly mother. Whatever these similarities, one points to the past, and the other to the future. The temporal differences and the rapid succession of their appearance in the space of a few pages suggest that they are balanced at some zero point—some functional capacity—of the mind. Thus they are not characters as much as moments in a continuous process. The multiplicative doubling of *Footfalls* undoes the sense that we can de-code the play by first inviting the reader inside the realm of a biographical reading, and then problematising the response. The presence of the artist in the work becomes but another imagined structure, indistinguishable from the other imaginary structures. Beckett's play is powerful because its formal structures bespeak the generative, functional nature of the mind. His sequence of mother-and-child pairs generates an aesthetic of successive approximation, that is, an awareness of each image as a term whose opposite can generate yet another term, yet another image, yet another reconciliation. Even the shape of May's pacing is transformed from a unitary, paradoxically one-sided figure (the Möbius strip) into the mathematical symbol for infinity: ∞ . The play accepts incompleteness as a fundamental feature of human expression, and it offers the infinite revision of meanings as a

strategic means of voicing the representational limit of language. That the real comes to include even the sign of the author is a mark of Beckett's rigor.

Whatever the idiosyncratic qualities of Beckett's voices, each is embedded with(in) lexical and descriptive structures that place it amidst discourses that are anxious about representation. Readers simultaneously participate in these symbolic aspirations while recognising their ultimate failure, a recognition produced by the dissonance between competing systematic knowledge. The dissonance reveals an incommensurability, an incommensurability or gap that itself is evidence of the functional nature of the mind. Inscribed in every articulate act, this function mutates and fails with each enactment so that its existence can only be inferred. In Beckett's work, between the cadenced instantiation of a symbolic language and its cancellation lies the commensurable relation of side and diagonal that eluded Pythagoras; the reader obtains a peculiar clarification: the representational failure becomes a failure of completeness, but it is a second-order failure made evident in the mapping and counter-mapping of simultaneous languages, mappings that fail to contain their own ties to the function that drives the curve of language toward an unnamable reality, an unnamable reality that includes even the imageless, purely potential function of the mind. His work transforms the anxiety of the pre-verbal, the zero, the gap . . . of failure itself, into an expressive opportunity. His artistic strategies are a measured response to the anxieties these provoke. They control the threat of symbolic failure degenerating into solipsism; it de-authorises totalising systems that would claim authority, and it does so by recognising the generative potential at the center of the anxiety of representation.

NOTES

1. Beckett may well have encountered the work through Pope's *Dunciad* (4: 459–62) where, as Nash notes, it is mocked.

2. S. E. Gontarski's *The Intent of Undoing in Beckett* (1985) provides much of the conceptual framework here, but also Beckett's repetitive re-doing of this reflects the cultural concern with representation. Iser's 'Subjectivity as

the Autogenous Cancellation of its Own Manifestations' focuses on similar issues from a phenomenological framework.

3. Thomas (1995) describes the various uses to which Gödel's work is put in the literary world.

4. Nagel and Newman (1958) provide a step-by-step explanation of the method that is meant for the non-mathematician. Other useful explanations of Gödel's methods are in Goldstein (2005) and in Hofstadter (1979).

5. Andrew Keen argues that irrational numbers are not central to *Watt*, and that Beckett asserts new mathematical strategies to express the differences between the representational means and their objects: 'Unfortunately for Watt, it is not just surds that challenge his attempt to impose order on the world. The recurring (significantly, *not* irrational) numbers featured in the threne heard by Watt in the ditch on the way from the station (*W*, 32–34) are . . . recurring decimals, and therefore are mathematically rational, [but] their precise magnitude within the scale of values between the integers 52 and 53, and 51 and 52, cannot be pinpointed. They are still the product of the positing of artificial patterns on to a prior system in order to force a sense of comprehensible logic on to the universe. The specific example used here, though—the impossibility of deriving a perfect calendar from the earth's movements in the solar system—is less significant than the medium through which it is expressed' (Keen, 2004).

6. Amid Scott's examination of the problematic meanings of this metaphor in Leibniz, he notes, 'The operations of two clocks, between which there is a constant and fixed relation, say, of keeping the same time, cannot normally be said to be "related." The example is more intuitively taken to indicate the random, accidental, unnecessary, and unconnected nature of the otherwise constant and regular relation between the clocks' (446).

7. Uhlmann (1994) notes that the Descartes and Geulincx allusions are obscured for reasons that go beyond philosophical concerns and toward the biographical.

8. Beckett is not the only author of the thirties to use the pineal as an emblem of reconciliation. Georges Bataille wrote five texts on the pineal between 1927 and 1930; the organ is treated as a visionary third eye (13–50). Two years later Bataille and Beckett were among those who signed 'Poetry is Vertical.' The manifesto appears in the same issue where the German poet Gottfried Benn summarises the neurological knowledge of the day. Beckett's progressive adaptation of neurology to more purely linguistic issues is reflected in his use of aphasias (Culik: 1979; 1983; 1982; 1989).

Aphasias raise the question of what remains of the self when it is cut off from language, a concern of contemporary neurologists that has roots in the Gestalt-neurological work of Kurt Goldstein.

9. Members of the short-lived Wurzburg School of psychology are all named in *Murphy*. Their experiments with 'imageless thought' quickly discovered the mediation of language. See Kevorkian (1994) and also Breuer (2006).

10. Young (1970) chronicles the rise of the idea of function in neurology, a possibility opened by Descartes' separation of mind and body. The cultural context for that change is the subject of DeGiustino (1975).

11. The death certificate lists 'paralysis agitans' as the cause of death.

12. Parkinson observed that the disease is always characterised by the 'invincible propensity to run, when wishing only to walk' (19). The symptom, a festinating gait, is still considered pathognomonic.

13. *Rockaby*, written in 1980, is similar to *Footfalls* in its use of an autobiographical groundwork. W's 'expressionless face' suggests the leaden facies of Parkinson's disease, the rocking is typical of seated acathisics, and her 'premature' aging suggests the fundamental acceleration of the aging process represented by the disease. Here, V is more specifically identified as 'The voice of W.'

WORKS CITED

- Bataille, Georges (1970), *Oeuvres complètes*, 2 vols, Paris: Gallimard, vol. 2, pp. 13–50.
- Beckett, Samuel, et al. (1929), *Our Exagmination Round his Factification for Incamination of Work in Progress*, Paris: Shakespeare and Company.
- Beckett, Samuel, et al. (1932), 'Poetry is Vertical', *transition*, 21, pp. 148.
- Beckett, Samuel (1955), *Molloy*, in *Three Novels by Samuel Beckett*, New York: Grove Press.
- Beckett, Samuel [1938] (1957a), *Murphy*, New York: Grove Press.
- Beckett, Samuel [1931] (1957b), *Proust*, New York: Grove Press.
- Beckett, Samuel (1959), *Watt*, New York: Grove Press.
- Beckett, Samuel (1977), 'Whoroscope', *Samuel Beckett: Collected Poems in English and French*, New York: Grove Press, pp. 1–6.
- Beckett, Samuel (1984a), 'Letter to Axel Kaun', trans. Martin Esslin, *Disjecta*, ed. Ruby Cohn, New York: Grove Press.
- Beckett, Samuel (1984b), 'Dante . . . Bruno . Vico . . . Joyce', *Disjecta*, ed. Ruby Cohn, New York: Grove Press, pp. 19–33.
- Beckett, Samuel (1984c), 'Les Deux Besoin', *Disjecta*, ed. Ruby Cohn, New York: Grove Press, pp. 55–7.

- Beckett, Samuel (1984d), 'Three Dialogues.' *Disjecta*, ed. Ruby Cohn, New York: Grove Press, pp. 138–45.
- Beckett, Samuel (1984e), *Footfalls*, in *The Collected Shorter Plays of Samuel Beckett*, New York: Grove Press, pp. 237–43.
- Beckett, Samuel (1984f), *Rockaby*, in *The Collected Shorter Plays of Samuel Beckett*, New York: Grove Press, pp. 271–82.
- Beckett, Samuel (1984g), *Worstward Ho*, New York: Grove Press.
- Beckett, Samuel (1992), *Dream of Fair to Middling Women*, New York: Arcade Publishing.
- Benn, Gottfried (1932), 'The Structure of the Personality (Outline of a Geology of the 'I')', *transition*, 21, pp. 195–205.
- Breuer, Horst (2006), 'Samuel Beckett and experimental psychology', 87. 3 (June), pp. 303–18.
- Culik, Hugh (1979), 'Mindful of the Body: Medical Allusions in Beckett's *Murphy*', *Eire-Ireland*, 14, No. 5 (Spring), pp. 84–101.
- Culik, Hugh (1982), 'Entropic Order: Beckett's *Mercier and Camier*', *Eire-Ireland*, 17, No. 1 (Spring), pp. 91–106.
- Culik, Hugh, (1983), 'The Place of *Watt* in Samuel Beckett's Development', *Modern Fiction Studies*, 29, No. 1 (Spring), pp. 57–71.
- Culik, Hugh (1989), 'Neurological Disorder and the Evolution of Beckett's Maternal Images', *Mosaic* 22, No. 1 (Winter), pp. 41–53.
- Davis, Philip, and Reuben Hersh (1996), *Descartes' Dream*, Boston: Houghton Mifflin.
- DeGiustino, David (1975), *Conquest of Mind: Phrenology and Victorian Social Thought*, Totowa, NJ: Croom Held.
- Descartes, René (1958), 'Of the Passions in General', in *Descartes: Philosophical Writing*, ed. N. K. Smith, New York: Random House.
- Goldstein, Rebecca (2005), *Incompleteness: the Proof and Paradox of Kurt Godel*, New York: Norton.
- Gontarski, S. E. (1985), *The Intent of Undoing in Samuel Beckett's Fiction*, Bloomington: Indiana University Press.
- Guthrie, W. K. C. (1962), *The Earlier PreSocratics and the Pythagoreans*, vol. 1 of *A History of Greek Philosophy*, 5 vols, Cambridge: Cambridge University Press.
- Hofstadter, Douglas (1979), *Godel, Escher, Bach*, New York: Basic Books.
- Iser, Wolfgang (1978), *The Implied Reader*, Baltimore: Johns Hopkins University Press.
- Keen, Andrew (2004), 'Samuel Beckett's Prose Fiction', Dissertation: Reading University; 1 December, Section 3.1. Accessed 6 October 2006. www.atjb07.dsl.pipex.com/phd/thesis.htm#_Toc91032492
- Kennedy, Sighle (1971), *Murphy's Bed*, Lewisburg: Bucknell University Press.

- Kevorkian, Martin (1994), 'Misreading Watt: the Scottish Psychoanalysis of Samuel Beckett', *ELH*, Volume 61, Number 2, Summer, pp. 427–43.
- Klein, Morris (1980), *Mathematics: the Loss of Certainty*, New York: Oxford University Press.
- Mathpages (2006), 'The Limit Paradox'. Accessed 25 December. <http://www.mathpages.com/home/kmath063.htm>
- Mitchell, W. J. T. (1995), *Picture Theory*, Chicago: University of Chicago Press.
- Nagel, Ernest, and James Newman (1958), *Gödel's Proof*, New York: New York University Press.
- Nash, Richard (1991), *John Craige's Mathematical Principles of Christian Theology*, *Journal of the History of Philosophy Monograph Series*, Carbondale, IL.
- Parkinson, James (1817), *An Essay on the Shaking Palsy*, London: Wittingham.
- Rotman, Brian (1987), *Signifying Nothing: The Semiotics of the Zero*, Stanford: Stanford University Press.
- Scott, David (1997), 'Leibniz and the Two Clocks', *Journal of the History of Ideas*, 58.3 (July), pp. 445–63.
- Thomas, David Wayne (1995), 'Gödel's Theorem', *PMLA: Publications of the Modern Language Association of America*, 110:5 (Oct), pp. 1053–56.
- Uhlmann, Anthony (1994), 'A Fragment of a Vitagraph': Hiding and Revealing in Beckett, Geulincx, and Descartes, in *Samuel Beckett Today*, ed. Anthony Uhlmann, Sjeff Houppermans and Bruno Clement, New York: Rodopi.
- Young, Robert (1970), *Mind, Brain, and Adaptation in the 19th Century*, Oxford: Clarendon Press.