Rhizomatic Mathematics David Foster Wallace and the Literary Infinite

Let's begin with Gerhard Schtitt, because it doesn't much matter where we begin, and that's largely the point. Schtitt is by all accounts a minor character in *Infinite Jest*: a septuagenarian tennis coach and Nazi-parody with a penchant for ice cream and corporal punishment. His moments are few, brief, and relatively unimportant. And yet he's as good a place to start as any.

Commenting on the structure of *Infinite Jest*, N. Katherine Hayles wrote "For such a novel, any starting point would be to some extent arbitrary, for no matter where one starts, everything eventually cycles together with everything else" (Hayles 684-5). She argues that David Foster Wallace wrote his masterwork as an intricate web of reflections, each informing another in all parts of the text. If we choose Gerhardt Schtitt as our point of entry to *Infinite Jest*, then, we need to place him in the larger scheme of the novel by examining his relationship with other characters, themes, and the book as a whole.

Schtitt came to work at Enfield Tennis Academy, the central setting of Wallace's text, because he "approached tennis more like a pure mathematician than a technician" (IJ 81). While most sports strategists use math as a strict statistical delineator à la Moneyball, Schtitt takes a more philosophical stance. Like James O. Incandenza, the founder of ETA and creator of "the Entertainment," the weapon that drives the book's plot, Schtitt sees tennis through the mathematics of the infinite.

[He] seemed to intuitively sense that it was a matter not of reduction at all, but perversely—of expansion, the aleatory flutter of uncontrolled, metastatic growth—each well-shot ball admitting of n possible responses, n² possible responses to those responses, and on into what Incandenza would articulate to anyone who shared his backgrounds as a Cantorian continuum of infinities¹ of possible move and response, Cantorian and beautiful because infoliating, contained, this diagnate infinity of infinities of choice and

¹ I.e. The Continuum Hypothesis. Much more on this later.

² intimidatingly Large American Novels. Inventing terms like this seems to have been in vogue in the 80s. The

execution, mathematically uncontrolled but humanly *contained*, bounded by the talent and imagination of self. (*IJ* 82)

To Schtitt, tennis is a game of the transfinite, infinities captured within established constraints. This is the foundation of tennis philosophy at Enfield Tennis Academy, and it is the lens through which James Incandenza understood the world. Most important of all, it forms the thematic and structural heart of *Infinite Jest*. This concept of the infinite within the contained appears at every juncture in the novel, revealing an elaborate network crafted with mathematical precision.

Wallace constructs *Infinite Jest* as a literary rhizome, a massive, elaborate fractal that enables limitless interpretations; the result is a novel that structurally combats its main antagonist, the sterile recursivity of the Entertainment and the postmodern condition it represents.

We find Schtitt's mathematic principles riddled throughout *Infinite Jest*, most notably in James Incandenza's annular fusion. Though Wallace never explicitly outlines annular fusion, he offers snippets of an explanation in disparate sections of the novel. We receive the most information about the subject in the most trivial of encounters, a conversation between two high school students studying for a physics test while they search for a bathroom. Here, Wallace reveals annular fusion at its simplest, "a type of fusion that can produce waste that's fuel for a process whose waste is fuel for the fusion," geometrically modeled as "nothing but a huge right triangle" (*IJ* 570-2). We learn about the origin of the process in an even more roundabout fashion: an excerpt from *The Chill of Inspiration: Spontaneous Reminiscences by Seventeen Pioneers of DT-Cycle Lithiumized Annular Fusion*, in which Incandenza recounts a domestic argument between his parents over a squeaky mattress. Incandenza claims his interest in annulation arose after he escaped his drunk father's ranting by leaping onto his bed and sending a doorknob into a series of cycloidal revolutions on the floor, resembling "what it would look like

for someone to try to turn somersaults with one hand nailed to the floor" (*IJ* 503). Thus from humble, random beginnings was American energy in [ter] dependence born.

These incidents are far more essential than they seem at first, since annular fusion is the source of the continental conflict at the heart of the plot. It seems curious, then, that Wallace would delay these details until the middle of the text, and even then in unrelated sections.

Thinking of Hayles's remark, however, we should worry instead about the lines we can draw between the anecdotes rather than their individual placement. While Gerhardt Schtitt, James Incandenza's alcoholic father, and ETA boys on their way to the bathroom might have little or nothing to do with beyond a commitment to competitive tennis, they echo each other's mathematics. Wallace lets the reader create a thematic connection rather provide a diegetically linear link. The rest of the text works much in the same way; *Infinite Jest* constantly darts across time, space, and perspective, forcing the reader to make whatever connections he or she can or will.

Drawing connections between 1079 pages of seemingly astructural text with a number of interwoven plot lines is daunting but fortunately not unprecedented territory. Commentary on two of Wallace's most prominent literary forebears, Thomas Pynchon and Don DeLillo, provides a critical machete to the hermeneutic thicket presented by *Infinite Jest*. Pynchon's and DeLillo's novels have been called "Mega-Novels" (by Frederick R. Karl) and "systems novels" (by Tom LeClair), respectively, academic terminology invented to address the rising trend of massive American books. Wallace follows in this tradition of textual labyrinth and encyclopedic overload. Like *Gravity's Rainbow*, *Infinite Jest* "has forsaken inclusivity in favor of indeterminacy. Its aims are decentering or deconstructing, rather than gathering in" (Karl 2).

LeClair explains this phenomenon more generally, calling iLANs² "larger open systems" (LeClair 24) that establish their own rules of operation. Wallace's iLAN is infamously indeterminate, with the major conflicts of the plot (intercontinental war, acquisition of the Entertainment, et cetera) occurring outside the text. We are left to decipher the book on its own terms, looking for auto-didactic passages that teach the reader how to read *in media res*. Passages like those that explain Gerhardt Schtitt's tennis philosophy or James O. Incandenza's inspiration for annulation operate in this way, revealing a mathematical prism at *Infinite Jest*'s center.

Karl's and LeClair's ideas about iLANs are thoroughly synthesized for the postmodern reader in the aesthetics of Gilles Deleuze and Félix Guattari as outlined in *A Thousand Plateaus*.³ "What takes place in a book composed instead of plateaus that communicate with one another across microfissures, as in a brain?" (D&G 22). This kind of text is a "rhizome-book," a literary work that operates like the self-contained network described by Karl and LeClair, "a strange mystification: a book all the more total for being fragmented" (D&G 6). Deleuze and Guattari go further, however, outlining a specific model for the postmodern text that maps eerily well⁴ onto *Infinite Jest*.

"Introduction: Rhizome," the first "plateau" in *A Thousand Plateaus*, offers six principles that define the authors' vision of the rhizome: connection, heterogeneity, multiplicity, asignifying rupture, cartography, and decalcomania. Condensed and simplified, these criteria tell us the following: The rhizome is a series of distinct yet interconnected units, in which "any point

² intimidatingly Large American Novels. Inventing terms like this seems to have been in vogue in the 80s. The acronym here attempts to carry on that noble, forgotten tradition with a millennial twist.

³ "Plateaux,' Wayne says, looking at the ceiling and pushing the back of his head isometrically against the door. 'With an X. *Plateaux*.'" (*IJ* 115)

⁴ There are also eerie similarities between Deleuze and Wallace, rhizomatic aesthetics aside: both are essential literary figures of the past forty years, both had a deep interest in mathematics, both took their own lives. "He also values humor, above what he sees as romantic and ultimately nihilistic subject-centered irony (due to the way irony reflects back on to the privileged position of the ironist, which itself proves to be hollow)" (Williams 40). Written about Deleuze, but could easily describe either.

of a rhizome can be connected to anything other, and must be" (connection and heterogeneity). These connections constitute multiplicities, and these multiplicities in turn constitute the body of the text. Because of these connections, "there are no points or positions in a rhizome...there are only lines." The rhizome has "no beginning or end; it is always in the middle" and can effectively begin from any point (asignifying rupture). As such, it resists most graphical representations. Maps and networks (cartography and decalcomania) are the only applicable models, though even these are faulty because they impose necessary pathways for dialogue (D&G 7-12, 25). Deleuze and Guattari structure *A Thousand Plateaus* around these concepts. The work is composed of sections described as "plateaus" (rather than "chapters") that can be read in any order. Every plateau circles the postmodern condition of decentralized interconnectivity from a different angle. Simply put, *A Thousand Plateaus* is a rhizome about rhizomes.

Between Pynchon and DeLillo, plenty of iLANs can be said to be rhizomes⁵, but
Wallace's *magnum opus* nearly epitomizes the archetype. A great many critics have described
the same qualities outlined by Deleuze and Guattari in *Infinite Jest* without expressly calling
them rhizomatic. Hayles suggestion that entry points to the text are arbitrary captures the spirit of
the asignifying rupture, and when Bradley Fest claims "the novel attempts to communicate with
every other section" (Fest 141), he shows Wallace embodying the Deleuzean principles of
connection and heterogeneity. As to the lines of multiplicity and the modeling principles of
cartography and decalcomania, one can look to Fest again, who contends "the basic formal
structure that *Infinite Jest* relies upon for its realization is the *distributed network*," a term he
borrows from Alexander Galloway, who in turn claims Deleuze's rhizome as his inspiration

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⁵ "American literature manifests this rhizomatic direction to an even greater extent...they know how to move between things." (D&G 25)

(Fest 141). But critical inquiry doesn't reveal as much as the popular dialogue surrounding *Infinite Jest*. The novel has been modeled in concept maps (and literal maps) by countless fans (see Fig. 4 and 5).

So *Infinite Jest* is rhizomatic. How does this speak to Wallace's larger concerns in *Infinite Jest*? What does a rhizome have to do with the Entertainment and lethal loops, if anything? Like Wallace and so many of his characters do, we should look to the math.

Given the tenuous relationship between those studying the humanities and the quantitative, this may seem a counterintuitive move at first. Even before a deep look at the text, however, there are reasons to consider the numbers. After all, Wallace majored in philosophy of mathematics at Amherst. Coupled with the complex explanations of everything from waste-free combustion to rotating doorknobs, a math textbook seems like a good place to start. Indeed, in his thesis on *Infinite Jest* (by most accounts the first critical work on the novel), Chris Hager was quick to point out the geometrical strategy inherent in the book's quasi-symmetry. Comparing *Infinite Jest*'s structure with the parabola metaphor in *Gravity's Rainbow* (Hager 9), Hager used the concept of a parabolic function's set trajectory as a means of projecting the major plot events not mentioned in the text into the diegesis.

With the parabola as structural trope, the curve's mathematical properties can indicate the significance of what happened to Hal (not the real event that is the cause). It is the ethereal focus of the text's parabolic curve, the thing that happened to Hal, and whatever did happen lies at the intersection of every character's and event's narrative vectors —vectors the novel notes but doesn't follow all the way through to intersection. (Hager 10)

Hager's instinct here is a good one; his approach resolves the foremost challenge of the text, the one that most immediately vexes readers, i.e. what actually *happens*. But the parabolic function model is fixed; it suggests one to one relationships between x and y coordinates, a guaranteed

single set interpretation. As such, the parabola theory is antithetical to a rhizomatic text, which is "not amenable to any...generative model" (D&G 12). Also, it's verifiably incorrect.

In April of 1996, Michael Silverblatt one-upped Hager⁶ (probably only weeks after the latter turned in his thesis) by suggesting in an interview with Wallace that Infinite Jest was modeled after a fractal. Impressed, Wallace confirmed his guess, saying that he structured the book like a Sierpinski Gasket, "a very primitive kind of pyramidal fractal...it looks basically like a pyramid on acid" (Bookworm) (see Fig. 2). The triangular structure comes to light when one considers the peculiar framing of the novel, the way Wallace places certain characters and information at congruent extrema of the text. Consider how the pivotal moment surrounding the Entertainment, the search for the film cartridge in Incandenza's head, is described in a state of delirium twice, once within the first fifty pages and once within the last fifty. All the information necessary to contextualize this event (Incandenza's resting place, the placement of the cartridge in his head, and so on) is interspersed in between while these anecdotes symmetrically bookend the text. The famed 304th footnote is another excellent example, referenced six times in Rémy Marathe episodes on pages 89, 108, 428, 722, 732, and 753. Wallace links to the footnote, a multi-layered account of the AFR, in almost perfect proportion to the triangular divisions of the Sierpinski triangle (see Fig. 1).

A fractal, especially a Sierpinski Gasket, is a thematically meaningful choice for Wallace; it reflects the same preoccupation with the infinite we find in Schtitt and Incandenza, because a fractal repeats indefinitely by nature; in this sense, the Sierpinski Gasket covers an infinite area. Tellingly, Deleuze and Guattari were also intrigued by the relationship of fractals to the infinite;

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⁶ To Hager's credit, though, he did gesture towards the structure of the Sierpinski Gasket's interpolated pyramidal arcs, noting that the "plot picks up speed as it descends the slope of the novel's first half, and slowly ascends the second half towards an end." (Hager 11)

⁷ "[The manuscript] went through some I think 'mercy cuts,' so it's probably kind of a lopsided Sierpinski Gasket now." - Wallace (*Bookworm*)

they discuss Sierpinski's fractals in a plateau about mathematical models (see Fig. 3). Though the largest triangle forms an outer boundary, there is nonetheless an endlessly repeating space within, much in the way Schtitt sees a game of tennis as a "Cantorian continuum of infinities." Like tennis, the triangle sets limits, but there are an infinite number of scenarios within these general restraints.

This is, to say the least, abstract stuff. Brain-bendingly abstract. Fortunately for us, David Foster Wallace wrote an accessible treatise on the subject, *Everything and More: A Compact History of Everything*. The heart of the matter lies in that "Cantorian continuum" Schtitt mentions. *Everything and More* demonstrates Wallace's near reverence for Georg Cantor, a nineteenth century mathematician that proved the concept of "transfinite numbers," a concept simply explained as varying degrees of infinity. Consider the difference between the infinitely large (infinite) and the infinitely small (infinitesimal); these were conventional concepts of infinity running back to Leibniz. Cantor added a new notion of the infinite, the limitless string of numbers between any two finite points. Wallace explains:

The finite interval on the Number Line is thus even more inconceivably crowded. There's not only an infinite number of infinite sequences of fractions, but also an infinite number of surds, each of which is itself numerically inexpressible except as an infinite sequence of nonperiodic decimals. Let's pause to consider the vertiginous levels of abstraction involved here. If the human CPU cannot apprehend or even really conceive of ∞ , it is now apparently being asked to countenance an infinity of ∞ s, an infinite number of individual members of which are themselves not finitely expressible, all in an interval so finite- and innocent-looking we use it in little kids' classrooms. All of which is just resoundingly weird. (E&M 80)

It gets worse:

In fact, there are as many points in the interval .0000000001-.0000000002 as there are on the whole Number Line. It also turns out that there are as many points in the above micro-interval (or in one one-quadrillionth its size, if you like) as there are on a 2D

⁸ Gilles Deleuze is often called a "Neo-Leibnizian," mostly for "reconstructing Leibniz's metaphysics" in *The Fold: Leibniz and the Baroque*, in which he weaves Cantorian proofs and the rhizome into Leibniz's calculus. "The Fold" is his metaphor for the central subject of his analysis: you guessed it, fractals. (Duffy 7, 44)

plane—even if that plane is infinitely large—or in any 3D shape, or in all of 3D space itself. (E&M 88)

Here's what it all means: any given space contains an infinity. Mathematicians refer to this principle as the "Continuum hypothesis," and it enables much of modern mathematics, including most of Wacław Sierpinski's career.⁹

Applying the continuum hypothesis to literature is a different, more complicated matter. Instead of a number interval, Wallace offers us a 1079 page iLAN. To find the infinite in a rhizome, we need to sink into deeper abstraction, reducing numbers from quantities to ideas, basic rhizomatic units. Keeping in mind Wallace's remark about infinitely large threedimensional space, Deleuze and Guattari's description of rhizomatic mathematics comes to mind: "the linkage between one vicinity and the next is not defined and can be effected in an infinite number of ways" (D&G 485). Instead of an infinite amount of values between two set values, there are an infinite number of multiplicities between parts of a rhizome. In set theory and philosophy, the space containing these infinities is called "state space." Where Cantor identifies surds and increasingly small fractions as transfinites, Deleuze and Guattari find possibilities and hypotheticals. Manuel De Landa points out that when A Thousand Plateaus explores this subject, Deleuze and Guattari are investigating the nature of modal logic, the logic of "if" and counterfactuals. 10 "Understanding a system," De Landa writes, "is not just knowing how it actually behaves in this or that specific situation, but knowing how it would behave in conditions that may not in fact occur. Thus, an ontological assessment of the structure of possibility spaces is what is needed" (De Landa 226-7). The rhizome's total is not simply the sum of its parts; it is the sum of every possible combination.

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⁹ Wallace makes a point of mentioning this in the final pages of *Everything and More*. (E&M 303)

¹⁰ Not coincidentally, Wallace's senior thesis at Amherst, "Richard Taylor's 'Fatalism' and the Semantics of Physical Modality," was a formal analysis of the intersection between language, literature, and the mathematics of state space.

If we couple this information with the knowledge that *Infinite Jest* is structured like a fractal with an infinite area, we are inclined to see how that area manifests itself in the textual state space. Wallace forces the reader to draw the lines between his multiplicities by splitting his narrative across time and space and omitting essential plot points. This allows us to project some events; the reader can consider the various modal possibilities and draw conclusions for him or herself. But as Hager points out, one can never know some things for certain—where the mysterious John Wayne goes, what happened to Hal Incandenza, who disseminated the Entertainment. Because of these ambiguities, there are an infinite number of ways to interpret the text, reading into some parts and omitting others in various combinations. And because of this, the novel *in toto*, according to De Landa's analysis of Deleuze's mathematics, is hermeneutically limitless. *Infinite Jest* is literally, mathematically and philosophically, infinite.

This is all fine and good, but doesn't much matter if we don't know why Wallace wrote the book that way. One theory: the dystopic Office of Unspecified Services interviews film academic Molly Notkin about the Entertainment. Her opinion about *Infinite Jest* the film:

The purportedly lethal final cartridge was nothing more than a classic illustration of the antinomically schizoid function of the post-industrial capitalist mechanism, whose logic presented commodity as the escape-from-anxieties-of-mortality-which-escape-is-itself-psychologically-fatal, as detailed in perspicuous detail in M. Gilles Deleuze's posthumous *Incest and the Life of Death in Capitalist Entertainment*. ¹¹ (*IJ* 792)

For a text so deeply influenced by Deleuze, the reference, no matter how tongue-in-cheek, demands attention. If one ignores Wallace's blatant parody of academic writing, Notkin's assessment is quite astute. Indeed, she seems to be echoing the concerns of many postmodern and Marxist critics, particularly those expressed by Frederic Jameson in "Postmodernism and Consumer Society." *Infinite Jest* the film is quite literally "the death of the subject...the failure of the new, the imprisonment in the past" (Jameson 1958-9). The Entertainment embodies the

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¹¹ Most definitely not a real book, in case there were any doubts.

dangerous feedback loop of contemporary media culture, what Jameson calls "the society of the media or the spectacle" (Jameson 1957). It's a repetitive screening of vacuous easy pleasure, empty as it addictive, and according to Wallace, fatal.

The text *Infinite Jest* is the diametric opposite of the Entertainment. The Entertainment is a closed loop, whereas *Infinite Jest* is an open rhizome. The Entertainment demands nothing from the viewer, whereas *Infinite Jest* forces us establish our own connections between plateaus[x]. When asked by Michael Silverblatt if he expected the reader to understand and appreciate the meaning of *Infinite Jest*'s fractal structure, Wallace admitted he did not. Rather, the book was about the way "life in America consists of enormous amounts of what seems like discrete bits of information coming, and the real kind of intellectual adventure is finding ways to relate them to each other and find larger patterns and meanings" (*Bookworm*). In that spirit, the point of the book for Wallace seems to be the point of living in a postmodern, media-saturated culture: Break free from the stale, recursive loop of contemporary life. Read the rhizome as you will; there are an infinite number of ways to do it, and that's what makes it exciting.

Figure 1: "The top of Figure 1 illustrates the procedure for generating a fractal called the Sierpinski Triangle. The starting figure is an equilateral triangle with sides of length 1. The next step consists of removing the white triangle in the middle with sides of length 1/2, the third step consists of removing the three white triangles with sides of length 1/4, and so on *ad infinitum*. (Frame, Mandelbrot 36-7)

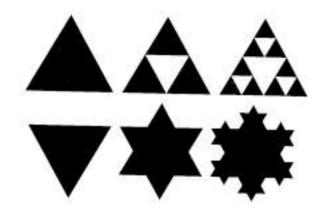


Figure 1: Top: Three steps in the creation of the Sierpinski triangle. Bottom: Three steps in the creation of the Koch snowflake.

Figure 2: A Sierpinski Gasket having undergone multiple iterations

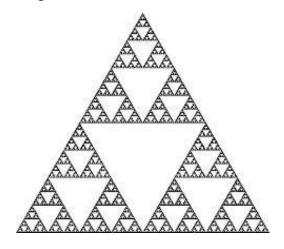


Figure 3: A Sierpinski sponge, as discussed in *A Thousand Plateaus*: "Sierpinsky's sponge: more than a surface, less than a volume...this cube is in the end infinitely hollow. Its total volume approaches zero, while the total lateral surface area infinitely grows." (Deleuze, Guattari 487)

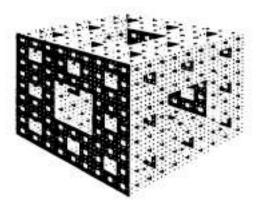
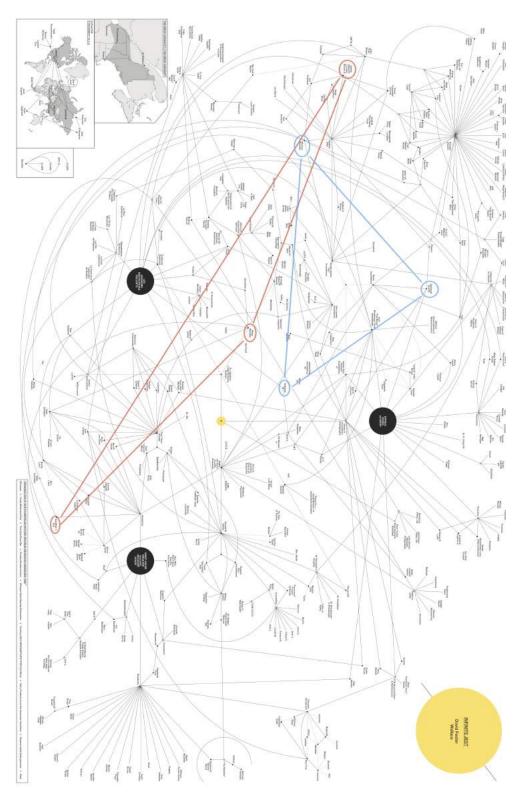




Figure 4: An excerpt of William Beutler's *Infinite Atlas*, an interactive digital project that maps all the locations in *Infinite Jest* and allows users to upload their own commentary and pictures. Pictured here is the greater New England area, with the Great Concavity highlighted in orange.

Figure 5: Included here is an edited version of Sam Potts's popular graphic web of the characters of *Infinite Jest*, an excellent example of Deleuze's rhizomatic principle of cartography, a text like "a map [that] has multiple entryways" (D&G 12). can trace every interpersonal link in the text through the web. Consider the triangle added in red, which represents footnote 304 (IJ 1055). James Albrecht Lockley Struck, Jr., Geoffrey Day, and Remy Marathe are all linked through Day's essay on Le Jeu du Procahin Train, though the three are located in distinctly separate spheres of the novel (ETA, Ennet House, and the Arizona plateau[x]). The diagram does an excellent job demonstrating how Wallace draws disparate together. important to note, however, that the graphic doesn't quite meet Deleuze's "ideal for a book [to lay] everything out on a plane of exteriority" (D&G 9). The graphic physically manifested maps relationships: location, occupation, political affiliation. It fails to account for the varying strengths of these relationships, their temporal placement, how characters line up thematically, et cetera. Now consider the blue triangle, which connects Himself, Schtitt, and the MIT sound engineer according to their association via annulation and the mathematical theory of the infinite. There are countless more complex dynamics like this that Potts can never graphically capture. We might try to plot points on a three-dimensional grid, but even that might not suffice. To adequately capture all the multiplicities of a



text, we might need to project our map into four dimensions. Wallace talks about the ability to mentally conjure a four-dimensional object, a tesseract. Unsurprisingly, it's no cakewalk. "Now try to really picture it. Concretely. You can feel, almost immediately, a strain at the very root of yourself, the first popped threads of a mind starting to give at the seams." (E&M 24)

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