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Rhetorics of Scale in Literary & Scientific Discourse

A dissertation submitted in partial satisfaction of the

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by

Jay Jin

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ABSTRACT OF THE DISSERTATION

Rhetorics of Scale in Literary & Scientific Discourse

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Professor Michael North, Chair

Rhetorics of Scale in Literary & Scientific Discourse examines the problem of scale as a mode of qualitative description, a problem that quietly underlies many theorizations of scale in both literary-critical and techno-scientific contexts but becomes incandescently knowable at their intersection. This dissertation unfolds the tangle of rhetorical and logical ambiguities, paradoxes, and slippages in three such intersections across the twentieth and twenty-first centuries: the development of zoom technology and aesthetics, the theorizations of hierarchy in narrative structuralism, organicism, and cybernetics, and debates over traditional versus computational literary criticism. With this unfolding, *Rhetorics of Scale* argues that these ambiguities are not barriers to understanding scale problems, but rather interpretive frames that make the concept of scale deployable as an analytical category in the first place—a category that analyzes the uncertainties of knowledge and describes their conditions.

The dissertation of Jay Jin is approved.

Ursula K. Heise

Mark I. Seltzer

Brian Kim Stefans

Michael North, Chair

University of California, Los Angeles

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***

Portions of Chapter Three have appeared in "Problems of Scale in 'Close' and 'Distant' Reading," *Philological Quarterly* 96, no. 1 (2017): 105-129.

JAY JIN

Curriculum Vitae

EDUCATION

M.A., English, UCLA (2013)
B.A., English and Physics, Boston College (2011)

AWARDS & FELLOWSHIPS

Dissertation Year Fellowship, Graduate Division, UCLA (2018-2019)
Dissertation Research Fellowship, English Department, UCLA (2016-2017)
Graduate Research Mentorship, Graduate Division, UCLA (2014-2015)
Mellon Pedagogy Fellowship, English Department, UCLA (2014-2015)
Graduate Summer Research Mentorship Program, Graduate Division, UCLA (Summer 2012)
University Fellowship, English Department, UCLA (2011-2012)

PEER-REVIEWED PUBLICATIONS

"Playing between Systems Theory, Affect, and Imitation in the Reality TV Show *Terrace House*." *ASAP/Journal* 5, no. 2 (Forthcoming Spring 2020)

"Problems of Scale in 'Close' and 'Distant' Reading." *Philological Quarterly* 96, no. 1 (2017): 105-129.

"The Physics of Voice in Joyce's 'Ithaca.'" *Joyce Studies Annual*. Edited by Philip Sicker and Moshe Gold. Fordham University Press, 2013: 238-251.

SELECTED PUBLIC WRITING

Review of Ted Underwood, *Why Literary Periods Mattered: Historical Contrast and the Prestige of English Studies* (Stanford U. Press, 2013). *Make Magazine* (Oct. 2015, Online)

Review of Frédérique Aït-Touati, *Fictions of the Cosmos: Science and Literature in the Seventeenth Century,* Translated by Susan Emanuel (U. of Chicago Press, 2011). *Make Magazine* (July 2013, Online)

TEACHING EXPERIENCE (UCLA, ENGLISH DEPARTMENT)

Instructor of Record (with select texts)

Critical Reading and Writing: Communicating Fragments (Fall 2019, Winter 2020, Spring 2020)
- *Harmonium, The God of Small Things, The Intuitionist*

Critical Reading and Writing: Plotting and Plodding Time (Spring 2018)
- *The God of Small Things, The English Patient, The Martian Chronicles*

Critical Reading and Writing: Networks of Power (Fall 2017)
- *The Trial, Americanah, Art: A Play*

Critical Reading and Writing: Weirded Language and Fictions (Spring 2016)
- *Babel-17, The Brief Wondrous Life of Oscar Wao, Betrayal*

Critical Reading and Writing: Science Fiction and Scientific Inquiry (Spring 2014)
- *Dune, Ubik, The Handmaid's Tale, Life of Galileo*

Critical Reading and Writing: Recording Mysteries (Winter 2014)
- *At Swim-Two-Birds, The Big Sleep, Hapgood*
Critical Reading and Writing: Literary Chaos and Order (Spring 2013, Fall 2013, Winter 2016)
-*Frankenstein, The Crying of Lot 49, Arcadia*

Teaching Assistant
Introduction to Visual Culture (Winter 2018)
Literatures in English to 1700 (Fall 2015)
20th Century British Literature (Winter 2013)
Literatures in English, 1850 to Present (Fall 2012)

CONFERENCES & PRESENTATIONS
"Hierarchy Theory in Narratology." Presented at the 20/21 (20th & 21st Century) Working Group, UCLA. (November 2019)
"Problems of Scale in 'Close' and 'Distant' Reading." Presented at the Americanist Research Colloquium, UCLA. (April 2016)
"Virtual Pets and Material Characters." Presented at the Friends of English Southland Conference: "Reading Matters," UCLA. (May 2014)
"Tense, Time, and Narrative in Elizabeth Bowen's *The Heat of the Day*." Presented at the Modernist/Experimental Literature and Text-Art Reading Group, UCLA. (May 2013)
"The Physics of Voice in 'Ithaca.'" XXIII International James Joyce Symposium: "Joyce, Dublin and Environs." Dublin, Ireland. (June 2012)

SERVICE
Co-Organizer of the Friends of English Southland Conference: "Critical Recursions," UCLA. (June 2017)

Introduction. Variations of Scale Talk

> "[M]an had translated himself into a new universe which had no common scale of measurement with the old. He had entered a supersensual world, in which he could measure nothing except by chance collisions of movements imperceptible to his senses"
>
> —Henry Adams, *The Education of Henry Adams* (1918)

> "Scale can be a frustrating concept."
>
> —Jingxiong Zhang, Peter M. Atkinson, and Michael F. Goodchild, preface to *Scale in Spatial Information and Analysis* (2014)

The influx of work on the broad topic of scale in literary-critical scholarship and analysis in the last couple of decades draws extensively from a range of scientific fields, including but not limited to ecology, geography, mathematics, and biology. Reprising Henry Adams's observation a century later, Michael Tavel Clarke and David Wittenberg note in their edited collection *Scale in Literature and Culture* (2017) that the "problems of scale" articulated across scientific disciplines can be said at their base to "comprise a region of thinking in which habits of everyday observation, or even possibly biases built into human perception itself, are especially slow to give way to empirical measurement and evaluation, even at scales far less extreme than the 'ungraspable' subatomic or the 'overwhelming' cosmological."[1] The various approaches that

[1] Michael Tavel Clarke and David Wittenberg, introduction to *Scale in Literature and Culture*, eds. Michael Tavel Clarke and David Wittenberg (Cham, Switzerland: Palgrave Macmillan, 2017), 4. Rob Nixon, *Slow Violence and*

empirical sciences have generated to rectify or theorize that gap are subsequently transposed into literary-critical contexts in two interrelated ways: discourses about scale in literature and discourses about scale in approaches to literature.

On the one hand, questions of scale are directed toward their representation in literary and cultural objects, often with a subsequent aim in tracing the ways in which such representations reveal the epistemological, affective, and social effects of scale shifts. One strand of this scholarship emphasizes forms of incommensurability between multiscalar thinking and novelistic literary representation. So for Mark McGurl, the "modern literary history of scale" commences with Daniel Defoe's *Robinson Crusoe* (1719) and Jonathan Swift's *Gulliver's Travels* (1726) as works in which "the strength of the human capacity for measure is affirmed."[2] This capacity becomes more constrained over the course of the nineteenth and early-twentieth centuries as it encounters a panoply of scientific developments, such as Darwinian evolution, modern atomic theory, and the determination of the universe's inescapable "heat-death," that all together compose Adams's "supersensual world." Faced with the "loss of the ability to scale experience appropriately," argues McGurl, literature turns instead to staging that inability as a

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the Environmentalism of the Poor (Cambridge, MA: Harvard U. Press, 2011) similarly argues that the primary difficulty of understanding cause-and-effect with regards to the broadly termed Anthropocene is because of "accelerated changes occurring at two scalar extremes—in the life-sustaining circuits of planetary biophysics and in the wired brain's neural circuitry" (11).

[2] Mark McGurl, "Gigantic Realism: The Rise of the Novel and the Comedy of Scale," *Critical Inquiry* 43.2 (2017), 413. For an extended consideration of how the human body functions as an important medium between scale as referent and scale as discourse, see Susan Stewart, *On Longing: Narratives of the Miniature, the Gigantic, the Souvenir, the Collection* (Durham, NC: Duke U. Press, 1993).

form of "posthuman comedy."[3] Looking at the novels of Thomas Hardy and Victorian geological discourses, Benjamin Morgan similarly suggests that the novel form is "not well fitted" for "reconciling multiple scales," and is in fact more instructive for dramatizing the anthropocentric limits of multiscalar representation.[4] Melody Jue likewise examines how the metaphorics of water in Amitav Ghosh's *The Hungry Tide* (2005) foregrounds the friction and Otherizing opacity involved in traversing (representationally and conceptually) across scales.[5]

Conversely, another strand of scholarship engages with such novelistic attempts as forms of stitchwork, rather than disjunction. Responding to Ghosh's assertion that the mainstream novel is ill-equipped to depict and theorize the nonhuman scales (and processes) of the Anthropocene, Ursula K. Heise points out that while Ghosh is correct with respect to the realist novel, other novelistic genres such as science fiction have explored these issues with a rather robust arsenal of literary techniques and premises such as time travel, serialized protagonists, and species narrative.[6] Charles M. Tung links these science fictional experiments to the modernist and postmodernist qualities of temporal montage and indeterminacy. In addition to signaling a kind of subjective resistance to the form of standardized time imposed by empire and capital,

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[3] McGurl, "Gigantic Realism," 419. See also Mark McGurl, "The Posthuman Comedy," *Critical Inquiry* 38.3 (2012): 533-553.

[4] Benjamin Morgan, "Scale as Form: Thomas Hardy's Rocks and Stars," in *Anthropocene Reading: Literary History in Geologic Times*, eds. Tobias Menely and Jesse Oak Taylor (University Park: The Pennsylvania State U. Press, 2017), 146.

[5] Melody Jue, "From the Goddess Ganga to a Teacup: On Amitav Ghosh's Novel *The Hungry Tide*," in Clarke and Wittenberg, *Scale in Literature and Culture*, 205.

[6] Ursula K. Heise, "Science Fiction and the Time Scales of the Anthropocene," *ELH* 86.2 (2019), 281-282.

such experiments, for Tung, produce a multiscalar and inhuman "heterochrony" and are thus "exit strategies from downscaled forms."[7]

If these two strands principally deal with scale in literature, then the other way scale discourse has become a topic of attention in literary-critical study is via approaches to literature. These approaches include questions of disciplinary categorization and methodology, as well as the "proper methods and political implications for grappling with cultural objects that either stretch or exceed the human scale."[8] So Wai Chee Dimock invokes the scale-invariant qualities of fractal geometry in order to express skepticism toward Franco Moretti's notion of "distant reading," suggesting that "if fractal geometry has anything to tell us, it is that the loss of detail is almost always unwarranted."[9] For Derek Woods, the ecological concept of "scale variance"—the notion that there exist empirically observable differences of operation and process that mark distinct scale domains—not only provides an important counterweight to the depiction of scale-

[7] Charles M. Tung, *Modernism and Time Machines* (Edinburgh: Edinburgh U. Press, 2019), 214. For interest in exit strategies from upscaled forms, see Scott Selisker, "'Stutter-Stop Flash-Bulb Strange': GMOs and the Aesthetics of Scale in Paolo Bacigalupi's *The Windup Girl*," *Science Fiction Studies* 42.3 (2015): 500-518. As he writes, "the novel makes a strong case for fiction's usefulness in rescaling and remediating technoscientific issues such as genetic modification" (500).

[8] Clarke and Wittenberg, *Scale in Literature and Culture*, 22. Heise, "Science Fiction" writes that in addition to exploring "the ability of existing narrative forms to engage with large scales of space and time" (the first way, in my account), questions of scale have also primarily revolved around issues of canon-broadening and digital (often computation-based) tools (275).

[9] Wai Chee Dimock, *Through Other Continents: American Literature across Deep Time* (Princeton, NJ: Princeton U. Press, 2006), 79.

invariance in canonical literature (such as the Lilliputians and Brobdingnagians in *Gulliver's Travels*) and to the scale-invariant assumptions of zooming in and out. What ecological "scale variance" shows, for Woods, is a more basic ontological truth: "[t]he evidence points to scale variance as the rule, scale invariance the exception, with the former central to understanding climate change."[10] In a similar vein, historian Julia Adeney Thomas weaves together insights from paleobiology, microbiology, and biochemistry to argue that we are underdetermined from above and overdetermined from below, not able to experience a species identity, yet so open to and molded by our chemical environments: "Each science," Thomas writes, "usefully defamiliarizes 'the human' as portrayed by most historians."[11] Common to these approaches is the sentiment that the sciences have developed rich and variegated accounts of scale, and literary scholarship can thus benefit in importing such insights.

My project chiefly contributes to this latter body of scholarship, examining the rhetorical constructions and deployments of scale that occur at the intersection between literary-critical and techno-scientific discourses.[12] In so doing my aims are threefold: 1) to attend to discursive and

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[10] Derek Woods, "Scale Critique for the Anthropocene," *Minnesota Review* 83 (2014), 136. See also Derek Woods, "Epistemic Things in Charles and Ray Eames's *Powers of Ten*" in Clarke and Wittenberg, *Scale in Literature and Culture*, 65.

[11] Julia Adeney Thomas, "History and Biology in the Anthropocene: Problems of Scale, Problems of Value," *American Historical Review* 119.5 (2014), 1603. See also Dipesh Chakrabarty, "The Climate of History: Four Theses," *Critical Inquiry* 35.2 (2009): 197-222.

[12] This formulation of "constructing scale" follows from work in human geography that shifts discussion from scale as an ontological environment in which events unfold toward scale as something "constructed" or "produced" by social and political actors. See Erik Swyngedouw, "Neither Global nor Local: 'Glocalization' and the Politics of

conceptual ambiguities encountered by scientific attempts to coordinate different kinds of scale, 2) to clarify these ambiguities as they have been replicated in literary-critical discourses, and 3) to argue that the critical potency of "scale" lies in its potential as an analytic that snaps these ambiguities sharply into view, to let us see, probe, and even reshape their contours. Indeed, these ambiguities—which, unfolded in more detail in the chapters, involve considerations of size and perspective, process and objecthood, interpretation and evidence—orbit around what Joanna Zylinska calls entanglement: namely that "the notion of scale cannot be seen as an external measuring stick that can be objectively applied in time and space but is rather part of the phenomena it attempts to measure."[13] Or formulated in different terms, entanglement evinces a Möbius strip-esque paradox where hetero-reference (pointing to the measurement) and self-reference (pointing to the measurer) are simply two sides of the same side. This project attends to these paradoxes as rhetorical and discursive formulations, not in order to suppress or solve them, but to "enlarge the frames of received opinion."[14]

Consider, for example, the opinion that begins and frames a recent survey on the topic of scale by geographers Jingxiong Zhang, Peter M. Atkinson, and Michael F. Goodchild: "Scale

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Scale," in *Spaces of Globalization: Reasserting the Power of the Local*, ed. Kevin R. Cox (New York: The Guilford Press, 1997): 137-166, and Sallie A. Marston, "The Social Construction of Scale," *Progress in Human Geography* 24.2 (2000): 219-242.

[13] Joanna Zylinska, *Minimal Ethics for the Anthropocene* (Ann Arbor, MI: Open Humanities Press, 2014), 29.

[14] Niklas Luhmann, "Paradox of Observing Systems," *Theories of Distinction: Redescribing the Descriptions of Modernity* (Stanford, CA: Stanford U. Press, 2002), 80.

can be a frustrating concept."[15] According to the authors, what scale "frustrates" (besides the researchers who grapple with it) is a kind of semantic transparency and orderliness. Indeed, one of the most colloquial references to scale—a large-scale or small-scale map—has opposite meanings between geographers and ecologists. While in geography a large-scale map conventionally means a map of a smaller area (like a town map as opposed to a state map; large-scale thus refers to a larger degree of spatial reduction), in ecology a large-scale map refers to the spatial extent of the represented area (and thus means a map of a larger area).[16] Within geography itself, biophysical geographers tend to consider scale as either a characteristic of ontological phenomena and processes or as a methodological constraint, while human geographers examine the ways in which scale is strategically constructed by actors in social and political contexts.[17] Paraphrasing the work of sociologist Bob Jessop, Andrew Herod observes a common failure to distinguish between three "scalar turns": the thematic turn in which scale becomes an analytic category, the methodological turn in which scale is seen as an important entry point for analysis itself, and the ontological turn in which scale is viewed as a key

[15] Jingxiong Zhang, Peter M. Atkinson, and Michael F. Goodchild, *Scale in Spatial Information and Analysis* (New York: CRC Press, 2014), ix.

[16] Monica G. Turner, Robert H. Gardner, and Robert V. O'Neil, *Landscape Ecology in Theory and Practice: Pattern and Process* (New York: Springer-Verlag, 2001), 30-31.

[17] Robert B. McMaster and Eric Sheppard, introduction to *Scale and Geographic Inquiry: Nature, Society, and Method*, eds. Eric Sheppard and Robert B. McMaster (Malden, MA: Blackwell Publishing, 2004), 2.

structuring feature of natural and social worlds.[18] Thus, Zhang et al. lament that scale "has multiple meanings even in a single scientific domain" and "significant variation in meaning across domains," and they accordingly offer to "alleviate some of this frustration by taking a rigorous, scientific approach to scale and its various meanings in relation to the geographic world"—scientific, which is to say, "heavily mathematical."[19]

Yet we can reframe these frustrating semantic problems by deploying two distinctions. The first is a constative/performative distinction, which shifts the question from what scale "means" to what scale "does" (from a question of how one describes scale to how scale describes).[20] The second is a distinction between the notion of different scales and different *kinds* of scale. The former (different scales) follows from the visual logic prompted by the Latin root word *scala* meaning ladder: different temporal-spatial scales are in this sense "rungs" along a continuum. Indeed, as Andrew Kirby has pointed out, geographical categories like the local, national, and global tend to be deployed analogously to the way "physical scientists have tended to organize the components of the universe...using a simple geometric progression such as meter-

[18] Bob Jessop, "Avoiding traps, rescaling states, governing Europe," in *Leviathan Undone? Towards a Political Economy of Scale*, eds. R. Keil and R. Mahon (Vancouver: U. of British Columbia Press, 2009): 87-104. Andrew Herod, *Scale* (London: Routledge, 2011), 37.

[19] Zhang et al., *Scale in Spatial Information and Analysis*, ix-x.

[20] See J. L. Austin, *How to Do Things with Words*, 2nd ed. (Cambridge, MA: Harvard U. Press, 1975). As Austin makes clear over the course of his ten lectures, the constative/performative distinction is not a taxonomy into which we can sort speech-acts, but an interpretive framework for any given speech-act: "every genuine speech act is both" (147).

^{1}, meter^{1}, meter^{10}, and so forth."[21] Even in an analytic framework like world-systems theory, Kirby notes, integrating the dynamics of the "small" family household with the dynamics of the "large" global capitalist economy requires, in a basic sense, a reaffirmation of their positions along a scalar continuum. What changes is the way we think about the relations between the rungs.

By contrast, with different kinds of scale we can think of different scale models, not only in the narrow sense of dioramas and miniatures (whose parts tend to be linearly scaled, i.e., made in a fixed proportion to its full size), but in the broader sense of discursive, physical, and mathematical tools that "compensat[e] for the renunciation of sensible dimensions by the acquisition of intelligible dimensions."[22] The problem of coordinating different kinds of scale—for instance, cartographic, measurement, and operational scales—is not just a matter of qualitative versus quantitative description, but, as Zhang et al. suggest in their epilogue, a problem of self-reference.[23] As they put it,

> we start with human experience and end with human experience. The sampling framework is driven in this view by the position and viewing angle of the observer, and that is all there is....For example, the separate processes for analyzing form, color, and

[21] Andrew Kirby, "Popular Culture, Academic Discourse, and the Incongruities of Scale," in *Geographies of Power: Placing Scale*, eds. Andrew Herod and Melissa W. Wright (Malden, MA: Blackwell Publishing, 2002), 171-172.

[22] Claude Lévi-Strauss, *The Savage Mind* (London: Weidenfeld and Nicolson, 1966), 24.

[23] Cartographic scale refers to the ratio between lengths on a map and lengths of the mapped area, measurement scale refers to the smallest distinguishable units of an image or object like pixels, and operational scale refers to the spatial and temporal extents of processes.

> movement in the human visual system are all used whether viewing a subject through a telescope (large distant objects) or a microscope (micro-scale objects) and may therefore all be scale invariant. It is only be reminding ourselves of...how close to or far away from the subject of interest we are that we can make sense of, and interact with, the world around us.[24]

Scale, then, is not only a phenomenon, quality, or process to be described, but itself a mode and model of description, a "form of world-making" that simultaneously points to its referent and to its own pointing.[25] In ecology, hierarchy theory—an analytical approach to modeling multi-scaled complex systems derived from the work of Herbert Simon, Ilya Prigione, and Jean Piaget—is first and foremost self-described as "a theory of the role of the observer and the process of observation in scientific discourse."[26] Or as Mark Seltzer writes with regard to the autopoietic and self-describing procedures of the "official world": "The scale model...makes visible the relation of observation to itself—and so its contingent and self-referential structure."[27]

Thus, we arrive at a well-mapped impasse. The concept of scale across scientific and

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[24] Zhang et al., *Scale in Spatial Information and Analysis*, 302.

[25] Mieke Bal, "Over-writing as Un-writing: Descriptions, World-Making and Novelistic Time," in *Narrative Theory: Critical Concepts in Literary and Cultural Studies*, ed. Mieke Bal, vol. 1 (New York: Routledge, 2004), 382.

[26] Valerie Ahl and T. F. H. Allen, *Hierarchy Theory: A Vision, Vocabulary, and Epistemology* (New York: Columbia U. Press, 1996), 27. See also T. F. H. Allen and Thomas B. Starr, *Hierarchy: Perspectives for Ecological Complexity* (Chicago: The U. of Chicago Press, 1982).

[27] Mark Seltzer, *The Official World* (Durham, NC: Duke U. Press, 2016), 100.

humanistic disciplines generally attempts to address the gap between, on the one hand, ordinary human sense perceptions of space and time and, on the other, the measurement and evaluation of the "supersensual" world. Yet, to understand scale as a mode of self-referential description is, in a sense, to close off access to that world. This is the philosophical crux Quentin Meillassoux summarizes as "correlationism," the hermetic relation between subject-object or language-referent that turns the possibility of reality outside of perception (the "great outdoors") into the impossibility of an ever-receding horizon.[28] It is also the crux of the prison-house of language that has motivated disciplinary calls in the past decade for "surface reading" and postcritique.[29] As Bruno Latour points out, climate change deniers in (mass and social) media and policy-making positions have quite seamlessly operationalized the very constructivist positions which had animated science studies in the 1980s and 90s—critical ground's hollowing out of itself.[30] "The mistake we made," Latour writes, "was to believe that there was no efficient way to criticize matters of fact except by moving *away* from them and directing one's attention *toward* the conditions that made them possible."[31] Aside from changing frames (the promise of surface reading, postcritique, etc.) there are also critical efficacies to indicating frames, not in the sense of disclosure ("the author declares there are no conflicts of interest"), but in the sense of making

[28] Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. Ray Brassier (New York: Continuum, 2008), 1-27.

[29] See, respectively, Stephen Best and Sharon Marcus, "Surface Reading: An Introduction," *Representations* 108.1 (2009): 1-21 and Rita Felski, *The Limits of Critique* (Chicago: The U. of Chicago Press, 2015).

[30] Bruno Latour, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30.2 (2004): 225-248.

[31] Latour, "Why Has Critique Run out of Steam?," 231. Italics his.

empirical observations.[32]

My approach to this impasse is thus rather old-fashioned. The chapters to follow are largely poststructuralist and new historicist in character, attending to rhetorical and discursive ambiguities between different kinds of scale and tracking those ambiguities along historical and disciplinary trajectories. Moreover, I argue that such ambiguations are, in part, what allow for discursive constructions of scale to be legible as such in the first place (i.e. conditions). This is nowhere so apparent as in physicist Geoffrey West's tersely titled but sprawlingly subtitled work, *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies* (2017). The title is an "integrated unifying conceptual framework" for its subtitle, as West puts it.[33] However, the construction of "scale" as a singular analytic proceeds by a patchwork of different scale models: most prominently featured are the quarter-power scaling laws that describe different scale-dependencies (such as size and density), but there are also fractal geometries and the rhetorical tropes of synecdoche and "scala."[34] So West notes the common occurrence of phrases like "the DNA of the company" and "the metabolism of the city," asking, "are these just metaphors or do they encode something of real scientific substance?"—encode substance, perhaps, but also direct and shape scientific

[32] So Niklas Luhmann, "Identity—What or How?" *Theories of Distinction* argues: "whatever its adherents may say, constructivism is obviously a realistic epistemology that uses empirical arguments. Its main thrust is directed only against epistemology's old claim to self-grounding and its forms of externalization: God or the subject" (205, n2).

[33] Geoffrey West, *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies* (New York: Penguin Press, 2017), 5.

[34] If synecdoche substitutes part for whole, "scala" substitutes an object or process from one scale domain for an object or process from another. See Woods, "Epistemic Things," 63-69.

inquiry.[35] Such was the case with the research programmes of molecular biologists in the 1960s and 70s, whose references to DNA "hybridization" blended the epistemic and discursive scale models of the organism (where classical genetics, with its focus on hybridized phenotypes, operated) with the scale models of the DNA molecule (and its genotypes). Rhetorical ambiguation and conflation did not dissolve a scalar distinction (organism/phenotype versus molecule/genotype) so much as reintroduce it on the level of the molecule, making available the notion of "the genotype's phenotype."[36] This is a paradox, but knowledge and action are founded on paradoxes.[37] Even West's grand vision of a quantitative framework for scale-dependence is, from the viewpoint of ecology, a framework for scale-independent scale-dependence: "West, like many physical scientists, thinks of scale in terms of dimensionless ratios that characterize processes or mechanisms," writes ecologist Aaron M. Ellison, "Because it is dimensionless, it can be applied to objects of any size...the result is a scale-independent understanding of physical processes and mechanisms."[38]

Rhetorics of Scale in Literary & Scientific Discourse examines rhetorical paradoxes, ambiguities, reintroductions, and conflations as frames of logic central to the discursive construction of scale—not to suppress these frames, but to clarify the different kinds of scale, the various scale models, that they marshal and coordinate. In so doing, my project makes a case for

[35] West, *Scale,* 10-11.

[36] Hans-Jörg Rheinberger and Staffan Müller-Wille, *The Gene: from Genetics to Postgenomics*, trans. Adam Bostanci (Chicago: The U. of Chicago Press, 2017), 81-82.

[37] Niklas Luhmann, "Deconstruction as Second-Order Observing," *Theories of Distinction*, 101.

[38] Aaron M. Ellison, "A Sense of Scale," *Bulletin of the Ecological Society of America* 99.2 (2018), 174.

literary-critical discourse as a co-participant in these constructions.[39] This is partly for the sake of historical and conceptual interest, but also for the sake of foregrounding the particular force literary-critical discourse has for understanding and deploying scale as a mode of qualitative description. This force is not one of demystification, or of pulling back the veil, but of explicitly proliferating frames for possible connection: of maintaining the world as severed by distinctions, frames, and scales, and maintained by its severance.[40]

Each chapter is a case study, unpacking a confluence of scale problems and considerations at the intersection of various literary-critical and techno-scientific fields during the twentieth and twenty-first centuries. Chapter one follows the emergence of the metaphor of zooming in and out as a way of conceptualizing continuity across scales of time and space. Tied to the political-visual technologies of the aerial view, as well as of popular and avant-garde cinematography, the metaphor of the zoom operationalizes scale and makes it legible by erasing, in sometimes quite a literal way, distinctions of size, perspective and magnification. Which is to say, "scale" as a singular discursive construct becomes a manner of pivoting seamlessly between scales of size and distance. Chapter two looks at the role of hierarchical levels in literary structuralism, cybernetics, and organicist biology during the mid-twentieth century. Scale

[39] This project thus complements work by Derek Woods on the rhetorical tropes deployed in ecological science writing and by Heise on the role of narrative in structuring biodiversity databases. See, respectively, Derek Woods, "Scale in Ecological Science Writing," *Routledge Handbook of Ecocriticism and Environmental Communication*, eds. Scott Slovic, Swarnalatha Rangarajan, and Vidya Sarveswaran (New York: Routledge, 2019): 118-128 and Ursula K. Heise, *Imagining Extinction: The Cultural Meanings of Endangered Species* (Chicago: The U. of Chicago Press, 2016).

[40] Luhmann, "Paradox of Observing Systems," 85.

discourse in these contexts was often the result of both conflating levels of classification with levels of reality and explicitly theorizing this conflation. Questions of whether objects and processes at a higher level enveloped or were composed of objects and processes at a lower level (organs systems, for example, are enveloped by an organism but do not "compose" that organism in the same sense that molecules are composed by atoms) were reprised in structuralist models of narrative analysis. The third and final chapter outlines a rather patchy history of the phrase "close reading" in English literature departments. It does so to argue that the methods of "close" and "distant" reading do not sit in positions along a single scalar continuum (one that goes, for instance, from a single passage to thousands of texts), but in fact coordinate scales of interpretation and scales of textual evidence.

If these chapters primarily focus, as I noted at the beginning, on discourses about scale in approaches to literature, the dissertation concludes with a brief coda that explores potential consequences for discourse about scale in literature. The coda returns to this question by dilating a transitory and passing exchange between Virginia Woolf and the science fiction writer Olaf Stapledon. Their mutual recognition of a shared project, one that for Woolf occurs on the scale of decades and for Stapledon on the scale of billions of years, sidesteps the question of whether their novels succeed or fail in reconciling multiple time scales. Rather, Woolf and Stapledon invite us to consider how narrative scales are legible as scales in the first place. Or put differently, they invite us to unfurl the two-sided distinction: how are narrative scales observed and what do they make observable?

Chapter 1. Zooming and the Spatial Construction of Scale

"You are lost in a small town, late for a vital appointment," Timothy Clark asks us to imagine at the start of his essay "Derangements of Scale," when a "friendly-looking stranger" provides you a map: "the whole town is there, he says. You thank him and walk on, opening the map to pinpoint a route. It turns out to be a map of the whole earth. The wrong scale."[41] Clark's aim here is to depict the importance of scalar difference and, following this, to diagnose the "dominant modes of literary and cultural criticism" as suffering from derangements of scale—an "implosion of scales, implicating seemingly trivial or small actions with enormous stakes," that has resulted from placing too much critical trust in cartographic scale (the ratio between ground and map distances) and its capacity to "move from a large to small scale or vice versa" via a "smooth zooming out or in."[42] One critic thus sees Clark's scenario as demonstrating the fact that "we cannot obtain the localised information we need to navigate our way through our immediate environment from a map on a global scale" and, conversely, that we cannot "orient ourselves globally from a large scale map of an individual town."[43]

But why is this a problem of scale and not a problem of, say, wrong maps? Put another way, what are we to make of this rhetorical and conceptual shift from "wrong map" to "right

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[41] Timothy Clark, "Derangements of Scale," in *Telemorphosis: Theory in the Era of Climate Change*, ed. Tom Cohen, vol. 1 (Ann Arbor, MI: Open Humanities Press, 2012), 148.

[42] Clark, "Derangements of Scale," 150, 152, 148.

[43] Pippa Marland, "320 Million Years, a Century, A Quarter of a Mile, a Couple of Paces: Framing the 'Good Step' in Tim Robinson's *Stones of Aran*," in *Framing the Environmental Humanities*, eds. Hannes Bergthaller and Peter Mortensen (Boston: Brill Rodopi, 2018), 56.

map, wrong scale"? For "the whole town is there," remarks Clark's stranger, who is not exactly the most trustworthy figure except that the question of "wrong map" versus "wrong scale" is precisely a question of whether the map "contains" anything it does not depict. "The problem with his map was not that it did *not* include the town," summarizes another critic, "but that it included so much more."[44] In other words, understanding the story as an illustration of scalar disjuncture, and specifically non-zoomable scalar disjuncture, requires one to accept the existence of the town and its streets "on" the map—they are there, just simply not visible or accessible at this scale. At the same time, however, this assumption of nested detail is predicated on the very metaphor of zooming in and out we are meant to do away with, as if the friendly-looking stranger, instead of handing out a map of the earth, handed out a phone loaded with Google Maps (pinch out to zoom in). Scale as an analytic category here is thus only made meaningful and recognizable as such ("wrong scale" and not "wrong map") because of the visual metaphor of the zoom, not in spite of it. Even as Clark argues for the limitation of the zoom when dealing with scale "jumps and discontinuities," he employs the zoom to describe those discontinuities. "A long fought-for nature reserve," he writes, "designed to protect a rare ecosystem, becomes, zooming out, a different place."[45]

Clark's attempts at articulating scale discontinuity resort back to the zoom, rhetorically and conceptually, because these "scales" are themselves in part constructed by the zoom in the first place. Although the parable of the town requires the town to remain unchanged, the

[44] Roman Bartosch, "Scale, Climate Change, and the Pedagogic Potential of Literature: Scaling (in) the Work of Barbara Kingsolver and T.C. Boyle," *Open Library of Humanities* 4.2 (2018), 2. Italics his.

[45] Clark, "Derangements of Scale," 149.

example of the nature reserve depends on the opposite: a map of the earth may show the town and its streets at the "wrong scale," but the nature reserve becomes a "different place." That both are examples of scale disjuncture attests to the way the zoom constructs the concept of scale through a contradictory procedure of ambiguating spatial logics of size, perspective, and magnification. The fiction of imagining a map of the earth that "contains" the town in detail, which is to say a map of seemingly infinite resolution, and calling that fiction a matter of scale, is the product of a historically specific zoom aesthetic.

Against this background, this chapter has two aims. The first is to denaturalize and historicize the visual metaphor of the zoom by tracking the history of the word itself, and through this history coordinate its development as a technology and aesthetic. The second is to examine the ways in which the historical transformation of the zoom from a description of bodies moving through space to a description of a point of view, as inaugurated by Ray and Charles Eames's 1977 film *Powers of Ten* and epitomized now by the procedures and aesthetics of Google Earth and Google Maps, has inflected the concept of scale with particular spatial connotations of perspective, distance, and size—connotations that need to be recognized and accounted, as will be explored in the coda, for when framing problems of scale in relation to literature and narrative.

"Baffling 'zoom' shots": From Speed to Magnification

The *Oxford English Dictionary* lays out a somewhat linear history for the word "zoom," recording its onomatopoeic origins in the second half of the nineteenth century as a reference to both the flitting movements of insects like bees and hornets and their corresponding buzzing

sounds. Its usage broadened to refer to speediness, but in the late 1910s and early 1920s it also began referring specifically to airplane movement and noise, an adoption that likely accompanied the airplane's "modern animism": the conceptualization of the airplane via comparisons to insects and birds across artistic and scientific discourses in the early twentieth century.[46] So although "zoom" as both verb and noun could still designate a general quickness and rapidity—"Burton escaped with a zoom around right tackle" (1921); "Walling's Return Zooms Husky Stock" (1923); "you can zoom past 'em all with this new [Harley-Davidson] motor" (1923)—it also came to signify a type of airplane maneuver and, by extension, American and European public interest in aviation as punctuated by Charles Lindbergh's 1927 solo flight across the Atlantic.[47] If in 1923 Harley-Davidson could run an advertisement for zooming-sans-airplane, by 1932 they advertised "Ground Flying": "Banking the turns, zooming up and over hills, then cutting the motor for long, thrilling 'dives' down the grades...the thrills of air travel without its risks and expense."[48] "Zoom - To climb rapidly at a very steep angle" concluded a 1921 article titled "The New 'Language of the Air,'" and in 1922 *Burlington Free Press*: "We heard a little about zooms before the war. But they had them just the same. The word has

[46] Robert Hemmings, "Modernity's Object: The Airplane, Masculinity, and Empire," *Criticism* 57.2 (2015), 286.

[47] Respectively, Paul Warwick, "Clemson Rushes Over Touchdown Against Tech, But Is Swamped," *Atlanta Constitution (GA)*, November 6, 1921; Frank Getty, "Walling's Return Zooms Husky Stock," *Lincoln Journal Star (NE)*, June 27, 1923; "You Can Zoom Past 'Em All With This New Motor," advertisement in *Star-Gazette* (Elmira, NY), July 28, 1923. For an historical account of public interest in aviation during the period and its intersection with contemporaneous social theories of organization, see Jeanne Haffner, *The View From Above: The Science of Social Space* (Cambridge, MA: The MIT Press, 2013).

[48] Advertisement in *Popular Mechanics* 7 (1932), 129.

entered very few dictionaries as yet. What is it?...A 'zoom' is a sudden leap upward of an airplane in flight."[49]

Then, by the end of the decade and in the early 1930s, expressions of aerial "zoom" fatigue:

> Reporters seem to have coined a brand new word for themselves when they write up spectacular airplane flights. It is "zoom." A plane goes zooming up or zooming down or in a circle. But we never heard of anything but bumble bees zooming. The scribes may forget to overwork "irk" for awhile now that they have a new pet word.
>
> Woe, for instance, to the aviation editor who chronicles that a plane "zoomed down." You can't zoom any way but up, say the authorities - but how is a newspaper writer to sense that a nice, expressive word like "zoom" has a limited usage unless she knows a great deal about aviation?
>
> My idea of nothing to read is a war story about the gruff top sergeant and the young born-with-a-silver-spoon-in-his-mouth hero who waited with his feet in the water for the zero hour. And airplane stories. I don't remember now whether they zoom up or zoom down; but they zoom most tediously.[50]

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[49] Respectively, "The New 'Language of the Air,'" *St. Louis Star and Times (MS)*, November 6, 1921; "Are You Zooming?" *Burlington Free Press (VT)*, January 24, 1922.

[50] Respectively, "Hits and Misses," *Wausau Daily Herald (WI)*, September 11, 1929; "Which War to Zoom," *Gaffney Ledger (SC)*, January 16, 1930; and Harry Carr, "War Stories," *Los Angeles Times*, September 2, 1932.

"Zoom" thus participated in what Alan Lovegreen calls the "Western discourse network" of "aerofuturism," an interwar imaginary about aviators, aviation, and aerial cityscapes that mediated public fears of aerial bombardment by reconfiguring the horizontal frontier into a vertical one (and indeed "zoom" referred to the maneuver that emphasized the airplane's verticality).[51]

This meaning of "zoom" also circulated, however, within the broader regime of speed as theorized by Enda Duffy. In Duffy's account, the modern experience of speed enabled by cars, airplanes, and trains after the turn of the nineteenth century was not an incidental byproduct of technological advancements, but more fundamentally an "expression of a new order of the organization of global space," that is, a politicized yet at the same time individualized response to "that paradigm-shattering moment when it became clear that the whole world had at last been mapped and conquered."[52] So even today we might say that a car or motorcycle zoomed "by" as a pure expression of speed and sound. Yet as Vittoria Di Palma observes, in terms of zooming "in" and "out" the zoom actually "renders space and distance irrelevant," de-corporealizing questions of speed and converting them into questions of magnification and resolution.[53]

The beginnings of this pivot from describing the movement of bodies through space to describing a mode of seeing itself is registered by the *OED* with the word's migration into

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[51] Alan Lovegreen, "Aerial Homsteading: Aerofuturism in Interwar America," *Criticism* 57.2 (2015), 235.

[52] Enda Duffy, *The Speed Handbook: Velocity, Pleasure, Modernism* (Durham, NC: Duke U. Press, 2009), 20, 19.

[53] Vittoria Di Palma, "Zoom: Google Earth and Global Intimacy," in *Intimate Metropolis: Urban Sights in the Modern City*, eds. Vittoria Di Palma, Diana Periton, and Marina Lathouri (London: Routledge, 2009), 260.

cinematographic and photographic contexts in the early 1930s. Nick Hall marks a distinction, in these contexts, between the "zoom lens" and the "zoom shot."[54] The first is the technological apparatus that allows one to continuously change a camera's focal length while keeping focus (the emphasis here on "continuously" and "keeping focus").[55] The second refers to the aesthetics of the resulting shot, produced by the movement of lens elements within the camera, in contrast to the "dolly" or "tracking" shots produced by the movement of the camera itself through space. As the story roughly goes, although one of the first experimental zoom lenses was developed by C.C. Allen in 1901, there is a gap of two-and-a-half decades between Allen's patent and the first recorded instance of the zoom shot in 1927.[56] In the early 1920s Joseph B. Walker, a Hollywood cinematographer, designed a zoom lens he named the "Traveling Telephoto lens."[57] From the mid-1920s through the early 1930s, zoom shots began to appear now and then in American films, almost all of which were produced by Paramount Pictures, and by the early 1930s, other

[54] Nick Hall, *The Zoom: Drama at the Touch of a Lever* (New Brunswick, NJ: Rutgers U. Press, 2018), 7-8.

[55] A technical explication of how this effect was historically achieved in various ways can be found in Rudolf Kingslake, "The Development of the Zoom Lens," *Journal of the Society of Motion Picture and Television Engineers* 69, no. 8 (1960): 534-544.

[56] Clile C. Allen, Optical Objective, US Patent 696788, filed February 25, 1901, and issued April 1, 1902. Rudolf Kingslake, *A History of the Photographic Lens* (Boston: Academic Press, Inc., 1989) calls Allen's varifocal system "to be the forerunner of many current zoom designs" (155). For an account of this historical gap, see Hall, *The Zoom*, 28.

[57] Joseph B. Walker and Juanita Walker, *The Light on Her Face* (Hollywood: The ASC Press, 1984), 267.

models entered commercial circulation.[58]

By 1932, Arthur Warmisham and R.F. Mitchell could introduce their "Varo lens" as "a new type of variable focus, variable magnification lens, generally designated as the 'zoom lens.'"[59] That same year, a letter from the president of the Society of Motion Picture Engineers to the American Standards Association asked for help in standardizing (among many things) industry definitions: "The terminology of the motion picture field is confused at present. Such terms as 'blimp,' 'zoom,' 'pan,' 'tilt,' 'projection angle,' 'wow,' or 'flutter,' and the like, are used without any official recognition."[60] Nor was the term limited to technical or industry-specific journals. Newspaper advertisements for Roland West's 1930 film *The Bat Whispers* referred to its inclusion of "one of the baffling 'zoom' shots" produced by a "'zoom' machine."[61] Some advertisements went as far as proclaiming that "the 'zoom' shot has been perfected for

[58] For the relationship between Walker's zoom lens and movie studios, see Barry Salt, *Film Style and Technology: History and Analysis*, 3rd ed. (London: Starword, 2009), 204. For an account of other commercial models, see Kingslake, "The Development of the Zoom Lens," 535.

[59] Arthur Warmisham and R.F. Mitchell, "The Bell & Howell Cooke Varo Lens," *Journal of the Society of Motion Picture and Television Engineers* 19, no. 4 (1932), 329.

[60] "SMPE Requests National Standards for Motion Picture Industry," *Journal of the Society of Motion Picture Engineers* 19, no. 4 (1932), 393.

[61] Examples can be found in "Spent 35 Cents Piles All Gone," *Logansport Pharos Tribune (IN)*, September 18, 1930; "Behind the Scenes in Hollywood," *Shamokin News Dispatch (PA)*, August 23, 1930; and "Social Activities in City," *Sheboygan Press (WI)*, August 25, 1930.

talking pictures."[62] David Bordwell suggests that "before the zoom lens came into wide use, the word 'zoom' was used for a fast tracking shot forward," and indeed some of the advertisements for *The Bat Whispers* describe its zoom shot as "send[ing] the camera 18 feet (in this instance) in the fraction of a second...as straight and silently as a spear."[63] This description stresses the quickness and stability of movement, and is much in line with Warmisham and Mitchell's own thoughts on the subject: "the ease and smoothness of operation...together with the speed of the lens, are its [the Varo lens's] outstanding attributes."[64]

Yet the word was not attached to variable magnification and focus lenses solely on the basis of speedy movement, independent from its usage in aerial contexts. The January 1932 issue of *American Cinematographer*, for instance, ran on its first page an advertisement for Warmisham's Bell & Howell Cooke Varo Lens promising a "totally different lens" which "makes possible to 'swoop' or 'zoom' down on a subject and to recede from it *without moving camera or scene*" (Fig. 1).

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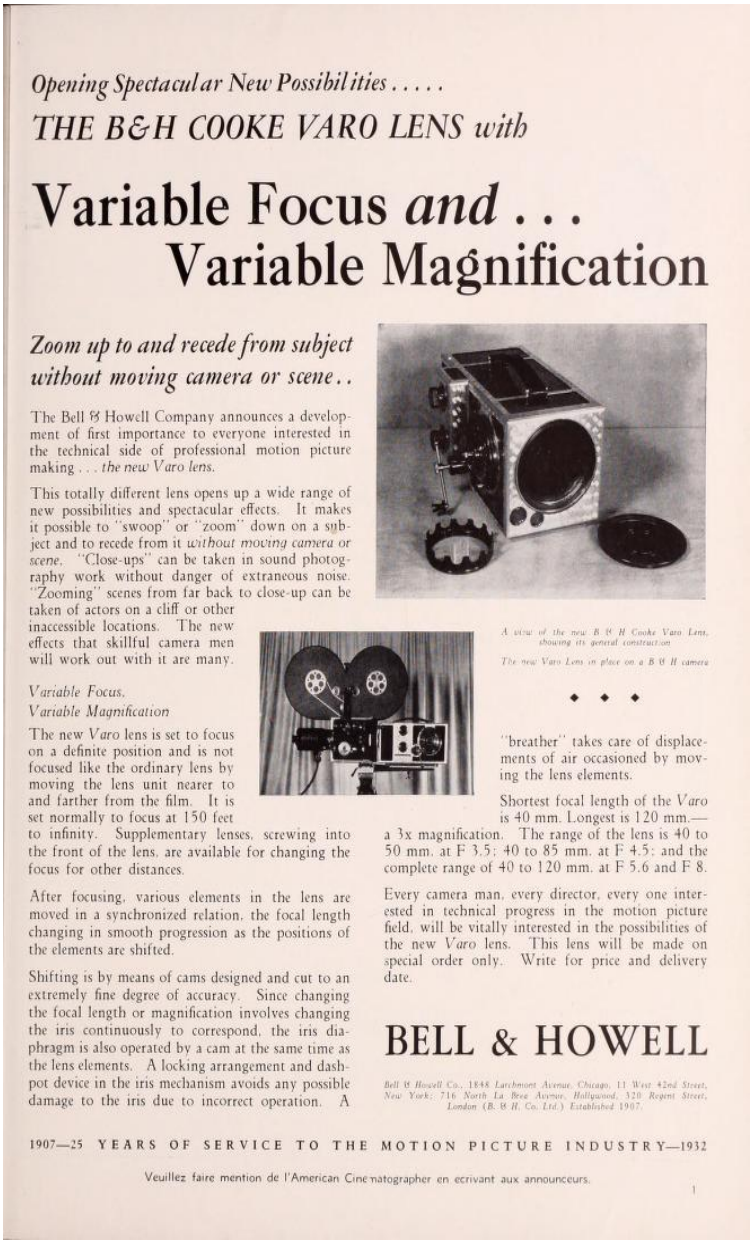
[62] See for instance: "'The Bat Whispers' Feature at Rialto," *Morning Call* (Allentown, PA), December 3, 1930; "Zooming Camera," *Detroit Free Press (MI)*, January 16, 1931; "The Bat Whispers," *Green Bay Press-Gazette (WI)*, February 3, 1931.

[63] David Bordwell, *On the History of Film Style* (Cambridge, MA: Harvard U. Press, 1997), 313. Advertisements cited in note 62.

[64] Warmisham and Mitchell, "The Bell & Howell Cooke Varo Lens," 339.



Opening Spectacular New Possibilities . . . . .

THE B&H COOKE VARO LENS with

Variable Focus *and* . . . Variable Magnification

Zoom up to and recede from subject without moving camera or scene . .

The Bell & Howell Company announces a development of first importance to everyone interested in the technical side of professional motion picture making . . . *the new Varo lens.*

This totally different lens opens up a wide range of new possibilities and spectacular effects. It makes it possible to "swoop" or "zoom" down on a subject and to recede from it *without moving camera or scene.* "Close-ups" can be taken in sound photography work without danger of extraneous noise. "Zooming" scenes from far back to close-up can be taken of actors on a cliff or other inaccessible locations. The new effects that skillful camera men will work out with it are many.

Variable Focus.
Variable Magnification

The new *Varo* lens is set to focus on a definite position and is not focused like the ordinary lens by moving the lens unit nearer to and farther from the film. It is set normally to focus at 150 feet to infinity. Supplementary lenses, screwing into the front of the lens, are available for changing the focus for other distances.

After focusing, various elements in the lens are moved in a synchronized relation, the focal length changing in smooth progression as the positions of the elements are shifted.

Shifting is by means of cams designed and cut to an extremely fine degree of accuracy. Since changing the focal length or magnification involves changing the iris continuously to correspond, the iris diaphragm is also operated by a cam at the same time as the lens elements. A locking arrangement and dashpot device in the iris mechanism avoids any possible damage to the iris due to incorrect operation. A "breather" takes care of displacements of air occasioned by moving the lens elements.

A view of the new B & H Cooke Varo Lens, showing its general construction

The new Varo Lens in place on a B & H camera

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Shortest focal length of the *Varo* is 40 mm. Longest is 120 mm.—a 3x magnification. The range of the lens is 40 to 50 mm. at F 3.5; 40 to 85 mm. at F 4.5; and the complete range of 40 to 120 mm. at F 5.6 and F 8.

Every camera man, every director, every one interested in technical progress in the motion picture field, will be vitally interested in the possibilities of the new *Varo* lens. This lens will be made on special order only. Write for price and delivery date.

BELL & HOWELL

Bell & Howell Co., 1848 Larchmont Avenue, Chicago, 11 West 42nd Street, New York; 716 North La Brea Avenue, Hollywood, 320 Regent Street, London (B. & H. Co. Ltd.) Established 1907.

1907—25 YEARS OF SERVICE TO THE MOTION PICTURE INDUSTRY—1932

Veuillez faire mention de l'American Cinématographer en ecrivant aux annonceurs.

Fig. 1. Advertisement for the Bell & Howell Cooke Varo Lens in *American Cinematographer* 12.9 (January, 1932).

The inclusion of "swoop" versus "zoom" does not signal here a jostling of nascent photographic terms, a nomenclature still in formation, but rather a deliberate reference to complementing aerial maneuvers (zooming up, swooping down) that were often found together:

> the fliers take off from some flying field in the metropolitan district, swoop low over Madison Square Garden as a signal to begin the tests, then zoom upward in steep spirals for new altitude records from which to make their observations.
>
> For several days Ontarians stood with mouths open and necks craned while they watched a large red airplane swoop out of the heavens, zoom over a certain section of the city and then nonchalantly continue on its way.
>
> With its great power and neat design, the Tommy [airplane] has a marvelous performance. It can climb better than a thousand feet a minute, after going level and fast it can zoom (swoop straight upward) for a thousand feet.[65]

It is no surprise, then, that the advertisement for the Durholz zoom lens, printed just three months after the first Varo lens advertisement in *American Cinematographer*, similarly invoked the country's airmindedness by announcing, "Yes, Camera Wings, the Durholz Lens...Zooming shots when and where you want them" (Fig. 2).

[65] Respectively, "Data Sought on Air Layer," *Courier-Journal* (Louisville, KY), September 18, 1927; "Stop Antics of Air Man," *Los Angeles Times*, December 28, 1928; and "Pursuit Planes Sent To Defense of Hawaiian Isles," *Honolulu Advertiser (HI)*, April 12, 1923.

Fig. 2. Advertisement for the Durholz Lens in *American Cinematographer* 12.11 (March, 1932).

Otto B. Durholz's description of the lens, printed in the same issue, even articulated the necessity of Einsteinian physics for its creation, characterizing the zoom lens as a decidedly modern technology: "the machine was called upon to solve an infinite number of problems involving

calculus, squares, addition, division, and even relativity" (from in the air to out in space).[66]

The relationship between the new "zoom" lenses and public interest in aviation in the late 1920s and early 1930s went beyond a figural echoing behind the word "zoom," but was part of a broader interest in the intersection between flying and cinema. As Paul K. Saint-Amour has demonstrated, the combination of cinematography with aviation in aerial reconnaissance during World War I led, in peacetime, to a "widespread reapplication of the language of realism to aerial mapping."[67] Paul Virilio writes that "by 1914, aviation was ceasing to be strictly a means of flying and breaking records...it was becoming one way, or perhaps even the ultimate way, of *seeing*."[68] The resumption of commercial flights in 1919 only precipitated public fascination with "aerial vision."[69] For Teresa Castro, "the history of the aerial view in cinema...is also the history of a fundamental complicity between the film camera and methods of aerial locomotion," while Jeffrey Geiger describes how "aerial cinematicity" produced "a distinctly American version of global awareness."[70] Looking more panoptically, Denis Cosgrove asserts that the

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[66] Otto B. Durholz, "A New Zoom Lens," *American Cinematographer* 12.11 (1932), 16, 37.

[67] Paul K. Saint-Amour, "Applied Modernism: Military and Civilian Uses of the Aerial Photomosaic," *Theory, Culture & Society* 28.7-8 (2011), 254.

[68] Paul Virilio, *War and Cinema: The Logistics of Perception*, trans. Patrick Camiller (London: Verso, 1989), 17. Italics his. For a similar observation on the parallel developments of the airplane and cinema, see Edgar Morin, *The Cinema, or the Imaginary Man: An Essay in Sociological Anthropology*, trans. Lorraine Mortimer (Minneapolis: U. of Minnesota Press, 2005), 5.

[69] Virilio, *War and Cinema*, 19.

[70] Teresa Castro, "Aerial Views and Cinematism, 1898-1939," in *Seeing From Above: The Aerial View in Visual Culture*, eds. Mark Dorrian and Frédéric Pousin (London: I.B. Tauris, 2013), 118; Jeffrey Geiger, "Making America

history and development of "twentieth-century global images and imaginings may be considered primarily in terms of the converging technologies of flight and photography."[71]

On a more fine-grained level then, although the zoom lenses of this period were marketed as cheaper alternatives to pull shots (with limitation), they were also designed with aviation and the aerial view explicitly in mind. So in the advertisement for the Durholz lens two examples are offered: there is a strip of film that zooms out from a shot of a toddler's face to a shot of the toddler in a bathtub, and below it a strip of film depicting a high-angle shot of an ocean liner by a waterfront and then a zoom in on the ocean liner. Warmisham and Mitchell wrote, "It [the Varo lens] is ideal for use in aeroplanes, towers, and the like."[72] "Now comes the 'zoom' lens for taking close-up photos from a great height" expressed a short 1932 newspaper article titled "'Zoom' Lens for Fliers" (a summary of a similarly short *Popular Mechanics* article).[73] Likewise, a syndicated article on the "Near-Far Camera":

> It is now possible to take close-ups or distant shots with an aerial camera by means of a new lens recently developed. This lens, called a 'zoom lens,' is an interconnected series

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Global: Cinematicity and the Aerial View," in *Cinematicity in Media History*, eds. Jeffrey Geiger and Karin Littau (Edinburgh: Edinburgh U. Press, 2013), 135.

[71] Denis Cosgrove, *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination* (Baltimore: The Johns Hopkins U. Press, 2001), 236.

[72] Warmisham and Mitchell, "The Bell & Howell Cooke Varo Lens," 339.

[73] "'Zoom' Lens for Fliers," *Daily Home News* (New Brunswick, NJ), August 4, 1932.

> of lens elements which permits changing magnifying power of the lens while in flight without making the pictures fuzzy.[74]

Thus technology, aesthetics, and rhetoric coincide: the word "zoom" joined the "lens" and its "shot," not only to capitalize on immense public enthusiasm for aviation, but because of its potential import for aerial cinematography. From its very inception the zoom lens, by its very name, generated not only associations with speed but also with the aerial view. If zooming, in a purely aerial context, tended to refer to descriptions of aviation as seen from the ground up, the zoom lens and its marketing helped shade the word with the possibility of looking down from up high. It is this possibility that we will later see realized in the zoom's conversion of speed to magnification, the transition from zooming "by" to zooming "in and out."

Still, zoom shots in film would only become more common after World War II. Rudolf Kingslake suggests that reluctance to film zoom shots by cinematographers in the 1930s may have been "due to conservatism or to the unfamiliar perspective effects," a reluctance compounded by the lenses' technical limitations.[75] Early zoom lenses had rather small apertures, which, as Salt observes, prevented their use in the interior lighting set-ups that were standard to studios at the time.[76] Writing in 1935 for a column called "Hollywood from the Inside, Virginia Helene remarked that the zoom lens, "very appropriately named," could only operate outdoors

[74] "Near-Far Camera," *Anniston Star (AL)*, June 28, 1932.

[75] Kingslake, *A History of the Photographic Lens*, 157.

[76] Salt, *Film Style and Technology*, 228.

and in sunlight.[77] Zoom shots rose in popularity after World War II with Frank G. Back's "Zoomar" lens, which boasted a larger aperture and kept the image in focus more reliably. Yet, what had been a promising new technology for Hollywood filmmakers in the 1920s and 30s was, after the war, almost exclusively used in television. As Hall extensively documents, the first Zoomar lenses were adopted in order to more efficaciously shoot and cover sports events, before branching into other television productions. In 1947 the newsreel division of Paramount purchased a Zoomar lens for that year's World Series between the New York Yankees and Brooklyn Dodgers, while NBC and CBS purchased Zoomars to cover the games live.[78] A *Variety* report on Paramount's newsreel clips lauded the technology for the new detail it revealed: "Focus is so sharp players' expressions became public knowledge."[79] Zoom technology hence remained squarely in the domain of television broadcasting throughout the 1940s and 50s until the development and importation of the Angénieux zoom lens, whose magnification ratio of 10:1 far outstripped the 3:1 ratio of the Zoomar lens.[80]

The wider implementation of zoom lenses and zoom shots in the 1960s by filmmakers was not, however, a simple matter of breaking through previous technical barriers. Two decades of zooming in television helped to normalize the technique, and the early 1960s saw an increase

[77] Virginia Helene, "Hollywood from the Inside," *Pittsburgh Post-Gazette* (Mar 16, 1935), 8.

[78] Nick Hall, "Zoomar: Frank G. Back and the Postwar Television Zoom Lens," *Technology and Culture* 57.2 (2016), 363, 367.

[79] "Zoomar' Lens a Boon for Newsreels" cited in Hall, "Zoomar," 364.

[80] Salt, *Film Style and Technology*, 293.

of television directors entering Hollywood.[81] Moreover, adoption of the zoom lens (or a lack thereof) in cinema was a matter of style. According to John Belton, the "self-referential properties" of the zoom lens—the fact that it not only distorts space but makes the act of distortion itself visible—simply did not fit the cinematographic styles of the 1930s and 40s.[82] Because the low apertures of zoom lenses in the 1930s and 40s relegated them to exterior shots, they offered little to no use for the "'interior' genres" more commonly found in the period.[83] Echoing Durholz's invocation of relativity, Belton thus sees the zoom as possessing "an Einsteinian (as opposed to Eisensteinian) identity."[84] By 1971, Paul Joannides could observe that "the main problem which zoom and telephoto lenses present is that older directors, or directors of little perception, will insist on using them as substitution devices."[85] Which is to say, if the freedom of space promised by the aerial-minded zoom lenses in the 1920s and 30s gave way to being a more mundane "reportorial device" in the 40s and 50s (to provide a close-up of an interviewer, to render for the public athletes' expressions mid-game), then the 1960s saw the realization of that promise in renewed terms.

Early viewers of zoom shots were astonished by their speed. Thus "as straight and

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[81] For a historical account of the zoom in television during the 1940s and 50s, see Hall, "Zoomar," 373. For its adoption in movies in the early 1960s, see John Belton, "The Bionic Eye: Zoom Esthetics," *Cinéaste* 11.1 (1980-81), 25.

[82] Belton, "The Bionic Eye," 25.

[83] Belton, "The Bionic Eye," 25. His examples include "the musical, the gangster film, the horror film, the screwball comedy, and the melodrama."

[84] Belton, "The Bionic Eye," 27.

[85] Paul Joannides, "The Aesthetics of the Zoom Lens," *Sight & Sound* 40.1 (1970-1971), 42.

silently as a spear," and thus Helene noting the "zoom" lens to be "very appropriately named" (her initial guess as to how the shot was filmed being that "the camera was on a cable and whizzed up to the final focus.") By the late 1960s and the early 1970s, this quick zoom was still part of cinema's visual dictionary—"another familiar use of the zoom is for dramatic purposes. A swift zoom in or out creates excitement," wrote Joannides, and Vincent Canby in his 1970 review of *The Strawberry Statement*:

> Do you have a dull, inanimate product you want to sell? Well, here's your man [director Stuart Hagmann]! He'll photograph it sideways, upside down, from the ceiling! He'll zoom in on it with pulsating rhythms so that the folks out in televisionland will feel as if they've made love to it!...This sort of speed treatment is great for boxes of detergents...Too much artificial stimulation, however, can be fatal to movies about recognizable human beings.[86]

Yet, films were also experimenting with the way the zoom could be slow, could flatten cinematic space. In 1947 reporter George Putnam could proclaim, "Through this [Zoomar] lens the eyes of the world take on third dimension [sic] of movement" and in 1971 Joannides could respond, "It [the zoom] annihilates the third dimension which all other camera movements respect."[87]

Exemplary in this latter regard is Michael Snow's 1967 experimental film *Wavelength*, in

[86] Joannides, "The Aesthetics of the Zoom Lens," 41. Vincent Canby, review of *The Strawberry Statement, New York Times*, June 16, 1970.

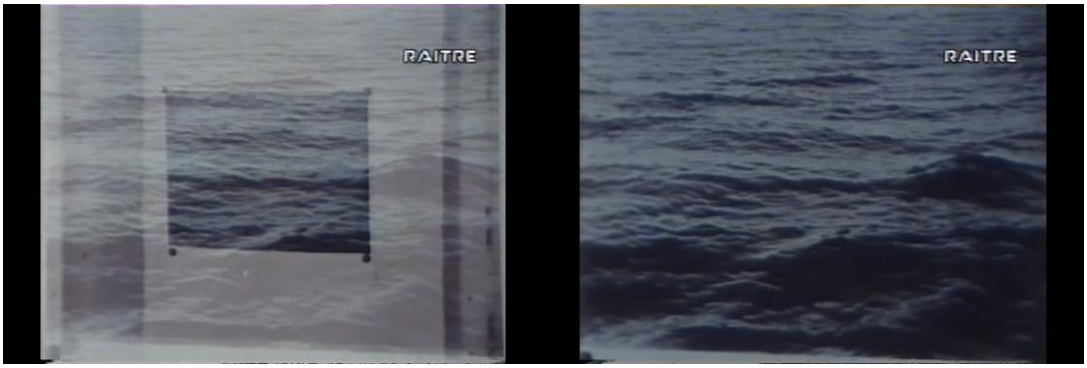
[87] Putnam cited in Hall, "Zoomar," 364. Joannides, "The Aesthetics of the Zoom Lens," 41.

which the camera remains in a fixed position at one end of an apartment room and points at a row of windows on the other end that open out to the street below (Fig. 3a). Inconspicuously in or near the center of the frame is a dark square, and over the course of the film's forty-five minutes the camera slowly zooms in on this square, which will turn out to be a photograph of water waves (Fig. 3d). "I knew I wanted to expand something—a zoom—that normally happens fast," remarked Snow, "you'd get to know this device which normally just gets you from one space to another."[88] The photograph eventually fills the screen (Fig. 3f), but does so not because the camera zooms in far enough. Instead, there is a dissolve from the frame of the photograph pinned to the wall to a larger image of the photograph that now fills the entire screen (Fig. 3e).

(a) (b)

[88] Michael Snow quoted in Scott MacDonald, *Avant-Garde Film: Motion Studies* (Cambridge: Cambridge U. Press, 1993), 63.

(c) (d)



(e) (f)

Fig. 3. Different shots from Michael Snow's *Wavelength* (1967). A single continuous zoom shot is stitched together and depicted as such from (a) to (d). In (e) the shot dissolves to the final image (f) of the water in the photograph.

Accompanying the zoom, starting eight minutes in, is a low electronically produced hum that steadily increases in pitch during the remainder of the film. Interspersed throughout are various changes in image visibility, color filters, and exposure (Fig. 3b), as well as four "human events" (Snow's phrase): a woman directs two men moving a bookcase into the apartment, two women enter and listen to the radio, a man staggers in and drops to the floor, and a woman enters and

calls someone stating that a man she does not know is dead on her floor.[89]

In a short statement composed for the film's entry into the Knokke-le-Zoute Experimental Film Competition, Snow describes *Wavelength* as "a continuous zoom which takes forty-five minutes to go from its widest field to its smallest and final field."[90] Yet, despite such a description, the zoom itself is far from "continuous," progressing in slight stutters at irregular intervals. Changes in lighting, as seen via the windows, during the course of the zoom indicate that the film was shot at different times of the day, and Elizabeth Legge notes that Snow in fact "started filming the zoom in the middle, with the man's death."[91] So although Snow explains that "*Wavelength* made you see a zoom," it may be more accurately stated that his film makes one see a particular kind of zoom, one that is composed of a discrete series of minor actions but is nonetheless articulated as a singular, homogeneous procedure. This gap between description and technical process should not be understood as misdirection on Snow's part, but instead as the very gap the film attempts to close: a stitching together of multiple minor zooming actions into one zoom. That is to say, *Wavelength* does not make one see a zoom so much as it makes one see *a* (singular) zoom—a "continuous," "long," "extended" zoom (of the irruptive dissolve Snow remarked, "it's sort of like cumming").[92] It is this zoom—what Julia Kristeva after viewing

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[89] Michael Snow, "On *Wavelength*," in *The Collected Writings of Michael Snow* (Waterloo, Ontario: Wilfrid Laurier University Press, 1994), 40. Originally published in *Film Culture* 46 (Autumn 1967).

[90] Snow, "On *Wavelength*," 40.

[91] Elizabeth Legge, *Michael Snow: Wavelength* (London: Afterall Books, 2009), 20.

[92] See Snow, "On *Wavelength*," 40-41. Snow's remark cited in Mike Hoolboom, *Inside the Pleasure Dome: Fringe Film in Canada* (Toronto: Coach House Books, 2001), 10.

Wavelength called "the progressive extinction of the visible field"—that is central to the film's project of rendering the illusion of space as an illusion since, as R. Bruce Elder points out, "a zoom-shot is essentially an adjustment of the frame, not a change in point of view...a continual reframing and not a camera movement."[93] To see that zoom, then, is to see a two-dimensional image constantly being reframed, as opposed to a representation of three-dimensional space through which the camera supposedly "moves."

After the photograph fills the screen, the camera resumes zooming in for approximately two minutes before the film ends. This conclusion, argues Elder, recreates the illusion of deep, three-dimensional space that was until then slowly demolished "by the flattening of the image," and so "the film therefore possesses a cyclical structure inasmuch as it begins and ends with a naturalistic image."[94] For Jacob Potempski, this cyclicality and resumption not only forms part of the "continuous" zoom, but suggests an endless one as well, a zoom without limit: "the recommencement of the zoom into a horizon which lay behind the horizon, in other words, implies the possibility of an infinite regress...as though the movement had no end."[95] Snow intimates as much when he describes the photograph as "an implication of a kind of total continuity for everything "—a "continuous" zoom, yes, but also a continuity between all the

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[93] Julia Kristeva, "Modern Theater Does Not Take (A) Place," trans. Alice Jardine and Thomas Gora, *SubStance* 6/7, no. 18/19 (Winter 1977 - Spring 1978), 132; R. Bruce Elder, *Image and Identity: Reflections on Canadian Film and Culture* (Waterloo, Ontario: Wilfrid Laurier U. Press, 1989), 209.

[94] Elder, *Image and Identity*, 207. The important difference, according to Elder, is that the audience is now able to recognize the illusion of depth as such.

[95] Jacob Potempski, "Revisiting Michael Snow's *Wavelength*, after Deleuze's Time-Image," *Acta Univ. Sapientiae, Film and Media Studies* 6 (2013), 11.

camera captures, an implied continuity between all that it does not.[96] The film posits a bounded world of things related via continuity—"I knew I wanted an extended zoom in a closed space," commented Snow—and because the camera remains fixed through the entire film, the constructed continuity of the zoom and the constructed continuity of the enclosed setting are coextensive.[97] Room and zoom are, in Snow's words, "cosmically equivalent."[98] Thus, instead of a zoom evoking seamless velocity, we have a zoom composed of a (supremely) slow series of stammers, and instead of the openness of flight and the aerial view, we have a closed, indoor space and its "infinite regress." The union of these two types of zoom gives rise to the most powerful visual conceptualization of scale in the twentieth century.

"We made the imaging more than real": *Powers of Ten, A Rough Sketch*, and *Cosmic Zoom*

Two types of zoom, then, or more accurately, two types of zoom aesthetics: first, the smooth shots of the 1920s and 30s with their sensations of speed and their relations to the view-from-above, and second, Snow's zoom that "made you see a zoom," slow and stuttering, continuous and potentially endless. This section examines three closely related films that take these two aesthetic modes, divorce them from the technics of the zoom lens, and combine them

[96] Snow, "On *Wavelength*," 42.

[97] Snow cited in Hoolboom, *Inside the Pleasure Dome*, 9. Simon Hartog wrote in 1969 that *Wavelength* "finishes when it starts, because the end is included in its single frame." Simon Hartog, "Knokke Notes," *Cinim* 3 (Spring 1969), 25.

[98] Snow, "On *Wavelength*," 40.

in different ways. The most well known is Ray and Charles Eames's 1977 *Powers of Ten*, which was adapted from Kees Boeke's 1957 educational book *Cosmic View: The Universe in 40 Jumps*. Less famous are two other adaptations of Boeke's work: the Eames' earlier attempt, *A Rough Sketch* (1968), and Eva Szasz's contemporaneous *Cosmic Zoom* (also 1968). By tracking these three films as adaptations in relation to each other, we will see how they produce visual logics of scale, and thus have a more fine-grained account of the "zoom" as a metaphor for scale.

Powers of Ten opens with a scene of a man and a woman picnicking in a park (in Chicago, the narrator informs us). The camera then cuts to a vertical overhead view of the couple before it "zooms out," ultimately reaching the bounds of the observable universe. From here the camera swiftly "zooms" back in on the couple, during which the narrator announces the film's next and penultimate destination to be a single proton. At 10^{-16} meters, amidst the "image" of quarks that make up the proton, the film ends (Fig. 4).

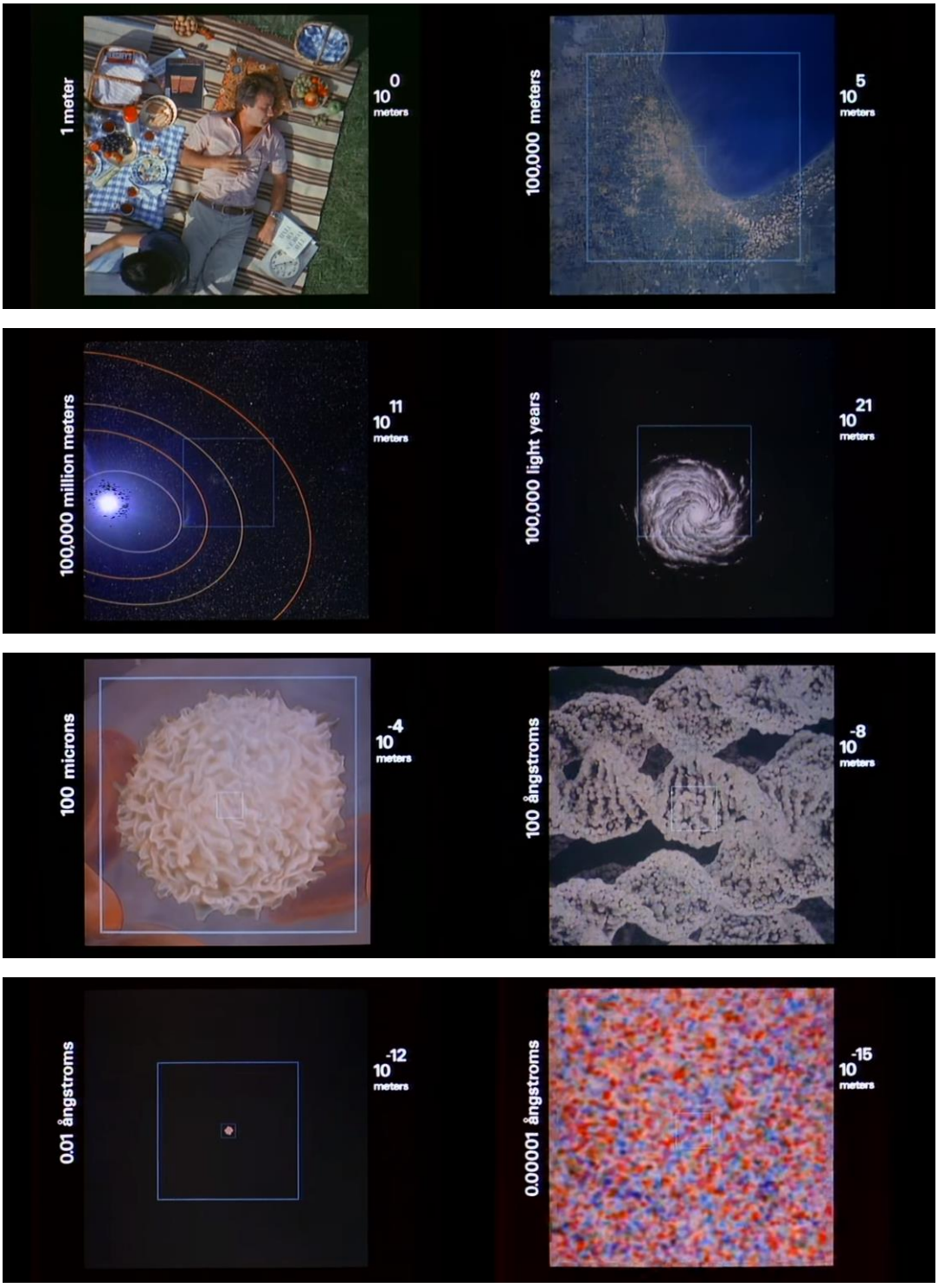

Fig. 4. Different frames from Ray and Charles Eames's *Powers of Ten* (1977). The blue box in each image represents the border of the previous power of ten.

Yet, at no point is the film's zoom effect actually produced by a zoom lens, instead being fabricated via an elaborate set of pull shots. In order to keep the perceived acceleration constant, the production team would glue a 3-inch photograph (for example, of the couple in the park) onto the center of a 30-inch picture (in this case a wider aerial shot of Chicago). The camera would begin with a close-up of the smaller photograph, pull back until reaching the edge of the larger image, and then cut.[99] The single dissolve from the conclusion of one zoom to the beginning of the next in *Wavelength* is utilized here, in *Powers of Ten*, as the transition between each shot and the next.[100] The film only stops zooming out because it approaches, as the narrator puts it, "the limit of our vision," but this is not in itself some unsurpassable boundary. At 10^{-16} meters the narrator comments, "we reach the edge of present understanding," suggesting that subsequent scientific discoveries or technological advancements would allow one to extend further versions of the film in either direction (and indeed David Wittenberg notes that the American Museum of Natural History's 2009 *The Known Universe* concludes at the scale of 14 billion light years compared to the Eames' 100 million).[101]

The film thus combines the quick, steady zoom with the "infinite regress" of Snow's

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[99] James Hughes, "The Power of *Powers of Ten*," Slate, December 4, 2012, http://www.slate.com/articles/arts/culturebox/2012/12/powers_of_ten_how_charles_and_ray_eames_experimental_film_changed_the_way.html.

[100] "The successive moves were linked by in-camera dissolves." Alex Funke statement in Philip and Phylis Morrison, *Powers of Ten: A Book About the Relative Size of Things in the Universe and the Effect of Adding Another Zero* (New York: Scientific American Library, 1982), 145.

[101] David Wittenberg, *Time Travel: The Popular Philosophy of Narrative* (New York: Fordham U. Press, 2013), 224.

continuous zoom to form an aesthetic that Derek Woods calls the "smooth zoom": "a meticulously constructed, pre-CGI simulation that imagines an impossible perspective on the universe."[102] It is difficult to overstate how influential the smooth zoom has been in promulgating an idea of scalar relations that are traversable, continuous, and invariant. Popular science writer Steven Johnson argues that the "long zoom"—a method of connecting "the scales of microbes [and] galaxies"—is the "defining view" of the late-twentieth and early-twenty-first centuries, and *Powers of Ten* is the ur-text for making it so.[103] Woods describes *Powers of Ten* as "an aesthetic event comparable to the first image of the earth from space...represent[ing] all known scales of the universe in one continuous zoom, expressing a space-age cosmology."[104] More concretely, *Powers of Ten* was a direct inspiration for Google Earth, following Google's acquisition of the Keyhole EarthViewer program. In 2004, Jonathan Rosenberg, then working for Google as Vice President of Product Management, wrote:

> We've always loved *Powers of Ten*, the classic 1977 film by Charles and Ray Eames that takes you on a visual ride from inside an atom to the edge of space in under 10 minutes. It turns out Keyhole brings a similarly astonishing perspective to its visual mapping software, and it's an incredibly powerful information tool besides. That's why we've

[102] Derek Woods, "Scale Critique for the Anthropocene," *Minnesota Review* 83 (2014), 134.

[103] Steven Johnson, "The Long Zoom," *The New York Times Magazine*, October 8, 2006, http://www.nytimes.com/2006/10/08/magazine/08games.html.

[104] Derek Woods, "Epistemic Things in Charles and Ray Eames's *Powers of Ten*," in *Scale in Literature and Culture*, eds. Michael Tavel Clarke and David Wittenberg (Cham, Switzerland: Palgrave Macmillan, 2017) 62.

acquired the company.[105]

If Google Earth "normalizes this visual logic" of effortless physical and epistemological traversal between spatial scales, observes Monica Brannon, then "this film [*Powers of Ten*] disciplined viewers...and plant[ed] the seed for the normalization of this optic in later decades."[106] *Powers of Ten* laid the cultural groundwork for a statistics-based, top-down mode of seeing that became, in the second half of the twentieth century, the dominant mode of producing knowledge about "real" or "true" space.

What I also want to draw attention to here is just how embedded this particular zoom aesthetic is in rhetorical formulations about scale, how central yet veiled it is to the very thinking of scale. When mathematician John Baez, in a talk given to The Long Now Foundation, says, "it just has to do with trying to understand time on a large scale...I want to zoom out," when Sharon Marcus praises Erich Auerbach's *Mimesis: The Representation of Reality in Western Literature* for "mov[ing] fluidly between the micro and the macro, zooming in and out from close readings to panoramic surveys and back again," and when Eve Sedgwick asserts that "the narrator of *Middlemarch*...can zoom in a mere two sentences from telescope to microscope," they employ the visual metaphor pioneered by *Powers of Ten*.[107] Moreover, this embeddedness

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[105] Jonathan Rosenberg, "Power of 2," *Google: Official Blog*, October 27, 2004, https://googleblog.blogspot.com/2004/10/power-of-2.html.

[106] Monica M. Brannon, "Standardized Spaces: Satellite Imagery in the Age of Big Data," *Configurations* 21.3 (2013), 299, 278.

[107] John Baez, "Zooming Out in Time," talk given to *The Long Now Foundation*, October 13, 2006, http://longnow.org/seminars/02006/oct/13/zooming-out-in-time/ (4:57-5:25); Sharon Marcus, "Erich Auerbach's

decontextualizes the smooth zoom as a visual strategy that relates, specifically, scales of size and space; now it can describe relations between scales of time (Baez), interpretation (Marcus), or textual narration (Sedgwick). The powers of ten displayed to the side of the frame (e.g. 10^{13}) easily swaps "meters" for "years," "close reading" looks like a picnic in the park, and George Eliot accomplishes in "a mere two sentences" the journey that takes *Powers of Ten* nine minutes (the film's runtime). Put another way, the very concept of what "scale" means as an analytic category in those contexts is structured according to the particular scalar logics of size and space produced by the smooth zoom.

The remainder of this section will track and elaborate on these logics. Philip Morrison, a physicist who aided the Eameses with the script for *Powers of Ten* and voiced the film's narrator, recounts:

> Nor is that straight route a randomly chosen line....the inner end was placed with care to make the trip full of interest. That end lies within carbon, the most interesting of atoms to living creatures, and within DNA, the most important of organic molecules. The route takes us vertically upward, to view from above the great city on the lake shore; it is a daylight view. The time of day and year could then be chosen so that the line not only passes vertically away from earth, but also straight out perpendicular to the flat disk of the Milky Way Galaxy.[108]

Mimesis and the Value of Scale," *MLQ* 77.3 (2016), 300; Eve Kosofsky Sedgwick, *Touching Feeling: Affect, Pedagogy, Performativity* (Durham, NC: Duke U. Press, 2003), 15.

[108] Morrison and Morrison, *Powers of Ten*, 111.

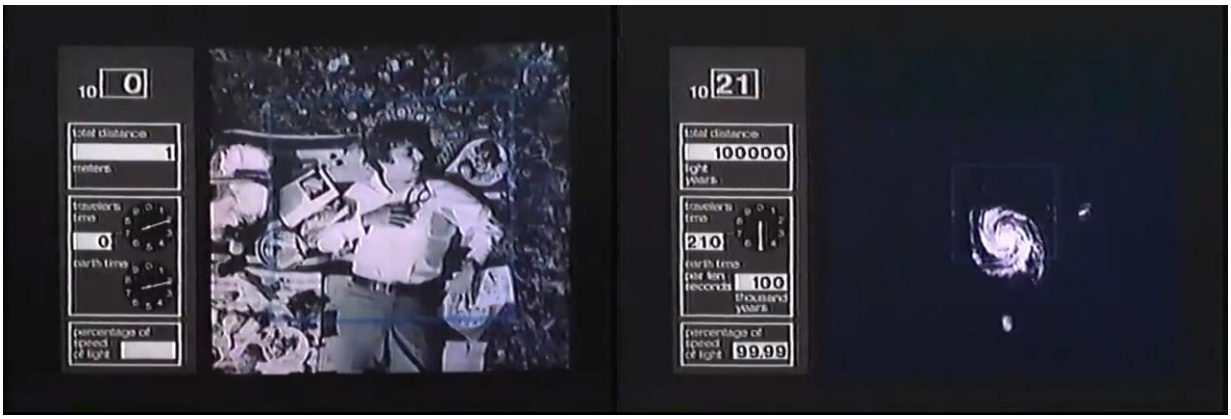
Morrison's comment evinces a realism of specificity (we had to choose to begin at *this* time, on *this* day) that only exists within the film's diegesis and also only exists following an imaginative act. "Imagine the photos were made all at one time by competent observers who agreed on when and how they would prepare their photos," states Morrison shortly after his description of the camera's "route."[109] His remark is immensely instructive for us here. Einstein's special theory of relativity tells us that measurement of synchronization, "made all at one time," always depends on the observer's frame of reference. There is no absolute spatio-temporal reference frame, and therefore no absolute measure of "simultaneity." As a physicist, Morrison's account does not disclose any ignorance on his part (obviously), but it does articulate in rhetorical terms the zoom's internal contradictions: to make scientific, objective, and realistic sense of one component of the film's claim to mimesis, we must give up another scientific, objective, and realistic sense, and this decision is formally arbitrary. "This is not a journey over time," he states, since "we would be limited, as are all moving objects, to the speed of light."[110] Thus, for Morrison it may not be scientifically realistic to view *Powers of Ten* as a depiction of a journey over time, but it is scientifically realistic to view it as a depiction of simultaneously taken snapshots, even though in another scientific context simultaneity as asserted is impossible. Even the footage of the picnickers in "the great city" of Chicago is not as straightforward as it appears. As Eames Demetrios (the Eames' grandson) reveals, it is in fact "the most disguised illusion of

[109] Morrison and Morrison, *Powers of Ten*, 111.

[110] Morrison and Morrison, *Powers of Ten*, 111.

the whole film," having been filmed in Los Angeles.[111]

Morrison's insistence on the atemporality of the smooth zoom refers directly to his influence on the 1977 *Powers of Ten*, in contrast to the Eames' 1968 *A Rough Sketch*. Though there are various differences between the two versions—a switch from a Miami golf course to a Chicago park, a change in narrator from Judith Bronowski to Morrison—I am going to focus on the most visually apparent: *A Rough Sketch* includes a whole set of frame elements referring to the time of travel that are eliminated for *Powers of Ten*.



(a) (b)

Fig. 5. Frame elements in Ray and Charles Eames's *A Rough Sketch* (1968). In (a) traveler and earth time are identical, while in (b) relativistic effects are depicted.

In addition to giving the total distance "traveled" by the film's zoom, the frame includes two clocks to compare the "traveler's time" with "earth time," and a space to indicate the "percentage of speed of light" (Fig. 5a). Eventually, the bottom clock converts to a display of "earth time per

[111] Eames Demetrios quoted in Hughes, "The Power of *Powers of Ten*."

ten seconds" (Fig. 5b), comparing the film's diegetic and extradiegetic time frames. The collapsed distinction between "zoom" and "pull shot" within the aesthetic of the smooth zoom holds in *A Rough Sketch*, even while it explicitly signals its camera movement as "physical" movement (or a "journey over time") within its diegesis. Writing of the film in 1970, Paul Schrader described it as both "a continuous zoom from the farthest known point in space to the nucleus of a carbon atom" (we might be reminded of Snow's description of *Wavelength* just three years earlier) and an "interstellar roller-coaster ride."[112] Morrison's reframing of the smooth zoom as a simultaneous set of snapshots rather than a time-bound journey is, in this sense, rather irrelevant. Schrader effused in 1968 about how "the spectator is in perspectiveless space; there is no one place where he can objectively judge another place," and Morrison in 1977 suggested the exact opposite, that the film was precisely a collection of places from which one could more "objectively" judge other places, the viewer was in a highly determined and perspectival space (at this time, on that day)—and the aesthetic of the smooth zoom between versions of the film remains entirely unchanged.[113]

These two comments point to the way the smooth zoom constructs the illusion of depicting a view from somewhere (Morrison), while presenting its scalar knowledge from the "view from nowhere" (Schrader). Coined by Thomas Nagel, the "view from nowhere" refers to the "objective" view if one were to measure distances, volumes, charge, etc., and has alternatively been called "aperspectival objectivity."[114] As Nagel writes, "the physical world as

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[112] Paul Schrader, "Poetry of Ideas: The Films of Charles Eames," *Film Quarterly* 23.3 (1970), 10-11.

[113] Schrader, "Poetry of Ideas," 11.

[114] Lorraine Daston, "Objectivity and the Escape from Perspective," *Social Studies of Science* 22.4 (1992), 599.

it is supposed to be in itself contains no points of view and nothing that can appear only to a particular point of view."[115] So Alex Funke, who worked on the 1977 production, expressed the smooth zoom's relation to the view from nowhere:

> We had the raw material—the aerial photographs and the shots from the Hasselblads of Skylab, the radio maps of hydrogen in the arms of our galaxy, the plates from the great telescopes, elegantly freeze-cleaved sections of leucocytes, and the vast mathematical models of large and small things, local groups of galaxies and clouds of electrons. *Then in each case we made the imaging more than real* through adding, by hand, the details of what might (or should) be there.[116]

"We made the imaging more than real": it is not, as Morrison suggests, just a matter of picking the right vertical route and stitching the "raw material" together, but a matter of reshaping that material so that stitching is possible to begin with. In an interview with Funke, James Hughes reports that "the crew had to take each photographic image apart and reassemble it, so the geometry would match."[117] This is a double operation, transforming views from somewhere into the view from nowhere and ensuring that this view from nowhere is indistinguishable from, or at

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[115] Thomas Nagel, *The View from Nowhere* (New York: Oxford U. Press, 1986), 14-15.

[116] Funke in Morrison and Morrison, *Powers of Ten*, 145. Emphasis mine. Funke's wording suggests an inversion, in this particular case, of the larger historical shift from "truth-to-nature" to "mechanical objectivity" that Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2010) tracks from the 18th to 19th centuries.

[117] Hughes, "The Power of the *Powers of Ten*."

minimum legible as, a view from somewhere.

The Eames' smooth zoom is only one particular conceptual and historical formation.[118] Its joining of the view from nowhere and view from somewhere can be clearly observed when juxtaposed with another filmic adaptation of Boeke's *Cosmic View*, Eva Szasz's 1968 *Cosmic Zoom*. Compared to either *Powers of Ten* or *A Rough Sketch*, Szasz's film is less "realistic," relying on animated scenes instead of photographic stills, and transitioning from a photograph of a boy in a boat to an illustrated rendition of that shot before commencing the zoom-out (Fig. 6).

[118] Woods, "Epistemic Things" puts it eloquently: "we can say that the transcalar zoom has shifted from an emergent cultural form to a media-technological dominant since the 1960s" (74).

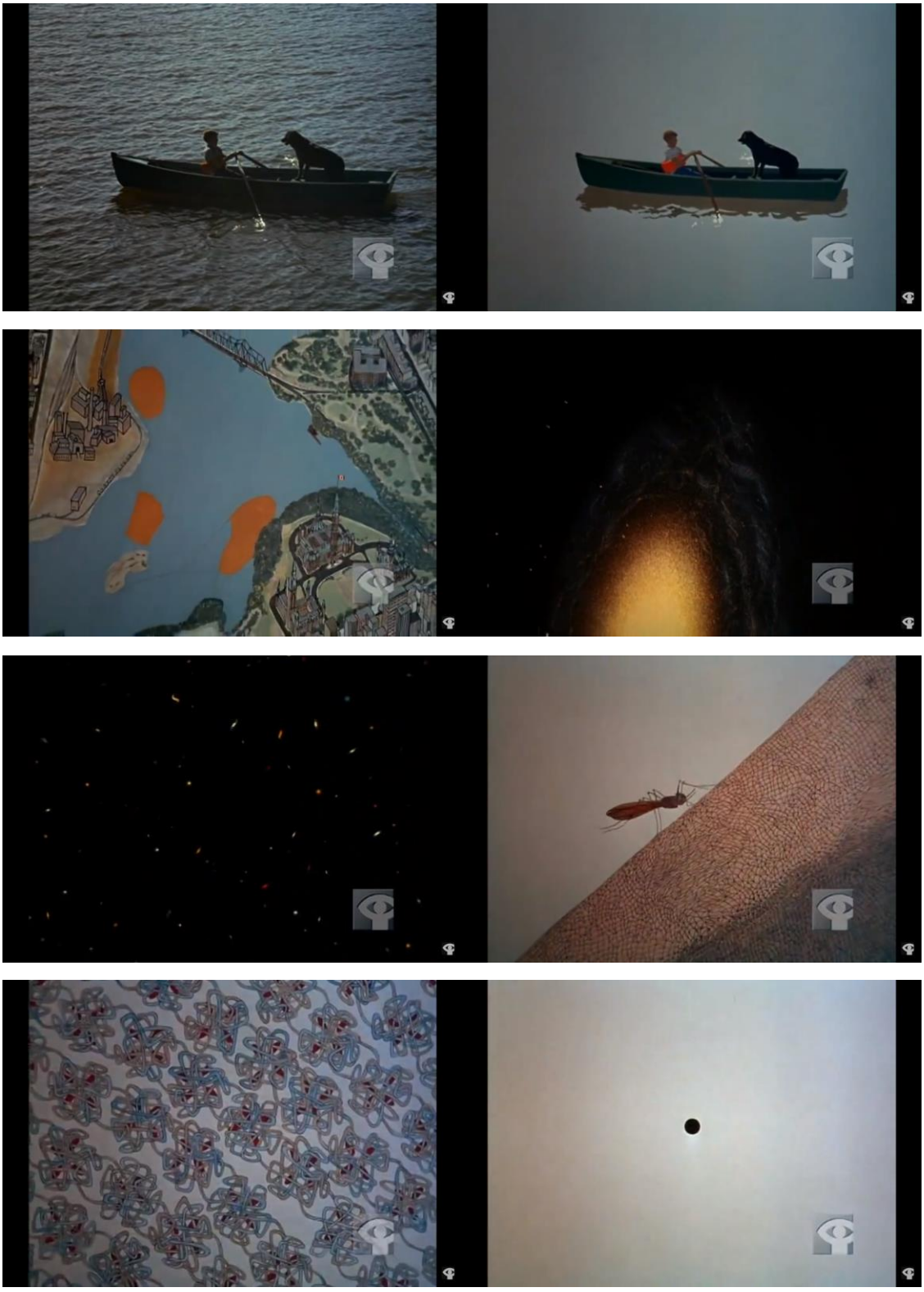
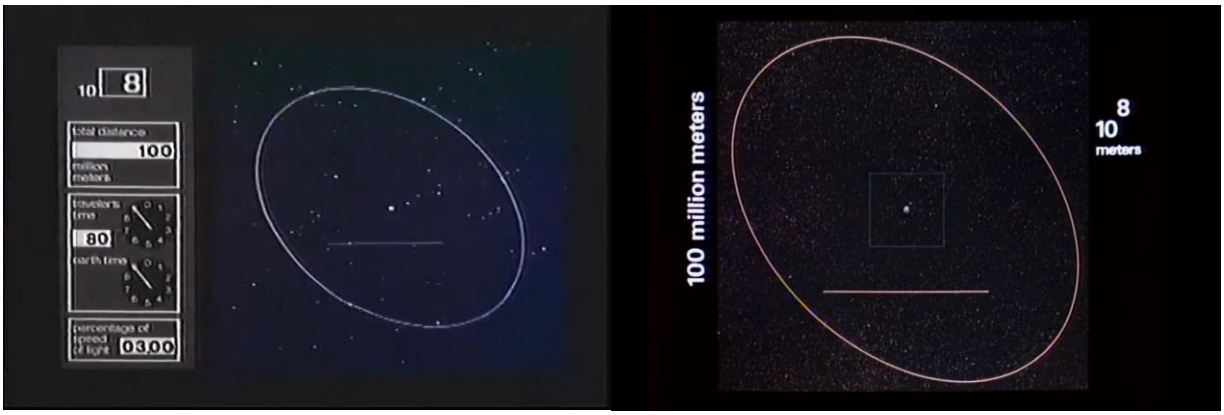


Fig 6. Different frames from Eva Szasz's *Cosmic Zoom* (1968).

Unaccompanied by narration or framing text, the film often furnishes a sensorium of colors and patterns with no extradiegetic markers identifying what those patterns are supposed to represent.[119] Moreover, the squares that, in the Eames' films and in Boeke's book, signify the previous field of view are absent in Szasz's adaptation. For these reasons, Woods sees *Cosmic Zoom* as "lack[ing] the mathematical trappings of *Powers*."[120]

For me, however, the key difference is a disconcerting moment, within the larger historical context of the Eames' normalized smooth zoom, when the camera "moves" past a moon that is much larger in the frame than the earth. The scene anchors its "point of view" in a representation of physical, perspectival space (Fig. 7).



(a) (b)

[119] Joe Koenig, one of the producers of *Cosmic Zoom*, raised this as a potential problem: "in some of the micro shots the use of similar reds left me a bit unclear about what I was looking at." It is unclear whether this was "corrected" for the final version, given that the reds appear to be still rather similar. Joe Koenig, memo dated 11/16/1967, provided by the National Film Board of Canada archives.

[120] Woods, "Epistemic Things," 72.

(c)

Fig. 7. Comparison of "views" between *A Rough Sketch* (1968), *Powers of Ten* (1977), and *Cosmic Zoom* (1968). In *A Rough Sketch* (a) and *Powers of Ten* (b), the moon is "smaller," while in *Cosmic Zoom* (c) it appears "larger" because of its depiction in perspectival space.

Later members of the National Film Board of Canada involved with *Cosmic Zoom* recognized the significance of this shot, opting for it to be the cover of the video jacket (it is also currently the image associated with *Cosmic Zoom* on the National Film Board website).

In *Powers of Ten* and *A Rough Sketch,* the moon is never visible. Only its orbit around the earth is shown, represented by a thin white line. One might respond by pointing back to Morrison's explanation and suggest that the time and day were chosen such that the route never "passes by" the moon, but if indeed this shot is understood via the view from somewhere, then it is a view from somewhere chosen specifically to maintain the coherence of the view from nowhere. A film whose aim is to depict the "relative size of things in the universe" cannot have a moon that appears larger on screen than the earth. If *Cosmic Zoom* purports to say that from "here" the moon looks bigger than the earth, then *Powers of Ten* and *A Rough Sketch* purport to say: this is what the earth and moon look like from "here," but, more crucially, this perspectival

shot accords with the "relative sizes" of the earth and the moon, what they "look like" from the view from nowhere. These two films attempt to render the view from nowhere (measurement of size) identical with the view from somewhere (perspectival space). That is to say, the scalar logic of the smooth zoom, indeed its very aesthetic of "smoothness," depends on making the presentation of "here is what *this* atom would look like from *this* many light-years away" indistinguishable from the presentation of "here are the comparative sizes of an atom and a galaxy."

It is not the union of the view from nowhere and view from somewhere in general, however, that constructs the vision of seamless navigation across scales of space, but the union of view from nowhere with specifically the aerial view. Mark Dorrian identifies the form of the "vertical aerial image" as historically "instrumental, disenchanted, and technical" because of its emergence and development as a military surveillance and scouting technique during World War I.[121] The vertical aerial images taken during the war involved a process of abstraction which, responding to the war's devastation of the "natural landscape," established a "metalevel of artificiality" from which one could make strategic information legible as such.[122] Importantly, this process removes people and their experiences from the picture in order to create the "geometrical and abstract space that makes strategic mobility of mass armies and related gigantic

[121] Mark Dorrian, "The Aerial View: Notes for a Cultural History," *Strates* 13 (2007), 8.

[122] Bernd Hüppauf, "Modernism and the Photographic Representation of War and Destruction," in *Fields of Vision: Essays in Film Studies, Visual Anthropology, and Photography*, eds. Leslie Devereaux and Roger Hillman (Berkeley: U. of California Press, 1995), 106.

logistics possible."[123] Saint-Amour thus observes the way "the body diminishes to a data point in the emerging statistical epistemes that were cognate with the aerial perspective."[124] It is easy to see how this logic of depersonalization informs the processes of abstraction that characterize platforms like Google Earth. As Brannon concisely puts it, "the visual layer of the social is first deleted from the data set, in that people are not seen in public satellite images. Second, it is then integrated back in, in the form of social and material statistics and quantifiable, sortable, and locatable information."[125]

Powers of Ten and *A Rough Sketch* stand as a sort of midway point between these two historical forms (we have already seen the zoom's early attachment to aviation in the 1930s and its impact on the optics of Google Earth), relying on the "instrumental, disenchanted, and technical" vertical aerial view to create a visual aura of scientific realism and mechanical objectivity that goes hand-in-hand with its smooth zoom aesthetic. Morrison's remarks suggest as much ("the time of day and year could then be chosen so that the line...passes vertically away from earth"), but this conjuncture is also explicitly articulated by Boeke in the forward to *Cosmic View*:

I began the project because of the importance of developing a *sense of scale,* and I

[123] Hüppauf, "Modernism and the Photographic Representation of War and Destruction," 120.

[124] Paul K. Saint-Amour, "Modernist Reconnaissance," *Modernism/modernity* 10.2 (2003), 352. Fredric Jameson makes a similar point in *Antinomies of Realism* (London: Verso, 2013): "all of the studies of aerial warfare and its techniques foreground the depersonalization of the individuals involved and their assimilation into the larger machinery" (256).

[125] Brannon, "Standardized Spaces," 298.

> therefore proposed to draw the same objects in different scales. In doing this I took advantage of the metric system, which logically corresponds with our numerical system, and made each successive scale one-tenth of the one before. When we do this we seem to go right up into the sky, so that we see objects from ever increasing heights.[126]

Boeke's description of the visual parallel between "draw[ing] the same objects in different scales" and "go[ing] right up into the sky" treats it as a fortunate coincidence, a lucky effect of employing the metric system, but the parallel is only possible if one draws those objects from the perspective of the vertical aerial view in the first place. So although Boeke continues with the seemingly commonsense assertion that "if we start at, say, five meters from the object...we first move to a distance of 50 meters in order to see it at one-tenth scale," this holds only because the vertical aerial view is a foundation, and not consequence, of his (and by extension the Eames') "*sense of scale*."[127]

After all, we do not look at a parked car from 50 meters away at street level and consider, in any ordinary sense, that we are seeing it at "one-tenth scale." Nor do we tend to think of an airplane as being viewed at "one-one-thousandth scale" when we look up at one passing overhead. Which is to say, everyday experience does not have us navigate the world through an unceasing flux of scaling and re-scaling its objects and inhabitants. Similarly, a photograph taken of the parked car 50 meters away or the airplane in the sky is more generally experienced and understood in terms of perspective (it looks smaller because it is farther away) than in terms

[126] Kees Boeke, *Cosmic View: The Universe in 40 Jumps* (New York: The John Day Company, 1957), 4. Italics his.

[127] Boeke, *Cosmic View*, 4-5.

of scale. As Saint-Amour explains,

> In any photograph, there are as many scales as there are depth planes. This continuum of scales is advantageous in most photographic contexts, as the greater scale of foreground objects contributes to the impression of their proximity over background objects, giving the viewer non-parallactic depth cues. But in aerial photos that would be used to rectify existing maps, a consistent scale was essential.[128]

In his account, spatial scales and scalar relations exist in every photograph, but only "emerge" as such when they need to be rendered uniform—that is, when the "continuum of scales" needs to be collapsed into a single scale. This need tends to occur in the context of mapping (as opposed to "most photographic contexts") and also in the context of the smooth zoom and aerial view, of organizing a plurality of spatial scales into a single seamlessly navigable one.

The anchoring of the view from nowhere to the aerial view is particularly strange once one considers that the "aerial view" is meaningless for a majority of the images depicted, an empty description when regarding lymphocytes and carbon atoms, nebulae and far-flung galaxies. "The time and path we chose to leave Chicago has brought us out of the [Milky Way] galaxy along a course nearly perpendicular to its disk," Morrison narrates, extending the visual logic of the vertical aerial view to an image that is, in a perspectival sense, truly a "view from

[128] Saint-Amour, "Applied Modernism," 255.

nowhere," since it is necessarily a composite of different images taken from inside the galaxy.[129] Woods diagnoses this kind of extension as an example of the film's "scalism," the "ontological privileging of one scale domain, with its specific qualities and constraints, as a model for all the others," and indeed many criticisms of the smooth zoom in the past decade or so tend to hone in on this "ontological privileging" of the "human mesocosm" and its consequential erasure of scalar difference.[130]

Thus, for Di Palma, "the zoom, when conjoined with the aerial view, unites different scales into a seamless flow, bringing the atomic and the planetary into correspondence," but does so at the cost of "undermin[ing] our awareness of the zoom's artificiality, and engender[ing] a visual experience that mimics the continuous flow of human vision itself."[131] Zach Horton criticizes all three filmic adaptations of Boeke's *Cosmic View* for "composing a cosmic view that is glassy smooth and fully continuous," while Bruno Latour, in his tersely-titled essay, "Anti-Zoom," laments how *Powers of Ten* has "led astray...many artists and scientists" with the "disastrous metaphor of the zoom"—disastrous precisely because of its claim to "materialize a near-continuous shift from the infinitely large (the galaxy), down to the infinitely small (atoms)."[132] Adjacent criticisms point out the various contradictions that arise from this attempt

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[129] Charles Eames and Ray Eames, *Powers of Ten: A Film about the Relative Size of Things in the Universe and the Effect of Adding Another Zero* (Los Angeles: IBM/Office of Ray and Charles Eames, 1977), video, https://www.eamesoffice.com/the-work/powers-of-ten/.

[130] Woods, "Epistemic Things," 79.

[131] Di Palma, "Zoom: Google Earth and Global Intimacy," 263.

[132] Zach Horton, "Composing a Cosmic View: Three Alternatives," in Clarke and Wittenberg, *Scale in Literature and Culture*, 56; Bruno Latour, "Anti-Zoom," in Clarke and Wittenberg, *Scale in Literature and Culture*, 98.

at erasure. Laura Kurgan observes that although the smooth-zoom aesthetic "intends to demonstrate that the universe is constructed as a set of transparent pictures, homogeneous and continuous," it in fact speaks more to the diverse imaging practices and techniques that occur at different scales.[133] Wittenberg similarly argues that the film undercuts its own intended project, since "paratextually all these things *are* the same size...The logarithmic scale of expansion or contraction ironically abets the radical domestication of scale."[134]

Common to all of these critiques is a positive emphasis on "scale variance," the idea that differences of scale are differences of kind, not degree.[135] The example often cited to describe this is J.B.S. Haldane's 1926 essay "On Being the Right Size." "A large change in size inevitably carries with it a change in form," Haldane says, meaning that humans could not be scaled up to sixty feet tall, for instance, without breaking their bones under the weight of gravity.[136] Yet these criticisms also share an underlying approach to discussing scale as a kind of ontological entity. Different scales exist as givens—the atomic scale, the human scale, the

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[133] Laura Kurgan, *Close Up at a Distance: Mapping, Technology & Politics* (New York: Zone Books, 2013), 19. Mark Dorrian, "Adventure on the Vertical," *Cabinet* 44 (Winter 2011/2012) discusses the way the "visual rhetoric of voyaging through scales" within the context of American geopolitics during the Cold War, "might also be read in terms of the domination and control of the realms that it pictures." Retrieved from http://www.cabinetmagazine.org/issues/44/dorrian.php.

[134] Wittenberg, *Time Travel*, 224.

[135] Woods, "Scale Critique," 136. "The concept of scale variance is proper to no discipline. It can be abstracted and adapted for cultural theories of the Anthropocene, among other uses," 137.

[136] J. B. S. Haldane, "On Being the Right Size," in *Possible Worlds and Other Essays* (London: Chatto & Windus, 1928), 18.

planetary scale, etc.—and the failure of the smooth zoom is a failure to adequately capture the complicated relations and disjunctures between them. It replaces scale variance with invariance, eliding the richness of difference by constructing a singular scale of scales that one can traverse with no bumps, stutters, or halts. In other words, the problem these criticisms take with the smooth zoom is not a matter of how the smooth zoom represents or constructs, say, planetary scale, but the manner in which it connects planetary scale (entity A) and atomic scale (entity B).

By focusing on how the smooth zoom relates scales, these critiques miss the way it constructs the concept of scale, recognizable as such. A picture of the earth is no more inherently a depiction of "planetary scale" than the word "earth" itself. Consider the film's supposed symmetry of micro and macro, reflected by assessments like Di Palma's and Latour's that describe the film as a journey, however illusory, between "the atomic and the planetary," from "the infinitely large (the galaxy), down to the infinitely small (atoms)." "Now every ten seconds we will look from ten times farther away and our field of view will be ten times wider," narrates Morrison during the beginning of the zoom out, articulating the visual logic of movement through perspectival space. Even in outer space, "giant steps carry us into the outskirts of the galaxy." Then, upon zooming in, the reverse: "Now we reduce the distance to our final destination by 90% every ten seconds, each step much smaller than the one before."[137] As Morrison explains in the book, via logarithmic progression "the traveler can take small, atom-sized steps near the atom, giant steps across Chicago, and planet-, star-, and galaxy-sized steps within their own realms."[138]

[137] Eames and Eames, *Powers of Ten*, video.

[138] Morrison and Morrison, *Powers of Ten*, 109.

Yet the fiction of these atom-sized steps does not cohere, at least not in the same perspectival framework in which the previous "giant steps" functioned, since implicit here is a second fiction that the traveler is also shrinking in size. By contrast, we do not watch the first minute of *Powers of Ten* under the impression that the film's "point of view" is rapidly increasing in size. Of course, what the film depicts is a series of images produced by various magnification techniques. It is not the case, however, that *Powers of Ten* simply presents images organized by the visual logic of magnification under the "guise" of movement through perspectival space (i.e. showing you one thing while saying it is another). When Morrison states that "in a few seconds we'll be entering the skin, crossing layer after layer from the outermost dead cells into a tiny blood vessel within," he is not just creating a smokescreen, since no amount of magnification of a hand (even with infinite resolution) would reveal an image of a capillary *beneath* the "outermost" layer of dead skin cells.[139] The visual logics of both magnification and perspectival movement are at work here.

Scale as constructed by the smooth zoom is not an ontological entity related to other ontological entities (other scales), but a relational form that collapses distinctions between size, magnification, and perspective. Something like the "scale of a carbon atom" can refer simultaneously to the size of the atom (about 1 angstrom or 10^{-10} meters) and the perspectival frame in which it is viewed (about 1 angstrom or 10^{-10} meters across and deep): "an object changes its size by a factor of ten," writes Morrison, "with any single step...Three steps and the scale changes by a thousand, no matter where you start or which direction you choose."[140] So

[139] Eames and Eames, *Powers of Ten*, video.

[140] Morrison and Morrison, *Powers of Ten*, 110.

although Latour refers to size when he writes of connecting "the infinitely large (the galaxy)" with "the infinitely small (atoms)," and Di Palma refers to something more like spatial extent or perspective when she talks about bringing "the atomic and the planetary into correspondence," these relations are synonymous with one another within the framework of the smooth zoom. Put another way, the smooth zoom does not bridge different scales of space so much as it constructs a matrix of contradictory spatial relations in which scale becomes a cohering analytic and descriptive term.

This matrix is nascently visible in *Cosmic View*. "However large the object is, the next jump ["up"] reduces it to one tenth its size," Boeke asserts, while still qualifying his depictions of the "very small" by drawing a distinction between distance and magnification: "to see this picture, taken from a height of only 5 millimeters, we should need a microscope."[141] Mark Slade, who worked on the production of Szasz's *Cosmic Zoom* (at the time titled *Scale*), observed the beginning of this conjuncture in his research notes on *Cosmic View*: "The idea that objects decrease in size the further we move away from them needs quite a lot of explaining. An object at 50 metres may or may not appear ten times smaller than at 5 metres. This may be a confusion between perspective and scale."[142] Twenty years later in *Powers of Ten*, this extra step of needing a microscope is no longer needed, since being 5 millimeters away from something 5 millimeters tall is already covariant with seeing it at one thousand times

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[141] Boeke, *Cosmic View*, 28, 36.

[142] Slade's comments appear to have influenced, in part, the ultimate decision to frame *Cosmic Zoom* from an oblique, rather than vertical, aerial view, and to forgo the strict adherence to the metric system that Boeke emphasized (and that the Eameses took up for their adaptations). Mark Slade, memo dated 1968, provided by the National Film Board of Canada archives.

magnification. Yet we should take away from Slade, still, his open-ended suggestion that "it is probable that there are aspects of scale that cannot be visualized at all."[143] Our goal is to move toward an account of scale and narrative that acknowledges: 1) current conceptions of scale are thoroughly inflected by a very specific visual logic of space, produced by the smooth zoom, that collapses distinctions of size, perspective, and magnification, and 2) this inflection is a historical formation and thus contingent.

[143] Slade, memo, 7.

Chapter 2. Narrative Structuralism, Hierarchy, and Scale

As we have seen in the previous chapter, the visual metaphor of the smooth zoom does not only traverse or connect different spatial or temporal scales, but generates a particular conceptualization of scale itself—scale as a category in which distinctions between size, perspective, and magnification blur and collapse.[144] Which is to say, under the rubric of the zoom, the notion of "galactic scale" is identical to both the (quantitative and/or qualitative) size of a galaxy and the view of a galaxy in perspectival space. This metaphor, moreover, depends on the aerial view as an organizing logic of perspective that correlates position in space with a hierarchy of size: moving "closer" to the atom, in this logic, becomes synonymous with shrinking to the size of an atom. So even though the aerial view does not, strictly speaking, make sense with regard to images of galaxies and atoms, its perspectival logic extends like a skewer, holding in place a linear continuum of sizes. The carbon atom in *Powers of Ten* is not only presented as a magnified image, but also as an image of what a (very small) observer would see if they were mere angstroms away. Indeed, at the 1968 symposium "Hierarchical Structure in Nature and Artifact," self-described as "the first scientific gathering on *hierarchy*," the symposium's organizers noted their "indebtedness to the Charles Eames Staff for their film, *The*

[144] Robert B. McMaster and Eric Sheppard, "Introduction: Scale and Geographic Inquiry," *Scale and Geographic Inquiry: Nature, Society, and Method*, eds. Sheppard and McMaster (Malden, MA: Blackwell Publishing, 2004) point out that "an interesting development in the cartographic representation of scale is the idea that, within a virtual environment, *there is no scale*…in that the traditional concept of scale is not meaningful for electronic data" (4).

Powers of Ten."[145]

This chapter investigates the relationship between hierarchy and scale in three interrelated contexts: organicism and theoretical biology in the 1930s and 40s, cybernetics in the 40s and 50s, and finally structural linguistics and narratology in the 50s and 60s. The argument, in brief, runs as follows: cybernetic concepts of noise, feedback, and information played a large role in laying some of the intellectual foundations for literary structuralism, largely by way of its influence on linguistics and anthropology. Contemporary with cybernetics, however, was a different kind of systems-thinking which had developed out of the "organicist" movement in the fields of embryology and biochemistry, one which engaged explicitly with issues of scale and hierarchy, and which confronted cybernetics for problematically ignoring and conflating different scalar hierarchies. Tracking the historical and conceptual contours of this confrontation reframes a small moment in Roland Barthes's literary structuralism, one that has hitherto been understood within the intellectual legacy of cybernetics and structural linguistics, but one which this chapter argues also indicates the presence of a nascent theory of narrative scale.

"Literatures are in fact arts of 'noise'": Cybernetic Structuralism

The longitudinal impact of "cybernetics"—defined by mathematician Norbert Wiener in 1948 as "the entire field of control and communication theory, whether in the machine or in the animal"—and the related fields of information theory and game theory on structuralist and post-

[145] Lancelot Law Whyte, Albert G. Wilson, and Donna Wilson, eds., *Hierarchical Structures* (New York: American Elsevier Publishing Company, Inc., 1969), vii, ix.

structuralist thought is well documented in certain circles but worth outlining here.[146] Lydia Liu, for instance, tracks how the "game" of game theory, as it was developed by John von Neumann (another mathematician) and economist Oskar Morgenstern in the 1940s, was translated into the French words "jeu" and "jeux" in the 1950s and 60s only to be retranslated back into English in the 1970s and 80s as the semiotic "play" of poststructuralism. As she puts it, "a great deal of what we now call French theory was already a translation of American theory before it landed in America to be reinvented as French theory."[147] Céline Lafontaine provides a similar account of what she calls the "cybernetic matrix," arguing that its de-centering of the humanist subject, though unrecognized by many of the scientists involved, was taken up, developed, and adapted by influential theorists working in humanities disciplines: "the influence of cybernetics on human sciences is obviously not limited to structuralism…The mainstream approaches that post-structuralism and postmodernism represent are profoundly influenced by cybernetics."[148] Two figures central to the link between cybernetics and literary (post)structuralism are the linguist Roman Jakobson and the anthropologist Claude Lévi-Strauss, both of whom taught (and

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[146] Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (New York: John Wiley & Sons, Inc., 1948), 19. For the purposes of this chapter, and despite the various conceptual and historical differences between them, I will be using "cybernetics" as a shorthand for the broad grouping of these fields. For an account of how Wiener's cybernetics differs from Shannon's information theory, see Phillip Schweighauser, "The Persistence of Information Theory," in *Traditions of Systems Theory: Major Figures and Contemporary Developments*, ed. Darrell P. Arnold (New York: Routledge, 2014), 29-31, 38-39.

[147] Lydia Liu, "The Cybernetic Unconscious: Rethinking Lacan, Poe, and French Theory," *Critical Inquiry* 36.2 (2010), 291. See also Liu, *The Freudian Robot: Digital Media and the Future of the Unconscious* (Chicago: The U. of Chicago Press, 2010), 174-176.

[148] Céline Lafontaine, "The Cybernetic Matrix of 'French Theory,'" *Theory, Culture & Society* 24.5 (2007), 37.

befriended each other) at the New School for Social Research in New York during the Second World War.[149]

As the story of cybernetics goes, the Macy Conferences on cybernetics between 1946 and 1953 gathered an interdisciplinary group of researchers from fields such as mathematics, electrical engineering, anthropology, and psychiatry. The title of the first meeting, "The Feedback Mechanisms and Circular Causal Systems in Biology and the Social Sciences,"[150] laid out the program's two overall goals: 1) to study feedback as a circular model of cause-and-effect that would replace the linear model of stimulus-response championed by behavioral psychologists, and 2) to frame and cross-pollinate the concepts of feedback, message, and information as a way of synthesizing the natural and social sciences.[151] One of the conferences' central organizers, Frank Fremont-Smith, thus remarked that in addition to "furthering knowledge about cybernetics," there was "a further, and perhaps more fundamental, aim…[of] the promotion of meaningful communication between scientific disciplines."[152] To facilitate this "meaningful communication," the structure of the (invite only) conferences was self-described as being unusual for the time. Rather than deliver polished talks or papers, attendees presented

[149] François Dosse, *History of Structuralism: The Rising Sign, 1945-1966*, trans. Deborah Glassman (Minneapolis: U. of Minnesota Press, 1997), 12.

[150] The word "cybernetics" would not be introduced until 1948, as coined by Wiener. It officially entered the title of the conferences starting with the sixth and remained for the duration of the program.

[151] Steve Joshua Heims, *The Cybernetics Group* (Cambridge, MA: The MIT Press, 1991), 15-16.

[152] Frank Fremont-Smith in *Cybernetics: Transactions of the Eighth Conference*, eds. Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber (New York: Josiah Macy, Jr. Foundation, 1952), vii.

general ideas with the intent of cultivating discussion.[153]

The result, according to Katherine Hayles, was an "intellectual free-for-all" in which participants had a difficult time understanding terms with unfamiliar technical contexts and definitions, but were nevertheless enthusiastic in considering their metaphorical and conceptual imports:

> When Claude Shannon used the word "information," for example, he employed it as a technical term having to do with message probabilities. When Gregory Bateson appropriated the same word to talk about initiation rituals, he interpreted it metaphorically as a "difference that makes a difference" and associated it with feedback loops between contesting social groups.[154]

Despite the utopian language that Fremont-Smith and others sometimes deployed, conference members and research collaborators often disagreed (quite vehemently) with such transplantations. Warren Weaver, who coauthored *The Mathematical Theory of Communication* with Shannon in 1949, described Wiener's *Cybernetics* as a "baffling book" for its attempt to use

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[153] "In contradistinction to the usual scientific meeting we place the emphasis upon discussion and not upon the presentation of formal papers. The introductory presentations at our conferences are merely the launching of the ship—the voyage is the important thing!" Frank Fremont-Smith in *Cybernetics: Transactions of the Seventh Conference*, eds. Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber (New York: Josiah Macy, Jr. Foundation, 1951), 7-8.

[154] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: The U. of Chicago Press, 1999), 51.

feedback as a skeleton key (of sorts) in understanding machine and animal behavior, writing that "I will not lose my respect for central nervous systems, nor be prepared to substitute, for them, machines."[155] Wiener himself was skeptical of anthropologists Bateson and Margaret Mead's optimism that cybernetic notions of information and feedback could pave significant inroads into anthropology, sociology, and economics.[156] Ralph Gerard, a neurophysiologist, thus described the situation:

> It seems to me, in looking back over the history of the group, that we started our discussion in the "as if" spirit. Everyone was delighted to express any idea that came in his mind, whether it seemed silly or certain or merely a stimulating guess that would affect someone else. We explored possibilities for all sorts of "ifs." Then, rather sharply it seemed to me, we began to talk in an "is" idiom.[157]

And it was this whirlpool atmosphere of mingling "as ifs" and "is's" in which Jakobson found himself when he attended, as a special guest, the fifth Macy Conference in the spring of 1948.

Although there are unfortunately no transcripts of this fifth conference,[158] its influence on

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[155] "Mathematical Biology"; Weaver to Lovitt, 28 January 1949. Cited in Lily E. Kay, *Who Wrote the Book of Life? A History of the Genetic Code* (Stanford, CA: Stanford U. Press, 2000), 88.

[156] Wiener, *Cybernetics*, 33-35, 189.

[157] Ralph Gerard, "Some of the Problems Concerning Digital Notions in the Central Nervous System," in von Foerster, Mead, and Teuber, *Cybernetics: Transactions of the Seventh Conference*, 11.

[158] There are no transcripts of the first five conferences, due to unsuccessful attempts at mechanically recording the meetings. See Heims, *The Cybernetics Group*, 18.

Jakobson is perhaps best recorded contiguously in his correspondence with Wiener and Weaver over the following two years. After the publication of *Cybernetics,* Jakobson enthused to Wiener in 1949: "At every step I was again and again surprised at the extreme parallelism between the problems of modern linguistic analysis and the fascinating problems you discuss...it is becoming still clearer how great are the outlooks for a consistent cooperation between modern linguistics and the exact sciences."[159] Toward the end of that same year, Weaver sent Jakobson a copy of *The Mathematical Theory of Communication* (as well as to Lévi-Strauss at Jakobson's request).[160] Jakobson wrote back: "Having returned from my lecture and study trip through seven European countries may I tell you that...I frankly pointed out your and Shannon's *Mathematical Theory of Communication* as the most important among the recent American publications in the science of language."[161] Over the next decade, Jakobson would work to transform and adapt the structural linguistics he had developed in the 1920s and 30s as part of the Prague Linguistic Circle into an information theory-based account of language. Within this new framework, Ferdinand de Saussure's notions of "la langue" (language system) and "la parole" (individual speech act) became "code" and "message."[162] Similarly, where Jakobson spoke of the syntagmatic and paradigmatic axes of language during the 1930s—terms which named relations in language—by the 50s he had replaced them, respectively, with "combination" and "selection," terms that evoked the processes of encoding and decoding messages by a

[159] Jakobson to Wiener, 24 February 1949. Cited in Kay, *Who Wrote the Book of Life?*, 297-298.

[160] Bernard Dionysius Geoghegan, "From Information Theory to French Theory: Jakobson, Lévi-Strauss, and the Cybernetic Apparatus," *Critical Inquiry* 38.1 (2011), 112.

[161] Jakobson to Weaver, 30 July 1950. Cited in Kay, *Who Wrote the Book of Life?*, 300.

[162] Roman Jakobson, *Selected Writings II: Word and Language* (The Hague, Netherlands: Mouton, 1971), 718.

speaker or listener.[163]

Jakobson's embrace of cybernetics in the context of linguistics served as an important frame for Lévi-Strauss, who did not attend (i.e. was not invited to) any of the Macy Conferences. In 1951 he began informally meeting, as a group, with Jacques Lacan, the linguist Émile Benveniste, and the mathematician Georges Théodule Guilbaud in part to discuss Guilbaud's work on translating cybernetic concepts and writings into French.[164] So Lévi-Strauss refers to "structural studies" as the "indirect outcome of modern developments in mathematics," citing von Neumann and Morgenstern's *Theory of Games and Economic Behavior*, Wiener's *Cybernetics*, and Shannon and Weaver's *The Mathematical Theory of Communication* as "outstanding achievements in this connection."[165] In this sense, we should not read "indirect" here as a synonym for "roundabout" or "weakly informed" but more akin to something like "one step removed from." This direct line from cybernetics to Jakobson's linguistics to Lévi-Strauss's anthropology is oversimplified as an account of intellectual history, but rather precise regarding Lévi-Strauss's 1951 essay "Language and the Analysis of Social Laws," which opens with an account of Wiener's objection to extending the mathematical logic and methods of cybernetics to the social sciences. According to Lévi-Strauss, Wiener's objection is two-pronged: 1) whereas in the natural sciences there is enough disjunction between the scale of the observer (us) and the scale of the phenomenon (stars, atoms), in the social sciences "the object of study is necessarily

[163] Jürgen Van de Walle, "Roman Jakobson, Cybernetics and Information Theory: A Critical Assessment," *Folia Linguistica Historica* 29.1 (2008), 113.

[164] Liu, "The Cybernetic Unconscious," 299-300.

[165] Claude Lévi-Strauss, *Structural Anthropology*, trans. Claire Jacobson and Brooke Grundfest Schoepf (New York: Basic Books, Inc., 1963), 283.

affected by the intervention of the observer, and the resulting modifications are *on the same scale* as the phenomena that are studied"; 2) the "statistical runs" available in, say, sociology and anthropology are far too short and limited to furnish conclusions that are comparable in "validity" to conclusions drawn from statistical data in the natural sciences.[166]

Lévi-Strauss thus begins his refutation by arguing that the study of language is, in particular, open to scientific (i.e. cybernetic) study as Wiener conceives it because 1) an observer cannot modify morphological or syntactical rules just by being conscious of them and 2) writing has existed long enough to provide robust data sets. Pointing to Jakobson's work on phonemes as a successful example of such application, Lévi-Strauss even suggests that one could, in theory, "construct a sort of periodic table of linguistic structures comparable to the table of elements."[167] His second move, then, is to postulate (quite loosely) that the *relations* that are the focus of linguistic study are in fact isomorphic with the kinds of relations (such as marriage rules) that are the focus of anthropology—an isomorphism that would then justify the application of cybernetic analysis to anthropological work.[168] As Lafontaine asserts, "the cybernetic revolution is what

[166] Claude Lévi-Strauss, "Language and the Analysis of Social Laws," *American Anthropologist* 53.2 (1951), 155-156. Italics his.

[167] Lévi-Strauss, "Language and the Analysis of Social Laws," 157.

[168] Lévi-Strauss, "Language and the Analysis of Social Laws" thus proceeds by "treating marriage regulations and kinship systems as a kind of language…That the mediating factor, in this case, should be the *women of the group*, who are *circulated* between clans, lineages, or families, in place of the *words of the group*, which are *circulated* between individuals, does not at all change the fact that the essential aspect of the phenomenon is identical in both cases" (159). Italics his. For a more in-depth examination of cybernetics' impact on Lévi-Strauss, see Christopher Johnson, *Claude Lévi-Strauss: The Formative Years* (Cambridge: Cambridge U. Press, 2003), 92-102.

supplies Lévi-Strauss with the foundation on which to build structural anthropology."[169] Bernard Geoghegan thus argues that developments in semiotics during the 1960s by theorists like Roland Barthes, Jacques Derrida, and others resulted from "adapt[ing] elements of Jakobson's and Lévi-Strauss's cybernetic structuralism and merg[ing] it with French Marxist critiques." "In the 1970s and 1980s," Geoghegan continues, "America's cybernetic gift to French semiotics began a slow migration home...American scholars learned from their French colleagues to understand texts, cultures, and entire societies as vying systems of cybernetic code."[170]

So it is no surprise that in Barthes's 1966 "An Introduction to the Structural Analysis of Narrative"—an essay that reconfigures structural approaches toward language (Jakobson) and myth (Lévi-Strauss) for literary analysis—one finds a definition of storytelling as "the ability to generate narratives (messages) based on the structure (the code)" and a description of "narrative units" which "identify or pinpoint certain elements of time and space" as "*bits of information*."[171] "Art" itself, Barthes declares, "does not acknowledge the existence of noise (in the informational sense of the word)...there are no wasted units," a characterization he would seemingly invert and develop in his next work on "codes," *S/Z*: "we see that literatures are in fact arts of 'noise'; what the reader consumes is this defect in communication, this deficient

[169] Lafontaine, "The Cybernetic Matrix," 34.

[170] Geoghegan, "From Information Theory to French Theory," 124-125. See also Lafontaine, "The Cybernetic Matrix," 36-41. For more detail specifically on the relationship between Derrida and cybernetics, see Christopher Johnson, "Derrida: the Machine and the Animal," *Paragraph* 28.3 (2005), 105-106.

[171] Roland Barthes, "An Introduction to the Structural Analysis of Narrative," trans. Lionel Duisit. *New Literary History* 6.2 (1975), 238, n2, 249. Italics his.

message."[172] Here, in his self-described "upset" of his structuralist approach in "An Introduction," Barthes attempts to radicalize the cybernetic account of communication by suggesting that meaning itself is produced from, and not antithetical to, "noise."[173] Yet even this (admittedly schematic) parallel shift—from structuralist to post-structuralist thought, from a rejection of informational noise to an embrace of it—is not what it seems. As Hayles has convincingly demonstrated, Barthes's position in *S/Z* of equating meaning to "noise" is in fact rather close to, if not a reproduction of, Weaver's conception of noise as he articulated it back in 1949.[174] This is where we need to part ways from the simplified outline we have been tracing, however, and hone in with detail on Barthes's moves in "An Introduction," because I want to suggest that in addition to "cybernetic structuralism" there exist resonances with developments in embryology and biochemistry—contemporary to and enmeshed with cybernetics but also in certain ways opposed to it. And I need to amplify these resonances because this chapter's ultimate aim is to identify a nascent theory of scale present in the beginnings of "structural" or "classical" narratology.[175]

"A narrative is a large sentence": Roland Barthes, Narratology, and Levels

[172] Barthes, "An Introduction," 245; Barthes, *S/Z*, trans. Richard Miller (New York: Hill and Wang, 1974), 145.

[173] "Interview: A Conversation with Roland Barthes" by Stephen Heath (1971), in *The Grain of the Voice: Interviews 1962-1980*, trans. Linda Coverdale (Evanston, IL: Northwestern U. Press, 1984), 134.

[174] Katherine Hayles, "Information or Noise? Economy of Explanation in Barthes's *S/Z* and Shannon's Information Theory," in *One Culture: Essays in Science and Literature*, ed. George Levine (Madison: The U. of Wisconsin Press, 1987), 127-135.

[175] See Gerald Prince, "Classical and/or Postclassical Narratology," *L'Esprit Créateur* 48.2 (2008), 115-116.

"What then are we to expect in the case of the analysis of narrative," asks Barthes early in the essay, "faced with millions of narratives?"[176] The answer he proposes is to follow the deductive procedures of structural linguistics, which is to say, to take a priori "a homologous relation between sentence and discourse, assuming that a similar formal organization encompasses all semiotic systems, whatever their substances or dimensions."[177] With this postulate in place, Barthes can then move on to classifying the different "narrative units" that make up this formal organization: functions, actions, and narration. However, our interest here is not in those units in particular, but instead that rather tall assumption, "whatever their substances or dimensions," which enables classification in the first place.[178] Confronted with "an infinity of materials" Barthes posits what Peter Steiner, in his study of the Russian Formalists, calls a "theoretical synecdoche": "it substitutes language—the material of verbal art—for art itself, and linguistics—the science of language—for literary studies."[179] Or as Barthes puts it, "a narrative is a large sentence, just as any declarative sentence is, in a certain way, the outline of a little

[176] Barthes, "An Introduction," 238-239.

[177] Barthes, "An Introduction," 240.

[178] For a summary of Barthes's classification scheme, see Frank Whitehead, "Roland Barthes's Narratology," *The Cambridge Quarterly* 21.1 (1992), 42-44. For a condensed account by Barthes, before his "turn" toward poststructuralism, see "The Discourse of History," trans. Stephen Bann, in *Comparative Criticism: A Yearbook,* vol. 3, ed. E. S. Shaffer (Cambridge: Cambridge U. Press, 1981), 14-15. Originally published in *Social Science Information* 6.4 (1967), 63-75.

[179] Barthes, "An Introduction," 240; Peter Steiner, *Russian Formalism: A Metapoetics* (Ithaca, NY: Cornell U. Press, 1984), 138.

narrative.[180] This baldly assertive "is," an equivalence of narrative and sentence, is precisely that "theoretical synecdoche," a scaling relation that holds true "whatever the dimensions." Thus, David Herman points out that Barthes, in conjunction with contemporaries like Tzvetan Todorov, A. J. Greimas, and Gérard Genette, made as a condition for structural analysis the assumption "that all categories pertaining to sentence-level grammar could be unproblematically scaled up to the discourse level, without compromising the descriptive or explanatory power of the grammatical machinery involved."[181] For Herman, then, Barthes's early narratology (and the general project of structural narratology as a whole during the 1960s) largely replicated the kind of synecdochic, scale-free logic that characterized New Critical close reading practices as they had developed two decades earlier.[182]

Yet smuggled within this "theoretical synecdoche," and at the same time in contradistinction to it, is a model of scale variance articulated in terms of hierarchy and levels.[183] Indeed, the very reason why Barthes wishes to turn to linguistics is not because it eliminates the need to consider scalar relations, but because it provides a framework for describing them:

> From the very first, linguistics provided the structural analysis of narrative with a decisive concept, because it pointed out the essentials of any system of meaning, namely

[180] Barthes, "An Introduction," 241.

[181] David Herman, "Histories of Narrative Theory (I): A Genealogy of Early Developments," in *A Companion to Narrative Theory*, eds. James Phelan and Peter J. Rabinowitz (Malden, MA: Blackwell Publishing, 2005), 30.

[182] Herman, "Histories of Narrative Theory," 25-29.

[183] On importing the ecological concept of scale variance for literary critique, see Derek Woods, "Scale Critique for the Anthropocene," *Minnesota Review* 83 (2014), 133.

> its organization; linguistics made it possible at once to spell out how narrative differs from a mere series of propositions, and to clarify the enormous mass of elements that go into the making of a narrative. Such a concept was that of the *level of description*.[184]

Moreover, the importance of this form of organization is not so much the levels themselves, but—in keeping with the structuralist emphasis on how signs mean, instead of what they mean—on the ways in which meaning is produced via the relations between levels:

> No unit pertaining to a certain level can be endowed with meaning unless it can be integrated into a superior level: a phoneme, although perfectly describable, means nothing by itself; it partakes in meaning only if integrated into a word; and the word itself must in turn be integrated into the sentence...Thus, in order to carry out a structural analysis, it is necessary first to distinguish several levels of description...and to place these levels within a hierarchical (integrative) perspective.[185]

Nor, it should be emphasized, is this hierarchical, integrative relation a version of that effortless scalability as constructed by the zoom: "narrative integration does not offer the appearance of smooth regularity...which would lead, from the infinite variety of simple elements through a symmetrical network of detours, up to a few complex masses."[186] Across these hierarchical relations are gaps and disjunctures, and the role of structural narrative analysis as laid out in "An

[184] Barthes, "An Introduction," 241-242. Italics his.

[185] Barthes, "An Introduction," 242-243.

[186] Barthes, "An Introduction," 270.

Introduction" is to map them in detail.

Barthes credits the Prague Circle, along with Benveniste, for this "theory of levels," also referred to as "the levels of integration."[187] Of course the basic idea that letters, words, and sentences may be categorized in hierarchical relation to one another does not originate in the twentieth century, but can be traced through Roman grammarians in antiquity all the way back to Plato's *Theaetetus*.[188] However, the important reformulation introduced by the Prague linguists and Benveniste, which Barthes takes up, are the combined notions that 1) signification is not unique to any one level but the result of relations within and across levels (what Benveniste calls "distributional" and "integrative" relations, respectively), and 2) higher levels are not decomposable into elements of a lower level and, conversely, lower level elements do not simply aggregate into higher ones.[189] So the Prague Circle criticized the concept of "immediate constituents," which had been conceived in the 1930s by the American linguist Leonard Bloomfield in order to describe the formation of sentence-level complexity. In Bloomfield's example, the sentence "Poor John ran away" is said to consist of two "immediate constituents": the "complex forms" (as Bloomfield terms it) "Poor John" and "ran away." The phrase "ran away" can be further decomposed into the morpheme "ran" and the complex form "away"—

[187] Barthes, "An Introduction," 242.

[188] Vivien Law, *The History of Linguistics in Europe From Plato to 1600* (Cambridge: Cambridge U. Press, 2003), 65-70.

[189] Émile Benveniste, *Problems in General Linguistics*, trans. Mary Elizabeth Meek (Coral Gables, FL: U. of Miami Press, 1971), 105-106. Originally published in 1966, although Benveniste's chapter on levels is adapted from an earlier talk given in 1962. See *Proceedings of the Ninth International Congress of Linguists*, ed. Horace G. Lunt (London: Mouton & Co., 1964), 266-293.

"away," in turn, consists of the morphemes "a-" and "way." Thus, for Bloomfield, "any complex form can be fully described (apart from its meaning) in terms of the immediate constituent forms."[190] By contrast, the Prague linguists held that "the summation of morphological units can never make up a sentence, because the latter is fundamentally something different from the total of the isolated words or groups of words by which it is implemented," a point echoed a decade later by Benveniste: "a linguistic unit will not be acknowledged as such unless we can identify it *within* a higher unit."[191] And at the foundation of their disagreement with "the doctrine of 'immediate constituents'" was the concern that it would "lead to a mechanistic analysis of speech units."[192]

So far this myopic account of Barthes's early narratological text accords with the broader historical contours of structural narratology's beginnings. Integrative levels would be just one of the many aspects of structural linguistics that French theorists attempted to import, adapt, and model for the purposes of literary analysis. In the general trajectory, this particular notion of levels would be discarded or reconfigured over time as part of the larger turn away from structural linguistics, a bit of conceptual detritus left over from an overly-enthusiastic strand of scientism. Yet the discourse of hierarchical, integrative levels found at this moment in Barthes is also centrally resonant with contemporaneous discourses of hierarchy and levels in the sciences, ones that also formed in opposition to the perceived epistemological and methodological dangers of "mechanistic analysis." Drawn from structural linguistics, Barthes's levels of integration

[190] Leonard Bloomfield, *Language* (London: George Allen & Unwin Ltd., 1973), 161, 167.

[191] Bohumil Trnka et al., "Prague Structural Linguistics," appendix to *A Prague School Reader in Linguistics*, ed. Josef Vachek (Bloomington: Indiana U. Press, 1964), 476; Benveniste, *Problems*, 104. Italics his.

[192] Trnka et al., "Prague Structural Linguistics," 476.

essentially referred to a hierarchy of classes and subclasses, not to a hierarchy of "size" or spatial composition. He stressed that the "smallest" units of narrative that made up the lowest level did not correspond to the linguistic units of either the word or sentence—"narrative units are independent of linguistic units with regard to substance"—nor to traditional divisions of narrative discourse such as scenes or paragraphs (the latter category quite visibly exploded by the 118-page paragraph in Samuel Beckett's *Molloy*).[193] Integrative levels as developed in the biological sciences in the 1930s and 40s aimed to coordinate and reconcile the hierarchy of types with the hierarchy of sizes, to account for both the scale of the observed system (biological parts and wholes) and the scale of the observing one (description, classification).

"So clear is the continuity": Hierarchy, Emergent Evolution, and Organicism

In 1932, the British biochemist and embryologist Joseph Needham anticipated that "the hierarchy of relationships, from the molecular structure of the carbon compounds at one end to the equilibrium between species in ecological wholes at the other, will probably be the guiding idea of the future."[194] Five years later, he elaborated on this prediction in a lecture entitled "Integrative Levels: A Revaluation of the Idea of Progress." As he announced from the get-go,

> The subject, then, to which our attention is to be given is the existence of levels of organisation in the universe, successive forms of order in a scale of complexity and

[193] Barthes, "An Introduction," 245-246.

[194] Joseph Needham, "Thoughts on the Problem of Biological Organisation," *Scientia* 52 (1932), 92.

> organisation....A sharp change in organisational level often means that what were wholes on the lower level become parts on the new, e.g. protein crystals in cells, cells in metazoan [i.e. multicellular] organisms, and metazoan organisms in social units.[195]

Needham's examples of various levels—proteins, cells, organisms, social units—are metaphorically spatial insofar they illustrate a compositional hierarchy, a hierarchy in which higher levels are "made up of" lower levels. Yet, as the subtitle of his lecture suggests, Needham was not only concerned with a spatial description of integrative levels, but a long-range temporal one as well: "There had been a time when a certain level of organisation had not existed, there would come a time when far higher levels would appear. Time was the inevitable datum."[196] Needham thus combined, implicitly, two overlapping but distinct discourses of "levels" that existed in the first few decades of the twentieth century: emergent evolution and organicism.

"Emergent evolution," as it was coined by the psychologist C. Lloyd Morgan, sought to provide an account of novelty that the Darwinian mechanism of natural selection, considered as a purely "negative" process, seemed unable to explain.[197] Which is to say, very basically, how could living things come to (positively) exist, as a class of being, in a universe that had solely consisted of non-living matter? Thus in *Emergent Evolution* (1923), Morgan indignantly positioned himself against explanations of life that reduced it to "a regrouping of physico-

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[195] Joseph Needham, "Integrative Levels: A Revaluation of the Idea of Progress," in *Time: The Refreshing River* (London: George Allen & Unwin Ltd., 1943), 233-234.

[196] Needham, "Integrative Levels," 246.

[197] Michael North, *Novelty: A History of the New* (Chicago: The U. of Chicago Press, 2013), 79-83. See also Reuben Ablowitz, "The Theory of Emergence," *Philosophy of Science* 6.1 (1939), 1-16.

chemical events...Against *such* a mechanical interpretation—*such* a mechanistic dogma—emergent evolution rises in protest."[198] Instead, he posited that mechanistic "resultants" of aggregated material on one level of reality provided the "quantitative continuity" which allowed a higher level of reality to emerge, "a qualitative change of direction, or critical turning point, in the course of events."[199] Morgan had developed this model in collaboration with the philosopher Samuel Alexander, the latter of whom Needham speculatively gave credit to for employing the term "levels" in such a context.[200] Alexander contended that "the different levels of existence which are more obviously distinguishable are motions [what he also refers to as Space-Time], matter as physical (or mechanical), matter with secondary qualities, life, mind" (Alexander would add "deity" as the final level yet to emerge, something that could not be equated with "merely infinite mind").[201] Although Morgan simplified Alexander's six levels to three (matter-life-mind), the historian of science David Blitz points out that debates over the number of levels, or what counted as a level—George P. Conger, for instance, postulated twenty-five levels categorized into three "realms"—still agreed, at their base, on a schema whose central organizing relation between levels was a matter of time.[202] As Conger put it after listing his twenty-five

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[198] C. Lloyd Morgan, *Emergent Evolution* (London: Williams and Norgate, 1927), 8. Italics his.

[199] Morgan, *Emergent Evolution*, 5. See also 9-11, 203-209.

[200] Needham, "Integrative Levels," 234, n1. For an account of Morgan's collaboration with Alexander, see David Blitz, *Emergent Evolution: Qualitative Novelty and the Levels of Reality* (Dordrecht, Netherlands: Springer Science+Business Media, 1992), 102-103.

[201] Samuel Alexander, *Space, Time and Deity*, vol. 2 (New York: The Humanities Press, 1927), 52, 329.

[202] George P. Conger, "The Doctrine of Levels," *The Journal of Philosophy* 22.12 (1925), 312-313; Blitz, *Emergent Evolution*, 126-128. According to Blitz, during the "eclipse" of emergent evolution in the 1930s to the mid-1950s "an aspect of emergentism was preserved in the concept of integrative levels in biology" (113).

levels, "*How do later levels develop from earlier levels?* This is, of course, the crux of the whole problem."[203]

The other discourse informing Needham's integrative levels was that of "organicism": an attempt at paving a third way in biology between mechanistic approaches—which claimed that full biological knowledge of an organism could be gleaned by way of analyses of its isolated parts—and vitalist approaches that asserted the presence of an "entelechy" or "élan vital" that crucially (but also rather mystically) made the whole more than the sum of its parts.[204] Invoked and popularized by the physiologist J. S. Haldane for the explicit purpose of distinguishing a middle path, "organicism" aimed to understand 1) the "wholeness" of an organism in relation to the organization of its parts (unlike the parts of a machine whose descriptions do not depend on their integration) and 2) the organism as a participant in its environment.[205] However, the term "organicism" itself has a somewhat confusing history and is worth sussing out. Organicism was not only retroactively and fully conflated with vitalism by biologists and philosophers of biology

[203] Conger, "The Doctrine of Levels," 313. Italics his. In this sense, "emergent evolution" can be seen as part of the longer tradition which Arthur O. Lovejoy identified as the "temporalizing of the Chain of Being" during the 18th century. See Arthur O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Cambridge, MA: Harvard U. Press, 1936), 242-287.

[204] For "entelechy" see Hans Driesch, *The Science and Philosophy of the Organism*, vol. 2 (London: Adam and Charles Black, 1908), 137-152 and Hans Driesch, *The History & Theory of Vitalism*, trans. C. K. Ogden (London: Macmillan and Co., Ltd., 1914), 202-206. For "élan vital" see Henri Bergson, *Creative Evolution*, trans. Arthur Mitchell (New York: The Modern Library, 1944), 57-62.

[205] John Scott Haldane, *Organism and Environment as Illustrated by the Physiology of Breathing* (New Haven, CT: Yale U. Press, 1917), 3, n1, 91, 112.

during the second half of the twentieth century and the beginning of the twenty-first,[206] but it was also accused of appearing as a kind of vitalism in sheep's clothing by contemporaneous opponents *and* proponents.[207] Thus, Needham referred to Haldane as an advocate of "vitalistic organicism": "it is a hard, round, smooth nut, which experimental analysis can neither crack nor lever open at any point….Hence the impotence of biologists confronted by Haldane's organisms."[208]

Needham's assertion was that organicism as articulated by Haldane, as well as by the marine biologist E. S. Russell, merely kicked the conceptual can down the terminological road. However, while Needham may have overstated his claim, it is helpful here to observe a distinction between two generations of organicism.[209] The earlier generation writing on organicism in the 1910s and 20s was exemplified by Haldane and Russell, while the later generation writing in the late 1920s through the late 30s included Needham, Joseph H. Woodger, Paul Weiss, and Ludwig von Bertalanffy (we will return to the latter two in the next section).[210]

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[206] Daniel J. Nicholson and Richard Gawne, "Neither Logical Empiricism nor Vitalism, but Organicism: What the Philosophy of Biology Was," *History and Philosophy of the Life Sciences* 37.4 (2015), 346-348.

[207] This blurring fed into New Critical conceptions of the "organic" text. See Craig Gordon, "Organicism and the Modern World: from A. N. Whitehead to Wyndham Lewis and D. H. Lawrence," in *Being Modern: The Cultural Impact of Science in the Early Twentieth Century*, eds. Robert Bud et al. (London: UCL Press, 2018), 339-340.

[208] Joseph Needham, "Organicism in Biology," *Journal of Philosophical Studies* 3.9 (1928), 38. See also Joseph Needham, "A Biologist's View of Whitehead's Philosophy," *Time: The Refreshing River*, 179.

[209] Donna Jeanne Haraway, *Crystals, Fabrics, and Fields: Metaphors of Organicism in Twentieth-Century Developmental Biology* (New Haven, CT: Yale U. Press, 1976), 202.

[210] Woodger and Needham were members of the Theoretical Biology Club in Cambridge which met from 1932-1938. Woodger met von Bertalanffy through the former's acquaintances in the Vienna Circle, and connected him

If the earlier generation referred to the idea of organization as an explanation of biological phenomena, i.e. the frame of scientific investigation, then the later generation took organization to be their focal point: not the explanation but what needed explaining.[211] "An intelligent outsider...would, I think, be astonished to find biologists disputing in this way about organization," wrote Woodger in *Biological Principles* (1929), "Is it not the first *fact* which strikes us about organisms?"[212] And as historians Daniel Nicholson and Richard Gawne coordinate, "one important aspect of biological organization that all of these organicists emphasized is its hierarchical nature...The hierarchical order of organisms enables us to distinguish—as we progressively move down the scale of organization—parts composed of cells, the cells themselves, parts of cells, molecular assemblies of parts of cells, and so on."[213]

Many of the second-generation organicists were deeply influenced by Alfred North

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to Needham. For a fuller account, see Erik L. Peterson, *The Life Organic: The Theoretical Biology Club and the Roots of Epigenetics* (Pittsburgh, PA: U. of Pittsburgh Press, 2016), 104-116. Weiss and von Bertalanffy had known each other since meeting in Vienna in the 1920s. See Manfred Drack and Wilfried Apfalter, "Is Paul A. Weiss' and Ludwig von Bertalanffy's System Thinking Still Valid Today?" *Systems Research and Behavioral Science* 24 (2007): 540-541.

[211] Nicholson and Gawne, "Neither Logical Empiricism," 365. Needham, "Thoughts on the Problem of Biological Organisation," writes: "This is the great difference between biologists of the type of Haldane on the one hand, and Bertalanffy and Woodger on the other. For the former it seems to be sufficient explanation of a biological event to attribute it to the organisation of the system in question; for the latter it is necessary to enquire in what organisation consists, and to find out what organising relations essentially are" (88).

[212] Joseph H. Woodger, *Biological Principles: A Critical Study* (New York: Harcourt, Brace and Company, 1929), 290.

[213] Nicholson and Gawne, "Neither Logical Empiricism," 366.

Whitehead's process-based "organic philosophy" as expounded in *Science and the Modern World* (1925) and were therefore focused on explicating hierarchical orders which considered the organism in flux.[214] So Woodger emphasized, "it is incorrect to speak of an ovum developing into a frog, it *is* a *temporal* part of the history which *is* the frog."[215] An important consequence of this approach was the reframing of "spatial hierarchy"—that familiar compositional hierarchy of atoms, molecules, cells, etc. (though Woodger mostly spoke in terms of cellular parts, cells, and cell-parts)—as an analytical abstraction derived from the process of hierarchical cell-division (called "division hierarchy"). In this sense, Woodger redrew the distinction between temporal and spatial levels as a distinction, respectively, between diachronic and synchronic ones: "A temporal slice is always a whole spatial hierarchy, whereas a spatial part is either a component or a constituent...of a spatial hierarchy."[216] Following Woodger's lead, Needham similarly described spatial hierarchies as "slices of life-histories."[217]

However, in attempting to reconcile the levels in organicism with those in emergent evolution, Needham's theory of integrative levels faced two problems. The first was that the diachronic "division hierarchy," which described acts of cell splitting, could not provide a model for emergent levels resulting from "integrative" processes. As he admitted, "it is difficult to

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[214] Erik Peterson, "The Conquest of Vitalism or the Eclipse of Organicism? The 1930s Cambridge Organizer Project and the Social Network of Mid-Twentieth-Century Biology," *The British Journal for the History of Science* 47.2 (2014), 286.

[215] Woodger, *Biological Principles*, 302-303. Italics his.

[216] Joseph H. Woodger, "The 'Concept of Organism' and the Relation Between Embryology and Genetics, Part II," *The Quarterly Review of Biology* 5.4 (1930), 457.

[217] Joseph Needham, *Order and Life* (Cambridge: Cambridge U. Press, 1936), 111.

picture an integrative mechanism except in distinctively morphological terms of contiguous situation."[218] The second problem involved extending the spatial hierarchical organization of the organism—originally formulated to refute reductionist views and to make the case for biology as a distinct scientific discipline—across a whole range of differently-sized entities, organic and inorganic. The theory of integrative levels thus looked to resolve both issues by transforming what had been two separate hierarchies into two aspects of a single hierarchical structure. Whereas Woodger stressed that diachronic and synchronic (i.e. spatial) hierarchies, though "interpenetrating" in any given multi-celled organism, were separate schemes with different levels, Needham asserted that "the world is a series of levels of organization, integration, and complexity; and...these levels occur both in time (evolutionary succession) and in space (morphological envelopes)."[219] Or put differently, he re-abstracted Woodger's original abstraction: if spatial relations were abstracted from a moment in time, then evolutionary succession was, in turn, abstracted from those spatial relations. "So clear is the continuity between inorganic, biological, and social order" proclaimed Needham, "the future state of social justice is seen to be no fantastic utopia, no desperate hope, but a form of organisation having the whole force of evolution behind it."[220] The spatial continuity of morphological parts and wholes guaranteed the temporal continuity of progress.

Implicit in this transformation of multiple hierarchies into aspects of a single hierarchy

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[218] Needham, *Order and Life*, 120-121.

[219] Joseph H. Woodger, "The 'Concept of Organism' and the Relation Between Embryology and Genetics, Part I," *The Quarterly Review of Biology* 5.1 (1930), 11; Joseph Needham, review of *Levels of Integration in Biological and Social Systems*, ed. Robert Redfield, in *Science & Society* 7.2 (1943), 190.

[220] Needham, "Integrative Levels," 235.

was a second transformation involving hierarchical relations of type and those of physical size. Compositional part-whole relations alone did not offer the morphological continuity Needham needed: organ-systems do not compose an individual body in the same way atoms compose a molecule. Thus, while still invoking those relations, Needham also introduced relations of containment, or what he called "envelopes." The passage is worth quoting at length:

> From the scientist's standpoint, the organic conception of the world involves *succession* in time and *envelopes* in space. Taking the latter first, it is obvious that the different levels of organisation, for such we must call them, occur one within the other. Ultimate particles, the proton, electron, etc. build up atoms, atoms build molecules, molecules build large colloidal particles and cell-constituents and paracrystalline phases and the like, these in their turn are organised into the living cell. Above this level, cells form organs and tissues, the latter combine into the functioning living body, and the bodies of animals, especially men, form social communities. As the central nervous system becomes more complex so mental phenomena emerge, until the elaborate psychological life of man is attained. There is a sense in which minds include and envelop bodies, for the boundaries of thought are far wider than those of what the special senses can record...The remarkable thing about our world is, however, that these envelopes seem each to be analogous to past phases in the history of its development….The fundamental thread that seems to run through the history of our world is a *continuous rise in level of*

organisation.[221]

"Occur one within the other," "build up," "combine into": spatial relations jostle back and forth between composition and containment, and even as Needham attempts to conceptually organize a singular hierarchical sequence—"a continuous rise in level of organisation"—rhetorically his sentences and grammars branch and recursively loop.[222] The linear chain of "x builds y, y builds z" spills into a polysyndeton of "large colloidal particles and cell-constituents and paracrystalline phases and the like." Having reached the level of social communities, he must double back to the central nervous system and suggest that minds, in fact, "include and envelop bodies." It is unclear in Needham's schema whether minds also envelop social, ecological, or astronomical formations, the latter two "levels" having existed long before the emergence of consciousness.

This ambiguity points to a second slippage with the notion of "enveloping" itself, which refers not just to physical nestedness, but typological inclusion of members in a broader class (drawn from Bertrand Russell and Whitehead). So Needham emphasized that "the concept we are dealing with is that of spatial dimension, not that size by itself has any importance, but because large things can contain smaller things, and hierarchical order is analogous to group-

[221] Joseph Needham, "A Biologist's View of Whitehead's Philosophy," *Time: The Refreshing River*, 184-185. Italics his.

[222] For two other influential formulations of this branching and looping, see James K. Feibleman, "Theory of Integrative Levels," *The British Journal for the Philosophy of Science* 5.17 (1954), 65; and D. J. Foskett, "Classification and Integrative Levels," *The Sayers Memorial Volume: Essays in Librarianship*, eds. D. J. Foskett and B. I. Palmer (London: The Library Association, 1961), 142-143.

theory, with its mathematical envelopes."[223] Borrowing from knowledge organization (KO) researcher Michael Kleineberg's account, a sequence like atom-molecule-cell can be interpreted simultaneously as a hierarchy of different kinds of matter (what Kleineberg calls a genus-species hierarchy) and as a hierarchy of different parts of an organism (a part-whole hierarchy).[224] Needham's introduction of "envelopes" in both spatial and typological contexts thus led to him to make the peculiar suggestion that atoms and electrons contained in a living organism were considered to be just as "alive" as the cells themselves.[225] According to Needham, then, the sequence electron-atom-molecule would be hierarchically related both as types of "living" matter and as parts of greater wholes.

For Kleineberg, working in the field of KO with an aim of examining and theorizing classification systems for archives, libraries, etc., such ambiguity as evident in Needham's integrative levels is to be avoided. Yet for us, such ambiguity emphasizes the role of the observer, of implicitly hierarchical classifications (types and sub-types) that are signaled semantically and grammatically, in postulating hierarchies of size and duration. In other words, it reminds us that that reflexivity is embedded in the hierarchical construction of scale. So the

[223] Needham, *Order and Life*, 112-114.

[224] Michael Kleineberg, "Integrative Levels," *Knowledge Organization* 44.5 (2017), 357. In other words, the relationship between each term in the sequence is transitive for both types of hierarchies. An example of intransitivity, still following Kleineberg's account, would be a sequence like arm-person-philosophy department, whereby the relationship between "arm" and "person" is a spatial part-whole while the relationship between "person" and "philosophy department" is of membership. The sequence is therefore intransitive because the arm cannot be said to be a "part" of the philosophy department in either sense.

[225] Needham, *Order and Life*, 117.

biologist Howard Pattee remarked in 1968, "I would suggest that 'being hierarchic' requires that the system control its dynamics through an internal record, which has some aspects of 'self-observation.'"[226] But this reminder is also old hat to the extent that reflexivity can be (and is here) understood as a general principle of system formation, and not as a unique characteristic of consciousness, certain novels written after 1945, or "being hierarchic."[227] What I want to suggest here is that the theory of integrative levels also provides an entry point for considering the converse: in what sense is reflexivity a scale-inflected procedure? In 1966, Barthes asked what it might look like to organize "levels of description" in a "hierarchical (integrative) perspective." Two years later, Pattee (conceptually) responded: "in systems which exhibit autonomous hierarchical organization, it is the internal collective simplifications which are the *cause* of the organization itself. In this sense, then, a new hierarchical level is created by a new hierarchical language."[228] Or as he elaborated, "when we say the flow of molecules in a gas forms a whirlwind, we have more than an alternative description; we have a new structure which dominates the motion of individual molecules. We can say a new hierarchical level has been formed."[229]

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[226] Howard H. Pattee, "Physical Conditions for Primitive Functional Hierarchies," in Whyte, Wilson, and Wilson, *Hierarchical Structures*, 170.

[227] Niklas Luhmann, "What is Communication?" *Theories of Distinction: Redescribing the Descriptions of Modernity* (Stanford, CA: Stanford U. Press, 2002), 156.

[228] Pattee, "Physical Conditions," 175.

[229] Howard H. Pattee, "Postscript: Unsolved Problems and Potential Applications of Hierarchy Theory," *Hierarchy Theory: The Challenge of Complex Systems*, ed. Howard H. Pattee (New York: George Braziller, 1973), 147.

"May I speak now?" "No, not now": Cybernetics meets Hierarchy

That different hierarchies of description and size were fundamental objects of investigation (and disagreement) in embryology, biochemistry, and theoretical biology meant that scientists working in those fields in the 1930s and 40s and in their intellectual wake in the 1950s and 60s were more attuned to identifying problematic conflations or distinctions.[230] It also allowed them to formulate critiques of one of cybernetics' core assertions on precisely those (hierarchical) grounds. Central to the cybernetic endeavor was an analogy between the brain and the computing machine. Warren McCulloch (who chaired all ten Macy conferences) and Walter Pitts (a core attendee) formulated the foundation for this analogy in a 1943 essay in which they posited an axiomatic parallel between the "all-or-none" characteristic of the neuron (it fires or it doesn't) and the binary logic of a propositional statement (true or false).[231] In 1945, von Neumann proposed that an automated computing system could be constructed on the basis of McCulloch and Pitts' logico-mathematical model of neural networks, with vacuum tubes

[230] Some examples of these debates: Alex B. Novikoff, "Integrative Levels in Biology," *ETC: A Review of General Semantics* 2.4 (1945): 203-213; Marjorie Grene, "Biology and the Problem of Levels of Reality," in *The Understanding of Nature: Essays in the Philosophy of Biology* (Boston: D. Reidel Publishing Company, 1967): 35-52; and Herbert A. Simon, "The Architecture of Complexity," *Proceedings of the American Philosophical Society* 106.6 (1962): 467-482.

[231] "To each reaction of any neuron there is a corresponding assertion of a simple proposition." Warren S. McCulloch and Walter H. Pitts, "A Logical Calculus of the Ideas Immanent in Nervous Activity," *Bulletin of Mathematical Biophysics* 5 (1943), 117.

"imitating" the neuron's all-or-nothing firing function.[232] By the time the Macy conferences formally commenced in 1946, the basic framing analogy was set: brains and machines were both "digital" in the sense that their activities involved quantized, discrete, and discontinuous processes, in contrast to the "analogical" perspective that considered neural activity in terms of continuity, i.e. chemical flows and electric fields.

This comparison was, one might guess, contested. At the seventh Macy meeting, Ralph Gerard—the neurophysiologist who had lamented the shift from "as if" to "is"—argued that "if we focus our attention too exclusively on the atomic aspects of the nervous system, we are likely to leave out an at least equally and perhaps more important [analogical] aspect of the mechanisms of neural functioning."[233] As his comment suggests, one major source of contestation came from the emphasis on hierarchical levels of integration and organization that second-generation organicists cultivated in the 1930s. Gerard had explicitly elaborated on Needham's model in a 1941 lecture titled "Higher Levels of Integration," coining the noun "org" to refer to an entity that exists as an integrated whole on one level and an integrating part on another (and also anticipating Arthur Koestler's more well-known coining of "holon" by almost three decades).[234] Moreover, the hierarchical levels of integration were both anti-reductionist reflections of a striated reality (physical envelopes) and of the institutional disciplines that

[232] John von Neumann, "First Draft of a Report on the EDVAC" (1945), 5. Reprinted in *IEEE Annals of the History of Computing* 15.4 (1993), 37.

[233] Gerard, "Some of the Problems," 17.

[234] Ralph Gerard, "Higher Levels of Integration," *Levels of Integration in Biological and Social Systems*, ed. Robert Redfield (Lancaster, PA: The Jacques Cattell Press, 1942), 74-75. For "holon" see Arthur Koestler, *The Ghost in the Machine* (New York: The Macmillan Company, 1967), 45-58.

studied their respective strata (classificatory envelopes).[235] When Julian Bigelow, an electrical engineer, defended the "digital" interpretation of the neuron by asserting that physicists considered the cell as an atomic "all-or-none" unit and not as "cells as they are described in somebody's book on cell structure," Gerard replied, "I think the physiologists would be likely to say that that is just like a physicist."[236] The following year, when organizing the transcripts of the eighth meeting for publication, the editors added a preface in which they pointed out Gerard's objection that "differences in levels of organization may be more than quantitative," before stating in totalizing fashion, "but the computing robot provides us with analogues that are helpful as far as they seem to hold, and no less helpful whenever they break down."[237]

So historian Jean-Pierre Dupuy observes that "cybernetics, very early in its career, was to find itself confronted by another conception of organized totalities, richer than the one it embraced and, in a sense, aimed against it."[238] Gerard, who attended every Macy meeting, was in this way "behind enemy lines." At his home institution of the University of Chicago, he had encountered and collaborated with two figures central to second-generation organicism (briefly mentioned in the previous section): Paul Weiss and Ludwig von Bertalanffy. Weiss had

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[235] J. S. Rowe, "The Level-of-Integration Concept and Ecology," *Ecology* 42.2 (1961), 422. This mirroring is refuted in Mario Bunge, "Do the Levels of Science Reflect the Levels of Being?" in *Metascientific Queries* (Springfield, IL: Charles C. Thomas Publisher, 1959): 108-123.

[236] Gerard, "Some of the Problems," 47.

[237] Heinz von Foerster, Margaret Mead, and Hans Lukas Teuber, "A Note by the Editors," *Cybernetics: Transactions of the Eight Conference*, xviii.

[238] Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science*, trans. M. B. DeBevoise (Cambridge, MA: The MIT Press, 2009), 129.

immigrated to the United States in the early 1930s and taken up a position in Chicago's biology department until the mid-50s. Gerard first met von Bertalanffy while the latter visited the university in 1937 to present his ideas for a "general system theory."[239] They would reconvene again in 1955 to establish, along with economist Kenneth Boulding and mathematician Anatol Rapoport, the "Society for General Systems Research" (SGSR).[240] Yet as Dupuy also notes, at the Macy conferences McCulloch, operating as the chair, exercised a rather high degree of control in directing and halting the flow of conversation. At one point during the seventh conference, while several other attendees debated Gerard's use of "analogical" versus "digital," Gerard piped up, "May I speak now?" to which McCulloch promptly said, "No, not now."[241] The case was entirely different across the country at the California Institute of Technology, when McCulloch and von Neumann gave presentations at the 1948 Hixon Symposium. Gerard, along with Weiss, was in attendance, surrounded by a more like-minded audience of biologists, psychologists, and physiologists.

Anticipating pushback, von Neumann admitted early on in his talk, "The General and

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[239] On Gerard's meeting with von Bertalanffy, see Debra Hammond, *The Science of Synthesis: Exploring the Social Implications of General Systems Theory* (Boulder: U. Press of Colorado, 2003), 145-146. On the development of general systems theory, see Ludwig von Bertalanffy, "An Outline of General System Theory," *The British Journal for the Philosophy of Science* 1.2 (1950): 134-165; and Ludwig von Bertalanffy, "General System Theory," in *General Systems: Yearbook of the Society for the Advancement of General Systems Theory*, vol. 1, eds. Ludwig von Bertalanffy and Anatol Rapoport (1956): 1-10.

[240] David Pouvreau, "On the History of Ludwig von Bertalanffy's 'General Systemology,' and on its Relationship to Cybernetics - Part II: Contexts and Developments of the Systemological Hermeneutics Instigated by von Bertalanffy," *International Journal of General Systems* 43.2 (2014), 184-185.

[241] Gerard, "Some of the Problems," 43.

Logical Theory of Automata," that "even the neuron is not exactly a digital organ…[and] in its fully analyzed functioning must be viewed as an analogy machine."[242] Nevertheless he asked listeners to "accept this oversimplification…[and] consider the living organisms as if they were purely digital automata"—a bit of rhetorical lip-service that seemed to make the "as if" to "is" move Gerard would critique two years later.[243] Yet as Von Neumann went on to point out, even the components of his machine, vacuum tubes and electromechanical relays, are actually complex analogical devices, and only exhibit the "all-or-none" response "under very particular conditions of operation":

> Thus the important fact is not whether an organ has necessarily and under all conditions the all-or-none character...but rather whether in its proper context it functions primarily, and appears to be intended to function primarily, as an all-or-none organ. I realize that this definition brings in rather undesirable criteria of "propriety" of context, of "appearance" and "intention." I do not see, however, how we can avoid using them, and how we can forego counting on the employment of common sense in their application.[244]

Thus, according to von Neumann, the neuron could be compared to the vacuum tube because neither *are* digital, but both *could be described* as such. This appears to be circular reasoning—we can describe the neuron as a digital "black box" so long as we ignore all analogical processes

[242] John von Neumann, "The General and Logical Theory of Automata," in *Cerebral Mechanisms in Behavior: The Hixon Symposium*, ed. Lloyd A. Jeffress (New York: John Wiley & Sons, Inc., 1951), 10.

[243] Von Neumann, "The General and Logical Theory of Automata," 10.

[244] Von Neumann, "The General and Logical Theory of Automata," 10-11.

for the purpose of describing it as a digital "black box"—but with a slight hitch: those "rather undesirable criteria of 'propriety' of context."

Von Neumann appeared to recognize, or at least ran right up to the edge of recognizing, that this assertion of propriety was not solely a propositional statement with a truth value, i.e. constative, but functioned as a performative one.[245] Indeed, these "undesirable criteria" were undesirable precisely because their truth values were indeterminable. This previous statement is not an abstract generalization, but a description of von Neumann's rhetorical and argumentative praxis. Knowing that no amount of argumentation could convince the biologists and psychologists in the room that the "proper context" of neural activity will make it "appear" digital, he appealed instead to propriety, appearance, and intention *as* performative functions: he simply could not "avoid using them." The "particular conditions of operation" thus doubly referred to the physical scale of observation (at this scale the neuron behaves digitally) and the performative procedures of description and classification. Or put differently, the neuron and the vacuum tube were not only physical systems conceived at a particular level or scale of observation, but "two instances of the same generic entity."[246]

McCulloch made a similar, though less explicitly self-reflexive, move in his talk, "Why the Mind is in the Head," where he reprised but also adapted the analogy that he and Pitts had

[245] According to Andrew Pickering, "Cybernetics and the Mangle: Ashby, Beer and Pask," *Social Studies of Science* 32.3 (2002), the development of cybernetics moved away from a "representational idiom" and toward a "performative idiom" (414).

[246] Von Neumann, "The General and Logical Theory of Automata," 12. This accords with Clifford Siskin's project to understand the concept of "system" in terms of "genre." See Clifford Siskin, *System: The Shaping of Modern Knowledge* (Cambridge, MA: The MIT Press, 2016), 1-3, 29-36.

advanced in 1943. In their original paper they drew a parallel between the binary "all-or-none" firing behavior of a neuron (as they thought was the case at the time) and the binary "true or false" logic of propositional statements. If a neuron fired, it represented the "truth value" of a proposition about external reality, and vice versa.[247] Yet at the Hixon Symposium, McCulloch remapped the binaries such that neural activity itself became subject to true-or-false values:

> a nervous impulse is also a signal. It is true if what it proposes is true, otherwise it is false. It is false if it arises from any cause other than the adequate, or proper, excitation of the cell....Press on the eye and you see light when there is no light. The signals are false. Thus nervous impulses are atomic signals, or atomic propositions on the move.[248]

In this remapping, he introduced a third term into his earlier definition of neurons as "bivalent systems."[249] The true-or-false value of a "nervous impulse" was here no longer determined by the "all-or-none" quality of its activation behavior, but by whether that impulse could be correlated with a proposition *outside* the neural network: namely, whether the source of "excitation" could be considered "proper" (echoing von Neumann's own invocation of propriety). Weiss caught this move, arguing that because the nerve signal was identical in both cases, it made no sense to assert that one stimulus (light) was "true" while the other (eyeball

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[247] This account taken from Günther Palm, "Warren McCulloch and Walter Pitts: A Logical Calculus of the Ideas Immanent in Nervous Activity," in *Brain Theory: Proceedings of the First Trieste Meeting on Brain Theory* eds. Günther Palm and Ad Aertsen (Berlin: Springer-Verlag, 1986): 229-230.

[248] Warren S. McCulloch, "Why the Mind Is in the Head," in Jeffress, *Cerebral Mechanisms in Behavior*, 46-47.

[249] McCulloch, "Why the Mind Is in the Head," 44.

pressing) was "false." Both signals, Weiss contended, were "manifestation[s] of that constitutional ability of the central optical apparatus to generate an activity sensed as light, whether stimulated 'adequately' or not."[250]

Thus, in his critique, Weiss articulated a model of self-organization that prefigured what Humberto Maturana and Francisco Varela influentially formulated as "autopoiesis" in the early 1970s.[251] As Weiss remarked,

> This brings us to the fundamental alternative, to which I think Dr. [Ralph] Gerard has likewise referred, of whether the central nervous system is merely a clearing house for input-to-output messages, or whether it generates activities of its own and has patterns of activities of its own, the elements of which are not pieced together by, and reflections of, the sensory input.[252]

McCulloch would re-encounter this "fundamental alternative" with his famous 1959 paper "What the Frog's Eye Tells the Frog's Brain" (co-authored with Pitts, Maturana, and Jerome Lettvin), which concluded that "the eye speaks to the brain in a language already highly organized and interpreted, instead of transmitting some more or less accurate copy of the

[250] Weiss, "General Discussion," in Jeffress, *Cerebral Mechanisms in Behavior*, 91.

[251] Dupuy, *The Mechanization of the Mind*, 129, 135-136.

[252] Weiss, "Discussion," in Jeffress, *Cerebral Mechanisms in Behavior*, 73.

distribution of light on the receptors."[253] Back in 1948, however, McCulloch more or less turned the idea into a joke. In the somewhat more contentious Caltech environment—given that he was available to be queried and could not arbitrate the discussion—McCulloch was bombarded with skepticisms regarding methods and technical details. After the dust settled and the questions were posed, he began his response by thanking Weiss for "liberating" him: "He [Weiss] holds the theory, you see, that the output is in no sense to be determined by the input...This suggestion of his makes it very easy to handle the host of questions. I cannot, for the life of me, attempt to answer them question by question. I would much rather try to give what I would call an organized statement."[254]

Still, where the 1959 paper referred to organization as a sufficient explanation, Weiss, in true organicist fashion, aimed to describe those "patterns of activities" in more detail. McCulloch and Pitts had defined neurons as propositional statements partly to describe, in a logico-mathematical way, reflexive neural activity, or what they called the "regenerative activity of constituent circles."[255] Weiss did not deny those circular processes, but argued that they were the result of scalar and hierarchical organization:

> the working of the central nervous system is a hierarchic affair in which functions at the higher levels do not deal directly with the ultimate structural units, such as neurons or

[253] J. Y. Lettvin, H. R. Maturana, W. S. McCulloch, and W. H. Pitts, "What the Frog's Eye Tells the Frog's Brain," *Proceedings of the IRE* 47 (1959), 1950. For the influence of this paper on the development of second-order cybernetics, see Hayles, *How We Became Posthuman*, 131-159.

[254] McCulloch, "General Discussion," in Jeffress, *Cerebral Mechanisms in Behavior*, 99.

[255] McCulloch and Pitts, "A Logical Calculus," 129.

> motor units, but operate by activating lower patterns that have their own relatively autonomous structural unity....The final output is then the outcome of this hierarchical passing down of distortions and modifications of intrinsically preformed patterns of excitation, which are in no way replicas of the input.[256]

Weiss's and Gerard's critique of cybernetics, then, was founded on their observation that McCulloch and von Neumann were either: 1) unwittingly conflating different kinds of hierarchical relations, substituting levels of description for levels of size and vice versa as it suited their argumentative and rhetorical needs at any given moment, or 2) disregarding the relevance of scalar differences altogether. So at the seventh Macy conference Gerard made a surprisingly strong semiotic move, remarking that one of the central intellectual contributions of cybernetics was to "make us recognize explicitly that the nerve impulse is not merely some physical-chemical event"—a position that would have already accorded with anti-reductionist organicism—"but a physical-chemical event carrying meaning. It is therefore a sign or a signal."[257] At the same time, he warned that even if we granted that *individual* nerve impulses had an all-or-none character, it would be "dangerous to go on from there and conclude that the functioning of the nervous *system* can be expressed essentially in terms of digital mechanisms."[258]

The point here is not to side with one mid-20th-century model of the nervous system over another, but to see in the confrontation between cybernetics and hierarchy a semiotic account of

[256] Weiss, "Discussion," 140-141.

[257] Gerard, "Some of the Problems," 12.

[258] Gerard, "Some of the Problems," 17. Emphasis mine.

scale-inflected reflexivity. What I mean by this is simply an analytical approach to narrative-linguistic representations of spatio-temporal scales that would keep explicit, on the one hand, Derek Woods's basic point that you need (at least) two scales to qualitatively talk about scale in the first place, and maintain, on the other, Susan Stewart's emphasis on "the skewed relation of language to physical scale...the fact that description of the miniature and description of the gigantic rely on internal systems of comparisons and social notions of the hierarchy of detail."[259] Reframed in this way, Barthes's notion of integrative levels is not only an artifact of a broader attempt at adapting structural linguistics for the purposes of literary-narrative analysis (Herman's "theoretical synecdoche"), but also deeply resonant with organicist-biological attempts to explore and foreground the often knotty relationship between different kinds of hierarchies (size, time, type, etc.).[260]

One straightforward consequence of observing this resonance is the reminder that the spatio-temporal scales of a narrative are not simply given, or produced on the level of story, but also on the level of discourse. A second, perhaps less straightforward, consequence is that even the distinction between story and discourse, often considered to be one of the central distinctions underlying classical structural narratology, is just one of any number of analytical hierarchies for

[259] Woods, "Scale Critique for the Anthropocene," 133; Susan Stewart, *On Longing: Narratives of the Miniature, the Gigantic, the Souvenir, the Collection* (Durham, NC: Duke U. Press, 1993), 94.

[260] Ernst A. Cassirer, "Structuralism in Modern Linguistics," *WORD* 1.2 (1945) made the suggestive but passing observation that the "methodological views and ideals" of Jakobson's "linguistic structuralism" were "very much akin" to those of von Bertalanffy's organicism (109).

thinking about discursive scale.[261] Thus, Olaf Stapledon's science fiction novel *Last and First Men* spans two-billion years not because one can piece it together across the entire narrative, or even because one can analyze how the narrative is pieced together, but because a single self-reflexive sentence puts it plainly: "the whole period to be covered by this chronicle is about two thousand million."[262] (This observation will elaborated in the coda.) So we have not been interested in debating what should constitute a narrative level, or in determining how many levels there ought to be, but in exploding their dimensions. Having cited Todorov's "two large levels" of story and discourse, Barthes wrote of the arbitrariness of the endeavor: "whatever the number of levels one proposes to study, and whatever their definition, there is no doubt that narrative is a hierarchy of levels of strata."[263] As we saw with Needham's integrative levels, hierarchies do not have to be understood as static, linear, and monolithic forms of stratification. They are subject to internal branchings, breakings, and loops, and they are often jointly formed by intersections and conflations with other hierarchies.[264]

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[261] For a summary of this distinction, see Jonathan Culler, *The Pursuit of Signs: Semiotics, Literature, Deconstruction* (Ithaca, NY: Cornell U. Press, 1981), 169-187 and Kent Puckett, *Narrative Theory: A Critical Introduction* (New York: Cambridge U. Press, 2016), 239-240.

[262] Olaf Stapledon, *Last and First Men*, in *Last and First Men & Star Maker: Two Science-Fiction Novels by Olaf Stapledon* (New York: Dover Publications, Inc., 1968), 142.

[263] Barthes, "An Introduction," 243.

[264] In this sense, the analytical model of hierarchy is not opposed to "heterarchy," which tends to be aligned with network organizations, but to "homoarchy": heterarchies define relations between elements that are either unranked or are ranked in multiple ways, while homoarchies define relations that are rigidly ranked in only one way. See Dimitri M. Bondarenko, "What is There in a Word?: Heterarchy, Homoarchy, and the Difference in Understanding 'Complexity' in the Social Sciences and Complexity Studies," in *Explorations in Complexity Thinking: Pre-*

Toward the end of the essay, Barthes writes that "the complexity of a narrative can be compared to that of an organigram, capable of integrating backtracking and forward leaps."[265] The translator notes that an "organigram" represents abstract hierarchical relations, such as those in a corporation, in contradistinction to a diagram which represents physical hierarchical relations.[266] Yet we can make our own "as if" to "is" move, and read in the "organigram" the discourse of levels in organicism that would confront and enmesh with the feedback and "feedforward" of cybernetics (the latter phrase coined by I. A. Richards at the eighth Macy conference).[267] A theory of narrative scale would not only be multi-scalar in the sense of coordinating the representations of different levels in, say, a size hierarchy, but it would be heteroscalar in trying to coordinate levels across different kinds of hierarchies, the represented and representing, the describing and described. As this chapter has argued, a theory of narrative scale existed in nascent and incipient form early on in structural narratology, jostling side-by-side with synecdochic assumptions and moves (pointed out by Herman earlier in the chapter). As we will see in the next chapter, this nascent theory of scale becomes neutralized when faced and combined with the more axiomatically scalable procedures of New Critical "close reading." If we are renewing our interests in the various rhetorical, narrative, and discursive constructions

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Proceedings of the 3rd International Workshop on Complexity and Philosophy, eds. Kurt A. Richardson and Paul Cilliers (Mansfield, MA: ISCE Pub., 2007): 35-47 and Carole L. Crumley, "Heterarchy and the Analysis of Complex Societies," *Archaeological Papers of the American Anthropological Association* 6.1 (1995): 1-5.

[265] Barthes, "An Introduction," 270.

[266] Lionel Duisit in Barthes, "An Introduction," 269, n73.

[267] See I. A. Richards, "Communication Between Men: Meaning of Language," in von Foerster, Mead, and Teuber, *Cybernetics: Transactions of the Eighth Conference*, 45-56 and 79-83.

of scale, it is important to understand the scalar assumptions embedded in the discipline's most influential hermeneutic and analytic methodology.

Chapter 3. Problems of Scale in "Close" and "Distant" Reading

In the preface to his 1975 work *Structuralist Poetics,* Jonathan Culler framed the importance of French literary structuralism by placing its methods and inquiries in direct opposition to New Critical ones. As he wrote, adopting the structuralist programme of "defin[ing] the conditions of meaning"—as opposed to determining meanings themselves—would "revitalize criticism and free it from an exclusively interpretive role" to which it had been relegated.[268] Culler elaborated on this opposition a year later in his essay "Beyond Interpretation," criticizing the ubiquitous "requirement of 'close reading'" in English departments as evidence of New Criticism's lingering yet "insidious" injunction to always and only interpret.[269] For Culler (in 1976), the problem with interpretation and "close reading" was a matter of scale. On the one hand, "close reading" was too boxed in by its focus on the individual, autonomous, work: "to engage in the study of literature is not to produce yet another interpretation of *King Lear*," Culler asserted, "but to advance one's understanding of the conventions and operations of an institution, a mode of discourse."[270] On the other hand, the problem of "close reading" was that it produced *too* much: "one can continue, almost ad infinitum, counting elements, noting their distribution, and generally producing facts about the

[268] Jonathan Culler, *Structuralist Poetics: Structuralism, Linguistics and the Study of Literature* (London: Routledge & Kegan Paul, 1975), viii.

[269] Jonathan Culler, "Beyond Interpretation: The Prospects of Contemporary Criticism," *Comparative Literature* 28.3 (1976), 244, 246.

[270] Culler, "Beyond Interpretation," 246.

text as object which have little relevance."[271] Thus, "close reading" was damned in two different scalar registers: its analytical reach was too small (*King Lear* versus a "mode of discourse"), while its observations were both too tiny and too many (elements counted ad infinitum).

Three decades later, Culler reappraised the phrase "close reading," maintaining its association with New Critical interpretation but now also covering structuralist poetics under its terminological umbrella:

> I would stress that close reading need not involve detailed interpretation of literary passages (though there is plenty of that around in close reading, especially when the texts in question are difficult to understand), but especially attention to how meaning is produced or conveyed...Thus it involves poetics as much as hermeneutics.[272]

In broadening the reach of "close reading"—what Peter Middleton describes as "our preferred contemporary term for a heterogeneous and largely unorganized set of practices and assumptions"—the quotation marks have dropped away.[273] Which is to say, "close reading" becomes close reading. Yet the rhetoricity of the term, the signaling of the term *as* a term by its containment in quotations, does not simply disappear along with the punctuation marks but is transmuted into the article's title: "The Closeness of Close Reading." Indeed, the marshalling

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[271] Culler, "Beyond Interpretation," 251.

[272] Jonathan Culler, "The Closeness of Close Reading," *ADE Bulletin* 149 (2010), 22.

[273] Peter Middleton, *Distant Reading: Performance, Readership, and Consumption in Contemporary Poetry* (Tuscaloosa: The U. of Alabama Press, 2005), 5.

together of New Criticism and literary structuralism, along with other procedures like new historicism, symptomatic reading, and deconstruction, into the grab bag of close reading's "closeness" is occasioned by the emergence of Franco Moretti's "distant reading" and its "analyses of large-scale trends."[274]

Although Culler disavows an antithetical relationship between "close" and "distant" at the beginning of the essay, stating that "distant reading" is "too divergent from regular modes of literary analysis to serve in a defining contrast," by the essay's end such defining contrast is clear:

> The notion of closeness might alert us to the importance, for the practice of close reading, of remaining close to the language of the text...It may become especially important to reflect on the varieties of close reading and even to propose explicit models, in an age where new electronic resources make it possible to do literary research without reading at all: find all the instances of the words *beg* and *beggar* in novels by two different authors and write up your conclusions.[275]

Here, the "closeness" of "close reading" directly opposes a conception of "distant reading" and its focus on "large-scale trends." The scalar rhetoric of "close reading" thus not only functions as a shorthand for the scalar logics undergirding various literary methodologies, but also plays a role in conceptualizing, relating, and differentiating those logics. So while Culler was

[274] Culler, "The Closeness of Close Reading," 20.

[275] Culler, "The Closeness of Close Reading," 24. Italics his.

distinguishing literary structuralism from New Critical "close reading" in the 1970s, René Wellek contemporaneously observed their affinities regarding "their concern for a microscopic analysis of texts."[276] It was not so much the observation of differences between scalar logics, but their rhetorical deployment that enabled Culler to mark a difference where Wellek saw a similarity. Culler's example of "find[ing] all instances of the words *beg* and *beggar*" is strikingly familiar to his earlier critique of New Criticism for interminably counting elements and "noting their distribution." In both instances, the scale of evidence is too small, and such textual "smallness" carries with it the evaluation of irrelevance, of "small" importance.

The first section of this chapter sketches a history of "close reading" as a phrase predominantly found in general usage in primary and secondary education handbooks during the 1930s that subsequently takes on more specialized usage in academic books and essays during the following two decades. The second section then details the issues of scale that crystallized in arguments about "close reading" once they came to focus on its "closeness"—which is to say, once "close reading" became an available term for the next half century against which adjectival reading (slow, distant, surface, deep, etc.) could push and define itself. The final section looks at current debates about scale that surround "distant reading" and "close reading," which often take the former to be a macroscopic view of corpuses consisting of thousands of texts and the latter to be the microscopic view of a single text, a few passages, or a couple of words. It explores how the rhetorics of scale employed in debates and arguments surrounding the practices behind "close reading" have informed and framed the debates over "close" and "distant" reading today.

[276] René Wellek, "The New Criticism: Pro and Contra," *Critical Inquiry* 4.4 (1978), 622.

"All respectable poetry invites close reading": Close Reading's Closeness

While the history of close reading is well known as part of the history of critics associated with Cambridge in the 1920s and 30s (I. A. Richards and William Empson, then F. R. Leavis and the *Scrutiny* group) and of the American New Critics (consisting at the core of John Crowe Ransom, Allen Tate, Robert Penn Warren, and Cleanth Brooks), the history of how "close reading" rose to prominence remains rather murky. In studies like Gerald Graff's *Professing Literature* (1987), John Guillory's *Cultural Capital* (1993), Virginia Jackson's *Dickinson's Misery* (2005), and Joseph North's *Literary Criticism* (2017), "close reading" is mostly referred to as a practice (or set of practices) and not as a term deployed in debates *about* critical and scholarly practice. A central reason for this relative absence is the lack of any clear "naming event," which Mark Seltzer defines as being

> more complex than a simple nominalism; it is not that the concept or category is simply "made up," but that the make-up of such concepts has its own internal "torque." It involves the positing of a category or type of person as a sort of point of attraction around which a range of acts, effects, fantasies, and representations then begin to orbit.[277]

So unlike "distant," "reparative," and "surface" reading—each of which can be associated with just one or two individuals, and each of which can be tracked across journals and books as "points of attraction"—"close reading" does not have, as Frank Lentricchia and Andrew DuBois

[277] Mark Seltzer, *Serial Killers: Death and Life in America's Wound Culture* (New York: Routledge, 1998), 108.

indicate, a "*single* influential manifesto or statement of purpose that insists on the term itself as the sole name for a particular practice."[278] It is more accurate in this case to see Seltzer's description in reverse: not as a "point of attraction" that then generates an orbit, but instead a constellation of practices, theorizations, "acts, effects, fantasies, and representations" that begin to pattern themselves around an absent center, one that will later be filled by the phrase "close reading."

In other words, one will not find a momentous event, but instead overlapping appearances of a name. However, the surprising fact is that there are almost no appearances of "close reading" in any of the usual suspects (Empson, Brooks, Warren, etc.).[279] While

[278] Frank Lentricchia and Andrew DuBois, introduction to *Close Reading: The Reader*, eds. Lentricchia and DuBois (Durham, NC: Duke U. Press, 2003), 3. On distant reading see Franco Moretti, "Conjectures on World Literature," in *Distant Reading* (London: Verso, 2013): 43-62; on reparative reading see Eve Kosofsky Sedgwick, *Touching Feeling: Affect, Pedagogy, Performativity* (Durham, NC: Duke U. Press, 2003), 123-151; and on surface reading see Stephen Best and Sharon Marcus, "Surface Reading: An Introduction," *Representations* 108.1 (2009): 1-21.

[279] My method was to look at each work in two ways: first through various keyword searches if the work was available online and text-searchable, and then through (manually) reading and skimming each work for the word "close." Following this, I cannot find the phrase "close reading" in Ransom's *The World's Body* (1938), Brooks and Warren's *Understanding Poetry* (1938) or *Understanding Fiction* (1943), Tate's *Reactionary Essays* (1936) or *Reason in Madness* (1941), R. P. Blackmur's *The Double Agent* (1935) or *The Expense of Greatness* (1940), Brooks's *Modern Poetry and Tradition* (1939) or *The Well Wrought Urn* (1947), or Yvor Winters's *Primitivism and Decadence* (1937). It does not seem to appear in any of their articles in *The Southern Review* during its publication between 1935 and 1942. On the British side, in addition to Leavis's books, "close reading" is absent from Empson's *Seven Types of Ambiguity* (1930), *Some Versions of Pastoral* (1935), and *English Pastoral Poetry* (the American

Lentricchia and DuBois state that "Ransom used the term, but not in a very specific sense" in *The New Criticism* (1941), I cannot find it anywhere in the book (they do not provide a quotation).[280] Terry Eagleton comments that "Leavis's name is closely associated with…'close reading,'" but likewise does not give a quotation.[281] I have subsequently been unable to find it in Leavis's *New Bearings in English Poetry* (1932), *For Continuity* (1933), *Culture and Environment* (1933), *Revaluation* (1936), or *Education and the University* (1943). The phrase occurs only three times in the entire run of *Scrutiny*: once by James Smith and twice by D. A. Traversi.[282] The notable exception is Richards's *Practical Criticism* (1929) where in one instance he writes, "All respectable poetry invites close reading."[283] Guillory thus credits *Practical Criticism* for pervasively using and promulgating "the little spatial trope that...was later elevated into a disciplinary term of art."[284] Of course, most of these critics employed metaphors of closeness, even if the exact phrase "close reading" is almost entirely absent. In this sense, Lentricchia and DuBois and Eagleton are correct in identifying critics who articulate criticism in

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publication of *Some Versions* in 1938), as well as from Richards's *Principles of Literary Criticism* (1924), *Science and Poetry* (1926), *Coleridge on Imagination* (1934), and *Interpretation in Teaching* (1938).

[280] Lentricchia and DuBois, *Close Reading*, 3.

[281] Terry Eagleton, *Literary Theory: An Introduction*, 2nd ed. (Minneapolis: U. of Minnesota Press, 1996), 37.

[282] See James Smith, review of *Form in Modern Poetry* by Herbert Read, *Scrutiny* 1.4 (1933), 395-396; D. A. Traversi, "Henry IV-Part II," *Scrutiny* 13.2 (1945), 117; and Derek Traversi, "Academic Criticism To-Day," *Scrutiny* 17.2 (1950), 182.

[283] I. A. Richards, *Practical Criticism: A Study of Literary Judgment* (New York: Harcourt, Brace and Company, 1929), 195.

[284] John Guillory, "Close Reading: Prologue and Epilogue," *ADFL Bulletin* 41.3 (2011), 23.

terms of closeness. Guillory draws a distinction, however, between this general metaphorical closeness, which "involves the question of attention," and "close reading" which entails more specific interpretive procedures.[285] For this reason, he argues that the tropes of closeness encountered in *Practical Criticism* are more a "prologue" to disciplinary "close reading" than any kind of origin.

Indeed, prior to the mid-1940s, the phrase "close reading" is most commonly found in discussions of primary, secondary, and early college education, and not of graduate studies or methods in the increasingly influential practice of academic criticism. (One of Richards's stated goals for writing *Practical Criticism* was "to prepare the way for educational methods more efficient than those we use now.")[286] So one finds in *The English Journal*: "Careful, absorbing study of a text does not come naturally...We should recognize the value of close reading in the training of superior students especially," and in workbooks like *Intelligent Reading* (1939): "Denotation is recorded in the dictionary; connotation the reader must discover by uniting a close reading of the text with a knowledge of the dictionary's definition."[287] Furthermore, "close reading" in these contexts is often just half of a balanced reading habit, the other half being "extensive," "rapid," or "wide" reading. The workbook *Develop Your Reading* (1941) is split

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[285] Guillory, "Close Reading," 24.

[286] Richards, *Practical Criticism*, 3.

[287] Tom Burns Haber, "Sharpening a Tool in the 'Tool-Course,'" *The English Journal* (College Edition) 23.6 (1934), 476; Edward A. Tenney, *Intelligent Reading: A Guide to Understanding the Printed Page* (New York: F. S. Crofts & Co., 1939), 3. Similarly, Helen H. Young, "Reading a Sentence: An Exercise in the Study of Meaning," *The English Journal* 30.6 (1941) writes of the need for "teaching close reading to older pupils in the secondary school" (457).

into two equal parts, "Rapid Reading" and "Close Reading," stressing the temporal, attention-focused connotations of "close."[288] In 1940, a committee of sociologists, educators, and anthropologists (including Margaret Mead) published the results of an eight-year examination of "the fundamental problems of education at the secondary level," stressing that "it is not the intent of this report to set the kind of close reading advocated against a wide reading. In fact, the two go hand in hand."[289] That is not to say that the phrase is entirely in academic-professional contexts. As early as 1941 the literary critic Norman Foerster conveyed satisfaction that

> never before...have we had so much close reading, sensitive discrimination, free-ranging alertness expressed in a subtle style suited to the task. I refer, of course, to men like T. S. Eliot, William Empson, John Crowe Ransom, Allen Tate, Cleanth Brooks, and R. P. Blackmur, who, though they have had other interests as well, have excelled in practical

[288] Pearle E. Knight and Arthur E. Traxler, *Develop Your Reading* (Boston: D. C. Heath and Company, 1941). An earlier book of theirs, *Read and Comprehend* (Boston: Little, Brown and Company, 1937), is also split into the two parts of "Extensive Reading: Can You Wear Seven-League Boots? And "Intensive Reading: Can You Plow Deeply?"

[289] V. T. Thayer, Caroline B. Zachry, Ruth Kotinsky, Willard W. Beatty, Helen M. Lynd, Margaret Mead, and W. Carson Ryan, *Language in General Education: A Report of the Committee on the Function of English in General Education for the Commission on Secondary School Curriculum* (New York: D. Appleton-Century Company, Inc., 1940), v, 192. In the preface the authors also expressed that their "debt...to I. A. Richards...is far more general than it has been possible to acknowledge through scattered specific references to his works" (viii).

criticism of the esthetic aspect of poems.[290]

But Foerster's rhetoric displays a phrase still in uncertain formation—"close reading" jostled with "sensitive discrimination" and "free-ranging alertness" as alternative descriptions of and for "practical criticism."

These occurrences of "close reading," in conjunction with the various metaphors of "closeness" deployed by Leavis, Ransom, Richards, and others, make up part of a longer rhetorical history of "paying close attention" as outlined by Michael Hancher. Tracking instances of the phrase "close reading" across a historical time span of centuries, Hancher thus argues that "the 'closeness' of close reading has long concerned not proximity but density and concentration."[291] Or as Joseph North puts it, "for the early critical paradigm, close reading was a way to use small units of text to focus one's attention."[292] Yet, we can also locate in these earlier literary-critical formulations of "closeness" a conceptual drift, one that shifts from describing the mental faculties of the reader toward describing aspects of the work itself. Indeed, "close reading" as Richards articulated it—"all respectable poetry invites close reading"—signified the work's quality as much as it described a reading act, the implication being that poetry of the non-respectable sort, or popular fiction and media more generally, does not "invite"

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[290] Norman Foerster, "The Esthetic Judgment and the Ethical Judgment," *The Intent of the Critic*, ed. Donald A. Stauffer (Princeton, NJ: Princeton U. Press, 1941), 71.

[291] Michael Hancher, "Re: Search and Close Reading," *Debates in the Digital Humanities 2016*, ed. Matthew K. Gold and Lauren F. Klein (Minneapolis: U. of Minnesota Press, 2016), 125.

[292] Joseph North, *Literary Criticism: A Concise Political History* (Cambridge, MA: Harvard U. Press, 2017), 106.

close reading. So Tate similarly asserted that only "good verse can bear the closest, literal examination of every phrase," as if bad verse would crumple under the weight, and Leavis praised Henry James's *The Awkward Age* precisely for "the extremely close and alert reading it demands."[293] The "good" text invites, demands, and supports close reading while the "bad" text does not.

Nor was it just the quality of the text, but specific qualities of the text that "closeness" brought into view. Ransom in *The New Criticism* talked of the need for critics to "obtain close studies of the structure-texture relations," citing William Empson as "the best endowed critic in the world for this purpose."[294] Yet even Empson, "the closest and most resourceful reader that poetry has yet publicly had," was criticized by Ransom for lagging "behind his readers in his sense of responsibility for logical structure in poetry as a whole." Which is to say, Empson read too closely, focusing too much on the minute poetic detail, the poetic texture, at the cost of considering the larger structure. There was a closeness to the poetic object that would illuminate its texture, and still another closeness that would allow one to "realize the *structure*...without sacrificing the *texture*."[295] In this Ransom echoed Richards from a decade earlier, who stressed that "the closest scrutiny of details is compatible with the fullest, fairest and most discriminating appraisal of the whole. Indeed, the two inevitably go together."[296]

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[293] Allen Tate, "Tension in Poetry," *The Southern Review* 4 (1938), 104; F. R. Leavis, "Henry James," *Scrutiny* 5 (1937), 413.

[294] John Crowe Ransom, *The New Criticism* (Norfolk, CT: New Directions, 1941), 275.

[295] Ransom, *The New Criticism*, 102, 129, 184.

[296] Richards, *Practical Criticism*, 38.

Already, then, from the late 1920s through the early 1940s, the rhetoric of close reading marshalled together the closeness of attention, the "smallness" of textual details, and the capacity to connect these small details to "the whole." What constituted small parts and larger wholes, however, varied from critic to critic. In Richards the "appraisal of the whole" meant the poem, while for Ransom it was "structure in poetry" itself. Moreover, the relation between parts and wholes ran in opposite interpretive directions. "The sovereign formula in all reading," wrote Richards, "is that we must pass to judgment of details from judgment of the whole. It is always rash and usually disastrous to reverse the process."[297] In other words, whereas Ransom wanted the small poetic details to provide the evidentiary ground for claims about larger poetic wholes, Richards advocated observations ("appraisals") of the whole to be the ground for claims about smaller textual details. The solidifying of "close reading" as a term in academic-professional contexts in the late 1940s and through the 1950s brought these differences into stark relief, functioning rhetorically as a way to raise questions about the different kinds of scale involved in interpretive procedures.

"The largest symbolizations possible": Close Reading as Too Big and Too Small

In 1947, Raymond Williams declared that "a course in close reading is inescapably necessary," referring specifically to adult education, but also claiming for "close reading" its wide analytical reach that the discipline still promotes and upholds today:

[297] Richards, *Practical Criticism*, 39.

> In a different interest, a course in reading may be applied to such institutions as newspapers, advertisements, popular fiction, pamphlets, &c., and its methods of analysis adapted to examine films, building, and broadcasting.[298]

Then in 1948, Stanley Edgar Hyman, teaching alongside Kenneth Burke at Bennington College, published *The Armed Vision* and lavished Empson, Leavis, and the New Critics with praise specifically for their "close reading." Thus, Winters contributes "some brilliant close reading," Brooks's *Modern Poetry and the Tradition* "illustrates its nature by detailed close reading," Leavis and his *Scrutiny* group provide "some of the sharpest close reading of our time," and Empson's *Seven Types of Ambiguity* contains "probably the finest close reading of poetry ever put down."[299] That same year, Arnold Stein reviewed Austin Warren's *Rage for Order* and referred to his "very considerable skill in the art of close reading."[300] Wellek and Warren published their *Theory of Literature* (1948), providing in the bibliography a subsection titled "Discussions of 'Close Reading' and Examples of Methods" in which they cited the Cambridge

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[298] Raymond Williams, "Some Experiments in Literature Teaching," *Rewley House Papers* 2 (1947), 15. Raymond Williams, *Reading and Criticism* (London: Frederick Muller Ltd., 1950) writes: "Not all great novels have a similar verbal pattern, but all have an essential structure which only close reading, or the more explicit process of literary analysis, will reveal" (86).

[299] Stanley Edgar Hyman, *The Armed Vision: A Study in the Methods of Modern Literary Criticism* (New York: Alfred A. Knopf, 1948), 71, 94, 302, 277. That same year, Ransom favorably reviewed the book in *The Kenyon Review* 10.4 (1948): 682-688.

[300] Arnold Stein, "Criticism and the Search for the Total View," Review of *Rage for Order* by Austin Warren, *The Sewanee Review* 56.4 (1948), 702.

and New critics, in addition to R. S. Crane and Elder Olson of the Chicago school (the phrase is absent from the works they list with the exception of *Practical Criticism*).[301] Hyman followed suit seven years later, including a subentry on "close reading" in his revised and abridged edition of *The Armed Vision*.[302] In 1950, Malcolm Cowley, as part of a roundtable with other literary critics like Burke, Tate, and William Barrett, suggested that "'close reading' would be a better phrase than New Criticism," since the latter had acquired too many polemical valances.[303]

By this time in the 1940s and 50s, the institutional negotiation between the New Critics and the older vanguard of historical scholars had produced an uneasy compromise that rested on the spatial metaphor of "intrinsic" versus "extrinsic" analyses. As Graff notes, "so long as the dualism was accepted between intrinsic and extrinsic, the work itself and its historical background, there remained a tension at the conceptual level that mirrored unresolved institutional tensions."[304] This metaphorical inside/outside distinction served as the basic format for Wellek and Warren's *Theory of Literature*, which categorized historical, social, and psychological approaches as "extrinsic" and metrical, stylistic, and symbolic ones as "intrinsic," as well as M. H. Abrams's synoptic review of contemporaneous literary theory, which contrasted theories requiring "external points of reference" with the "objective" theories that analyzed a text

[301] René Wellek and Austin Warren, *Theory of Literature* (New York: Harcourt, Brace and Company, 1948), 365.

[302] Stanley Edgar Hyman, *The Armed Vision*, rev. ed. (New York: Vintage Books, 1955), viii.

[303] Malcolm Cowley in William Barrett, Kenneth Burke, Malcolm Cowley, Robert Gorham Davis, Allen Tate, and Hiram Haydn, "The New Criticism," *The American Scholar* 20.1 (Winter 1950-1951), 98.

[304] Gerald Graff, *Professing Literature: An Institutional History* (Chicago: The U. of Chicago Press, 1987), 184.

"solely by criteria intrinsic to its own mode of being."[305] Moreover, this inside/outside distinction depended on a model of the concrete "work itself," what Ransom stressed as "the autonomy of the work itself as existing for its own sake" and what W. K. Wimsatt in *The Verbal Icon* (1954) described as the hypostatization of the poem-as-act into the poem-as-critical-object.[306] Though the contradictions and assumptions of this distinction have been much discussed, my focus here is on: 1) how the inside/outside boundary that defined the work as an object of analysis also extended in a rather rhetorically fraught way to analysis itself, and 2) how the coalescing of "close reading" as a phrase provided a new rhetorical arena in which arguments over New Criticism and literary scholarship could be conducted.[307] Although the two are related, the tendency to conflate "close reading" with "intrinsic criticism" as terms designating New Critical practices has obscured the ways in which critics during this period conceptualized the role of scale in interpretation.

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[305] M. H. Abrams, *The Mirror and the Lamp: Romantic Theory and the Critical Tradition* (New York: Oxford U. Press, 1953), 26.

[306] John Crowe Ransom, "Criticism, Inc.," in *The World's Body* (New York: Charles Scribner's Sons, 1938), 343; W. K. Wimsatt, Jr., *The Verbal Icon: Studies in the Meaning of Poetry* (U. of Kentucky Press, 1954), xvii. Douglas Mao, "The New Critics and the Text-Object," *ELH* 63.1 (1996) shows that there are finer differences between Ransom and Wimsatt, as well as Brooks, in how they negotiate the inside/outside metaphor. Mao nevertheless argues that the "assumption that the text has a thingly aspect continues to be essential to literary study" (229).

[307] E. D. Hirsch, for instance, argued that the central assumption in intrinsic criticism that equated "poetic excellence" with "moral excellence" meant that "so-called intrinsic criticism" was in fact all extrinsic. Hirsch, "'Intrinsic' Criticism," *College English* 36.4 (1974), 447, 454. For a more recent summary, see Fredric V. Bogel, "Toward a New Formalism: The Intrinsic and Related Problems in Criticism and Theory," *New Formalisms and Literary Theory*, eds. Verena Theile and Linda Tredennick (New York: Palgrave Macmillan, 2013): 29-53.

Paul de Man observed in *Allegories of Reading* (1979) that New Critical formalism had effected a particular reversal of the inside/outside distinction, such that "internal meaning ha[d] become outside reference, and the outer form ha[d] become intrinsic structure."[308] For de Man, however, the point was that despite this reversal, and despite subsequent critiques of New Criticism that sought to reverse the reversal, the basic metaphor of inside/outside foundational to both efforts remained unexamined.[309] Indeed, the conceptualization of the text as having a boundary and thus an inside/outside generated a meta-rhetoric about criticism which also located the critic in relation to the text on inside/outside terms. We can see the kind of contorted spatial gymnastics that following these terms could lead one to perform. In a footnote in *The Well Wrought Urn* (1947), Brooks admitted that

> No theory of poetry can make poetry autonomous in the sense that it denies that every poem is rooted in the language of a particular time. We *start* outside the poem. But there is another sense in which it may be held that we are forced to go *outside the poem*: in

[308] Paul de Man, *Allegories of Reading: Figural Language in Rousseau, Nietzsche, Rilke, and Proust* (New Haven, CT: Yale U. Press, 1979), 4. See also Paul de Man, "Form and Intent in the American New Criticism," in *Blindness and Insight: Essays in the Rhetoric of Contemporary Criticism* (New York: Oxford U. Press, 1971): 20-35. For an appraisal of deconstruction's relationship with the discourse of intrinsic/extrinsic analysis, see Stephen R. Yarbrough, "Intrinsic Criticism and Deconstruction: Their Methods' Legacy," *South Central Review* 3.1 (1986): 78-89.

[309] Robert Foulke, "Intrinsic vs Extrinsic Criticism: A Valid Distinction?" *Modern Language Studies* 7.2 (1977) similarly described debates over intrinsic and extrinsic analysis as "the critical seesaw which has left the form of the distinction unchanged" (3).

> determining the power of the tensions generated, the fact of the reconciliations achieved, etc., the reader will have to have recourse to his own experience, and on occasion different readers may disagree.[310]

Brooks's distinction between "starting" outside the poem and being "forced to go outside" of it (is the latter after we have somehow gotten "inside" the poem?) is all the more obscured if we consider the statement that is footnoted: "he [the critic] would not be forced to go outside the poem to find some criterion external to it, but would be able to find a criterion in the organization of the poem itself by assessing...the power of the tensions involved in it, the scope of the reconciliation which it is able to make, etc."[311] In hewing to the inside/outside distinction, Brooks runs up against its rhetorical and conceptual limits. On the one hand, this footnote is a concession to the impossibility of purely intrinsic criticism. We all necessarily "start" outside, bringing the ability to, say, recognize a sonnet as a sonnet, or to even read English in the first place. The second sense of being forced to "go outside the poem," however, does not refer to the relation between the critic and the poem (the conditions that make reading possible), but instead to the relation between pieces of evidence and their corresponding interpretation. Here Brooks means something more like being forced to "look" outside the poem, to draw from experiences "outside" the text in order to make claims about what is happening "inside it."

"Close reading," then, provided another set of spatial terms with which to conceptualize

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[310] Cleanth Brooks, *The Well Wrought Urn: Studies in the Structure of Poetry* (New York: Reynal & Hitchcock, 1947), 255. Italics his.

[311] Brooks, *The Well Wrought Urn*, 255-256.

this latter relation in literary criticism. Whereas the language of "intrinsic" and "extrinsic" approaches conceptualized the role of evidence and interpretation in terms of what side of the boundary they could be located on, the rhetoric of "close reading" more explicitly foregrounded the relation itself between textual evidence and interpretation. Functionally, both descriptions ("close reading" and "intrinsic criticism") could fit, say, Brooks's paradigmatic analysis of John Keats's "Ode on a Grecian Urn."[312] As early as 1948, however, such a rhetorical distinction allowed Hyman to group "intrinsic" New Critical practices together with "extrinsic" psychoanalytic associations (as well as knowledge about "the nature of capitalist society") under the umbrella of "a kind of close reading and detailed attention to the text that can only be understood on the analogy of microscopic analysis."[313] Or put another way, with "close reading" the question was not about accurately drawing boundaries, but about determining appropriate distance, size, and magnification—the three spatial logics whose varied coordinations produce, as we saw in chapter one, conceptions of scale.

The literary historian Douglas Bush thus opened his 1948 presidential address to the Modern Language Association by complimenting "the new critics' close reading of poetry"[314] before launching into invective against its closeness. Critics practicing such close reading, he asserted, "prefer to shun big works and to confine their operations to short poems and lyrics (and to furnish only sidelights on them)," a preference that produced "intellectual bubble-blowing."[315]

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[312] See chapter 8 of Brooks, *The Well Wrought Urn*.

[313] Hyman, *The Armed Vision*, 3.

[314] Douglas Bush, "The New Criticism: Some Old-Fashioned Queries," *PMLA* 64.1, part 2 (1949), 13.

[315] Bush, "The New Criticism," 15, 17.

Bush's polemic did not rehearse arguments about the merits or boundaries of "intrinsic" and "extrinsic" analysis, but instead focused on the "smallness" of New Critics' textual examples and, by extension, the "smallness" of their resulting interpretations and conclusions. In the following year, Brooks replied: "there is a tendency to identify the new criticism with 'close textual reading' and to assume that it is limited to problems of what used to be called 'diction.' The essays here collected should supply a corrective to such a view."[316] Articulating his own corrective, Brooks made the case that

> Words open out into the larger symbolizations on all levels—for example, into archetypal symbol, ritual, and myth. The critic's concern for 'language' need not be conceived narrowly, even if his concern leads to an intensive examination: it can be extended to the largest symbolizations possible.[317]

Brooks's response to assertions of close reading's narrow scope was to keep the scale of the text—a word, a few lines, a short lyric poem—more or less the same, while broadening the scale of symbolic interpretations available to it ("all levels"). Close reading's scalability, in other words, functions by assuming a relation between text and interpretation that fixes the scale of the former while removing any limitation of scale of the latter. A useful comparison here is with

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[316] Cleanth Brooks, foreword to *Critiques and Essays in Criticisms, 1920-1948: Representing the Achievement of Modern British and American Critics*, ed. Robert Wooster Stallman (New York: The Ronald Press Company, 1949), xix.

[317] Brooks, foreword to *Critiques and Essays in Criticism*, xix.

Wellek and Warren's suggestion of how their "intrinsic" method of analyzing a single text might scale to larger literary genres and archetypes. In *Theory of Literature* they posited an approach that would slowly build from "common elements or factors which would approximate two or more given works of art," allowing one to transition "from the analysis of one individual work of art to a type such as Greek tragedy and hence to tragedy in general, to literature in general, and finally to some all-inclusive structure common to all arts."[318] If Wellek and Warren were advocating a slow and summative procedure—making sure one level of analysis was secure before moving onto the next—Brooks, by contrast, claimed for close reading a relation that could bypass intermediate levels: the words themselves could "open out" to any scale of interpretation or analysis.

So while Bush emphatically targeted close reading's "smallness," others took issue with the opposite end of the interpretive scale: the "largest symbolizations possible." Crane, for instance, saw promise in "the strong emphasis placed by academic representatives of the [New Critical] school on the 'close reading' of texts," but as of 1952 this was still only a promise.[319] The central flaw, according to Crane, was that the particularities of a given text analyzed via "close reading" were always subordinated to "a more abstract kind of theory."[320] By beginning with fundamental definitions and qualities of ("good") poetry—paradox, ambiguity, irony, etc.—that were encompassing enough, it was trivial, Crane argued, for New Critics to demonstrate

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[318] Wellek and Warren, *Theory of Literature*, 151.

[319] R. S. Crane, introduction to *Critics and Criticism: Ancient and Modern*, ed. R. S. Crane (Chicago: The U. of Chicago Press, 1952), 15.

[320] Crane, introduction to *Critics and Criticism*, 24.

how any particular poem, passage, or phrase instantiated those qualities.[321] In 1953 John Holloway censured the "'close-reading' critics" for having transformed literary criticism into a "game" of producing "extravagant results," and a few years later Jacques Barzun expressed a similar sentiment, writing that while "'close reading' has undoubtedly done some incidental good by reminding readers that accuracy is a virtue...Practice shows that there is no limit to the number of subtle, profound, and startling ideas and connections that can be squeezed out of any ten lines of verse and prose."[322]

Already at the term's beginnings, then, its rhetorical "closeness" engendered skepticisms that, in a Goldilocks fashion, took close reading to task for interpretive conclusions which were either "too small" or "too big." In 1951 Leslie A. Fiedler explicitly leveled a critique against close reading's "excluded middle," arguing that without a focus on middle structures such as plot, point of view, and character, criticism became either "the schoolmaster's niggling concern with words" (too small) or "a Colonel Blimpish sort of moral indignation" (too big).[323] Nested within Fiedler's objection, moreover, was the suggestion that the middle scale of textual evidence necessarily corresponded with a middle scale of interpretation. So "with the middle

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[321] See also R. S. Crane, "Prefatory Note," *The University Review* 8 (1942): 199-202.

[322] John Holloway, "The Critical Intimidation," *The Hudson Review* 5.4 (1953), 488; Jacques Barzun, *The Energies of Art: Studies of Authors Classic and Modern* (New York: Harper & Brothers, 1956), 14.

[323] Leslie A. Fiedler, "The Critic's Excluded Middle," review of *The Novel in France* by Martin Turnell, *The Kenyon Review* 13.4 (1951), 702. In this review, Fiedler uses the phrase "close analysis" (in quotations), but his emphasis is on the "'close' discussions of verbal patterns," 702. In Fiedler's "Archetype and Signature: A Study of the Relationship between Biography and Poetry," *The Sewanee Review* 60.2 (1952), he calls "'close reading'...a cant phrase of the antibiographist" (259).

that is its functional embodiment," Fiedler wrote, "is lost the capital insight of 19th Century criticism: that the job of the fictionist is the evocation of 'felt life.'"[324] Indeed, the central problem with close reading for critics like Fiedler, Barzun, and Crane was not necessarily the "largest symbolizations" in themselves, but the fact that those symbolizations had been fixed to the relatively small scale of short lyric poems.[325]

This relation between the small-scale text and large-scale symbolizations is what Julie Orlemanski calls "close reading's synecdochic logic," whereby the focus of investigation (the word, the plot, etc) becomes representative of some "larger" moral, social, or historical claim.[326] Ransom, invested in the autonomy of the work of art, thus argued that "synecdoche is a way of indicating the irreducibility of the object as a whole by citing some perfectly intractable part."[327] Burke likewise defined the "well-formed work of art" as being "internally synecdochic."[328] Lurking behind these statements, however, was another synecdoche, which was not the part of the poem in relation to the whole, but now the part of the world (the poem) in relation to the whole. For Ransom, the lyric alone stood as the poet's perfect "microcosm."[329] Consequently, a

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[324] Fiedler, "The Critic's Excluded Middle," 702.

[325] Fiedler's objection thus also raised generic concerns, since the excluded middle was most readily visible in prose fiction. As Virginia Jackson, *Dickinson's Misery: A Theory of Lyric Reading* (Princeton, NJ: Princeton U. Press, 2005) observes: "Lyric became a *metaphor* for the New Criticism, in the sense that both the genre and the critical perspective on that genre came to stand for one another" (93). Italics hers.

[326] Julie Orlemanski, "Scales of Reading," *Exemplaria: Medieval, Early Modern, Theory* 26.2-3 (2014), 223.

[327] John Crowe Ransom, "The Irish, the Gaelic, the Byzantine," *The Southern Review* 7.3 (1942), 528.

[328] Kenneth Burke, "Four Master Tropes," *The Kenyon Review* 3.4 (1941), 427.

[329] John Crowe Ransom, "Shakespeare at Sonnets," *The Southern Review* 3.3 (1938), 532.

double substitution enabled a direct relation between poetic "texture" (the details of the literary text) and world-sized structures ("the world's body") to replace sociohistorical context.

Ian Watt raised the issue of synecdoche in his classic explication of the first paragraph of Henry James's *The Ambassadors*, remarking, "it [practical criticism] contains an inherent critical bias in the assumption that the part is a complete enough reflection of the literary whole."[330] He consequently made the case for his own particular close reading by asserting that in "selecting thoughts and events which are representative of the book as a whole, and narrating them with an abstractness which suggests their larger import, James introduces the most general themes of the novel."[331] Which is to say, Watt justified his synecdochic close reading in part by tying it to the synecdochic quality of James's writing technique—and not all authors exhibited such representativeness. Charles Dickens and Jane Austen were offered as examples where Watt's method could not apply, and Joseph Conrad as the writer who came closest to "suggest[ing] something of James's ambitious attempt to achieve a prologue that is a synchronic introduction of all the main aspects of the narrative."[332] Writing in 1960, Watt's justification for his method still involved making a crucial first step, which was to argue for the synecdochic representativeness of the passage before doing a close reading of it.

Yet while the scales of textual evidence and interpretation were, as we have seen, matters of metaphorized magnitude ("size"), they also involved matters of multitude. Arguments about close reading conducted along this latter axis had less to do with whether such a hermeneutic

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[330] Ian Watt, "The First Paragraph of the *Ambassadors*: An Explication," *Essays in Criticism* 10.3 (1960), 251.

[331] Watt, "The First Paragraph," 268.

[332] Watt, "The First Paragraph," 270.

could infer something significant about poetry writ large from just a short line of a lyric and more to do with quantities of textual evidence and, conversely, quantities of interpretative claims. As we'll examine in more detail in the next section, contemporary debates involving close and distant reading often rhetorically invoke "scale" in a broad sense while pivoting rather brusquely between these different kinds of scale (text and interpretation, magnitude and multitude).[333] These debates provide a helpful avenue toward clarifying the role of multitude in scalar rhetoric because they reprise, with surprisingly similar terms and moves, how these scales were prominently discussed at "close reading's" mid-twentieth-century inception: namely via critiques of scientism.

"Thirty thousand feet above the ground": What's Distant about Distant Reading?

Advocates and critics of quantitative analysis in literary study have turned alike to a

[333] By distant reading I refer to the strand of practices and discourses within the digital humanities that Nan Z. Da, "The Computational Case against Computational Literary Studies," *Critical Inquiry* 45.3 (2019) identifies with the phrase "computational literary studies": "the project of running computer programs on large (or usually not so large) corpora of literary texts to yield quantitative results which are then mapped, graphed, and tested for statistical significance and used to make arguments about literature or literary history or to devise new tools for studying form, style, content, and context" (601-602). I use the phrase "distant reading," however, since the focus of this chapter is on the way rhetorics of closeness and distance have variously marshalled, and in some instances blurred, conceptual problems of scale in literary analysis. In doing so I also follow Ted Underwood's assessment in *Distant Horizons: Digital Evidence and Literary Change* (Chicago: The U. of Chicago Press, 2019) that 1) distant reading is still an apt term to describe literary scholarship that uses quantitative and computational methods, and 2) distant reading need not be confined to the "speculative rationale" that Moretti advanced for it back in 2000 (xix).

rhetoric of scale, which can be sorted into two related positions. In the first position, the close/distant binary is reaffirmed as a binary, often via its rearticulation as a micro/macro distinction that takes the "distant" or macro view as something analogous to a bird's-eye view. With this analogy, one necessarily loses the detail or "texture" of the individual text, author, or passage that lies "below." So Ted Underwood writes, "Distant reading is simply a new scale of description," a mode of analysis "thirty thousand feet above the ground," while Wai Chee Dimock questions whether "the loss of the text [is] a price worth paying in order to project literature onto a large canvas...If fractal geometry has anything to tell us, it is that the loss of detail is almost always unwarranted."[334] Along the same lines as Dimock, Heather Love remarks: "Distant reading refuses the richness of the singular literary text in favor of the production of knowledge on an enlarged scale."[335] These statements conceptualize scale as a visual perspective, and extrapolate from the experiential facts that follow. With the naked eye, an "aerial survey" might provide a perspective from which to view a whole city at the loss of

[334] Underwood, *Distant Horizons*, xx-xxi; Wai Chee Dimock, *Through Other Continents: American Literature across Deep Time* (Princeton, NJ: Princeton U. Press, 2006), 79. Matthew L. Jockers, *Macroanalysis: Digital Methods & Literary History* (Urbana: U. of Illinois Press, 2013) likewise describes computational analysis as the view "from thirty thousand feet" (9).

[335] Heather Love, "Close But Not Deep," *New Literary History* 41.2 (2010), 374. Gayatri Chakravorty Spivak, *Death of a Discipline* (New York: Columbia U. Press, 2003), also argues that literary study "must depend on texture" (108). Spivak explicitly identifies a "resonance" between her position on distant reading and Wai Chee Dimock's in "World Systems & the Creole," *Narrative* 14.1 (2006), 102.

seeing its people.[336] Mapped onto distant reading, then of course loss of individual detail seems to be the logical consequence of such an approach.

This visual metaphor of distance involves an additional mapping that appears intuitive but is as contingent as the scalar logics that were foregrounded in mid-twentieth-century debates over "close reading." Namely, this position maps the scale of textual multitude onto the scale of interpretive magnitude. Thus, close reading involves a small scale of texts in number (one, a few) versus distant reading's large scale of texts (hundreds, thousands, etc.). The aim is not to look at one thing from afar, but to view multitudes of texts, samples of texts, prepositions, etc.[337] The assumption behind this mapping is that the small scale of texts in number can only convincingly, or accurately, produce interpretive claims that are small in size (socio-historically, generically, biographically, etc.), and vice versa. In other words, small numbers of texts go with "small" claims, and large numbers go with "large" claims. The first position thus schematically draws parallels, respectively, between close/distant (method), few/many (textual evidence), and small/large (interpretive claim).

The second position, by contrast, identifies quantitative analysis with both micro and macro scales while tying close reading to some middle mesoscale. This placement of close reading in the middle is how Moretti originally defined distant reading: "it allows you to focus

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[336] Wai Chee Dimock, "The Egyptian Pronoun: Lyric, Novel, the Book of the Dead," *New Literary History* 39.3 (2008), 619.

[337] Daniel Shore, *Cyberformalism: Histories of Linguistic Forms in the Digital Archive* (Baltimore: Johns Hopkins U. Press, 2018) accordingly argues that whereas New Criticism studied the singular and New Historicism the few, "Massive and growing digital archives confront literary study with *the many*" (31).

on units that are much smaller or much larger than the text."[338] Or as Moretti, along with Mark Algee-Hewitt and Ryan Heuser, have posed the matter more recently: "the conjunction of very small units and a very large outcome is typical of the digital humanities...whereas criticism has traditionally worked with *the middle* of the scale: a text, a scene, an episode, an excerpt."[339] Stephen Ramsay similarly sees "distant reading" and "text analysis" of the data mining sort as "antonyms to close reading."[340] In this second position, scale does not stand in for physical perspective. Quantitative analysis is neither "further from" nor "closer to" the text in the way distant reading, as articulated in position one, can be metaphorically "far away" from it. Instead, position two blurs the scales of text and interpretation, in both registers of size and numerousness, by transposing them onto the micro and macro ends of a single scale. Thus, in one sense distant reading operates on the macro level of textual evidence because a corpus can contain thousands of books compared to the dozens one might close read (it lets us consider more books, not bigger books), and it operates on the micro level because phrases, words, tropes on a page are "smaller" than the book itself. At the same time, distant reading is understood in this position to operate on the macro level in terms of "big" interpretative and socio-historical claims ("a very large outcome") and, implicitly, on the micro level of a smaller number of claims

[338] Moretti, "Conjectures on World Literature," 48-49.

[339] Mark Algee-Hewitt, Ryan Heuser, Franco Moretti, "On Paragraphs: Scale, Themes, and Narrative Form," *Canon/Archive: Studies in Quantitative Formalism* (New York: n+1 Books, 2017), 65.

[340] Stephen Ramsay, *Reading Machines: Toward an Algorithmic Criticism* (Urbana: U. of Illinois Press, 2011), 77.

("*a* very large outcome").[341]

Related to this second position is the metaphor of zooming, which conceptualizes computational analysis as having the flexibility to shift between scales of analysis. So the strength of "macroanalysis"—Matthew Jockers's preferred term to distant reading—is that "it allows for both zooming in and zooming out."[342] Ryan Cordell likewise advances "zoomable reading" as a description of how computational approaches move between "the nodes of the individual texts (close) and the edges of intertextual conversations (distant)," while Martin Mueller suggests the term "scalable reading" because it captures the power to "change your perspective from a bird's eye view to close-up analysis."[343] Yet as the first chapter examined, the metaphor of the zoom operates by blurring distinctions of visual perspective, size and multitude. Mueller's "scalable reading" and Jockers's zoomable "macroanalysis" are more or less synonymous with distant reading ("this is not close reading" remarks Jockers, specifically on

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[341] This latter implication is elaborated by Ramsay in *Reading Machines*: "However far ranging a scientific debate might be, however varied the interpretations being offered, the assumption remains that there is a singular answer (or a singular set of answers) to the question at hand. Literary criticism has no such assumption. In the humanities the fecundity of any particular discussion is often judged precisely by the degree to which it offers ramified solutions to the problem at hand. We are not trying to solve Woolf. We are trying to ensure that discussion of *The Waves* continues" (15).

[342] Jockers, *Macroanalysis*, 23.

[343] Ryan Cordell, "'Taken Possession Of': The Reprinting and Reauthorship of Hawthorne's 'Celestial Railroad' in the Antebellum Religious Press," *Digital Humanities Quarterly* 7.1 (2013), http://www.digitalhumanities.org/dhq/vol/7/1/000144/000144.html; Martin Mueller, "Shakespeare His Contemporaries: Collaborative Curation and Exploration of Early Modern Drama in a Digital Environment," *Digital Humanities Quarterly* 8.3 (2014), http://www.digitalhumanities.org/dhq/vol/8/3/000183/000183.html.

such zooming), while Cordell's "zoomable reading" is his attempt to describe analytical movement between the two ends of close and distant reading.[344]

The point of this schematic is not to bindingly identify the scholars mentioned with a particular position (which would be impossible), but to suggest that much of how scale has been conceptualized and articulated in current discussions of close and distant reading stems from the way these two positions rather murkily superimpose, invert, and align different kinds of scale.[345] Nor is it the case that these varied relations are inherently incompatible. The issue is that the concept of scale performs a lot of similar rhetorical work in distinct logical and metaphorical frameworks. In this sense, reconciling close and distant reading is not a matter of placing them as complements along a single scalar continuum or iteratively pivoting back and forth between "distant and close scales," but of considering the ways in which different kinds of scale function as acts of rhetorical "deformance": rhetorical acts that deform and reshape texts to be understood as pieces of evidence, parts in an argument.[346] Indeed as Ramsay observes, every "critic who

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[344] Jockers, *Macroanalysis*, 23.

[345] This chapter has been focusing on considering relations between scales of textual evidence and scales of interpretive claims, but Lauren F. Klein, "Dimensions of Scale: Invisible Labor, Editorial Work, and the Future of Quantitative Literary Studies," *PMLA* 134.1 (2020): 23-39 has recently proposed the distinction visible/invisible as a way of analyzing the kinds of scale involved in editorial labor.

[346] The concept of "deformance" was put forward by Jerome McGann and Lisa Samuel in Jerome McGann, *Radiant Textuality: Literature after the World Wide Web* (New York: Palgrave, 2001), 105-35. See also Ryan Cordell, "Scale as Deformance," http://ryancordell.org/research/scale-as-deformance/. On close and distant as complements, see James F. English and Ted Underwood, "Shifting Scales: Between Literature and Social Science," *MLQ* 77.3 (2016), 287; on iteration between close and distant, see Richard Jean So, "All Models Are Wrong," *PMLA* 132.3

endeavors to put forth a 'reading' puts forth not the text, but a new text in which the data has been paraphrased, elaborated, selected, truncated, and transduced."[347] In the case of close reading, this rhetorical deformance was synecdochic in terms of size. Thus, the small scale of textual evidence could generate large-scale interpretive claims. Yet as we have observed in current debates about close and distant reading, the scales of text and interpretation are also scales of multitude (not just magnitude), and this second type of deformance can be understood as a kind of metonymy.

"The metonymical crisis": Scale and Scientism in "Close" and "Distant" Reading

Consider, for instance, Andrew Piper's assessment of Erich Auerbach's scalar deformance in *Mimesis*, which according to Piper

> dramatized, perhaps more than any other work in the field before or since, the metonymical crisis that lay at the core of literary criticism, an incommensurable relationship between part and whole. Every chapter begins with a passage from a "great work," where the singular instance of text is meant to stand for the singular nature of the work under review, which in turn stands for all of "occidental literature."[348]

(2017), 671 and Andrew Piper, "Novel Devotions: Conversional Reading, Computational Modeling, and the Modern Novel," *New Literary History* 46.1 (2015), 68-69.

[347] Ramsay, *Reading Machines*, 16.

[348] Andrew Piper, *Enumerations: Data and Literary Study* (Chicago: The U. of Chicago Press, 2018), 7.

What "metonymical crisis" means here seems at first equivalent to close reading's synecdochic logic, or what Sharon Marcus calls Auerbach's "synecdochic bent."[349] The value of computational models then, for Piper, is that they are able to "recontextualize both words and documents within greater levels of scale...Part and whole are always kept simultaneously in view."[350] Yet Piper's description of Auerbach's double substitution (passage for work, work for all of Western literature) is not quite right, since the second substitution is not so much *the* work for Western literature, but a set of works whose relations to one another together stand in for it. In other words, the passage's relation to the work may be synecdochic, but the passages' relation to Western literature is metonymical in an alternate sense of relations between parts (rather than part for whole) that Piper elsewhere describes as a "reticulation of numerousness."[351] This formulation of metonymy is echoed by Liu in his work on the rhetoric of cultural criticism, who notes that "the science of lists depends on...a syntagmatics or metonymics whose illusion is that wholes are polymers of parts."[352] However, whereas cultural criticism ultimately turns to the synecdochic substitution of part for whole to rescue itself "from the wasteland of endless syntagm," the computational methods of distant reading are rather at home with such

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[349] Sharon Marcus, "Erich Auerbach's *Mimesis* and the Value of Scale," *MLQ* 77.3 (2016), 300.

[350] Piper, *Enumerations,* 16.

[351] Andrew Piper, "Reading's Refrain: From Bibliography to Topology," *ELH* 80.2 (2013), 378. In this paper Piper defines "metonymic contingency" as the fact that "there are always an infinite number of possible topologies at different scales" (389).

[352] Alan Liu, *Local Transcendence: Essays on Postmodern Historicism and the Database* (Chicago: The U. of Chicago Press, 2008), 122.

metonymics.[353] Ramsay thus points out that the outcome of "virtually any text-analytical procedure...even if recapitulated in the form of an elaborate interactive visualization, remains essentially a list."[354]

Metonymy as Liu and, in certain contexts, Piper conceive it follows Hayden White's definition of metonymy as "the modality of part-part relationships, on the basis of which one can effect a *reduction* of one of the parts to the status of an aspect or function of the other."[355] This broader notion of metonymy, influenced heavily by Kenneth Burke, is helpful here for unraveling the tangle of scale rhetoric and distant reading that has been otherwise knotted together. The bird's eye or macro view of distant reading is the perspective that observes relations between works that comprise a corpus as if they make up its topography (the metonymic mode White also calls "the simple *contiguity* of things").[356] The micro view sees words, parts of speech, and phrases not as microcosms of some "greater" whole, but in relation to other words, parts of speech, and phrases. Accordingly for White, "statistical representations are little more than projections of data construed in the mode of metonymy."[357] A basic line graph of an object's velocity, for instance, charts relations between points of data—no single

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[353] Liu, *Local Transcendence*, 122

[354] Ramsay, *Reading Machines*, 80.

[355] Hayden White, *Metahistory: The Historical Imagination in Nineteenth-Century Europe* (Baltimore: Johns Hopkins U. Press, 1973), 35. Italics his.

[356] Hayden White, *Tropics of Discourse: Essays in Cultural Criticism* (Baltimore: Johns Hopkins U. Press, 1978), 128. Italics his.

[357] White, *Tropics of Discourse*, 21.

data point is synecdochically representative of the whole graph—to display one axis (displacement) as a function of the other (time). Such a graph's legibility further depends on its indications of scale via labeling axes, choosing units, determining interval marks, etc. Which is to say, the metonymic logic of statistical representation, of distant reading, necessitates that decisions of choosing and relating different kinds of scale be made consciously.

To be clear, the distinction between synecdoche and metonymy is not being mapped, respectively, onto close and distant reading, but rather onto relations between scales of size and relations between scales of numerousness. Even if the individual data points are not synecdochically representative of the whole graph in, say, Matthew Jockers's graph "A Network of Three Thousand Novels," every data point (all three thousand of them) synecdochically stands in for an individual novel.[358] More specifically, each data point represents 1) the deformation of a novel into a table of word lists and frequencies, and 2) the reformation of that table in the form of a closed, unified dot which comes to synecdochically stand back in for the novel itself.[359] Moretti makes, seemingly unintentionally, these synecdochic and metonymic deformations clear when he declares,

> People like me used to work on a few hundred 19th-century novels. Today we work on

[358] Jockers, *Macroanalysis*, 164-168.

[359] One of the central contributions of Da "The Computational Case" is its empirical demonstration that "no matter how fancy the statistical transformations, CLS [computational literary studies] papers make arguments based on the number of times *x* word or gram appears...all the things that appear in CLS—network analysis, digital mapping, linear and nonlinear regressions, topic modeling, topology, entropy—are just fancier ways of talking about word frequency changes" (606-607).

> thousands of them; tomorrow, hundreds of thousands. This has had a profound effect on literary history, but also on critical methodology. When we work on two hundred thousand novels instead of two hundred, we are not doing the same thing, one thousand times bigger; we are doing a different thing. The new scale changes our relationship to our object, and in fact it changes the object itself.[360]

If the objects themselves have changed, then the novels studied on the scale of "a few hundred" are in fact quite different from the novels studied on the scale of thousands and hundred of thousands—so different, in fact, that they might not be comparable in multitude at all. That is to say, what enables this rhetorical shift of scale are initial metonymic deformations (the novel into multitudinous parts related to other parts), followed by synecdochic ones (these relations standing back in for a singular novel), and concluded with another metonymic one (hundreds of thousands of novels as literary history).

Close reading, too, involves these metonymic deformations where the scales of textual evidence and interpretive claim are related as matters of multitudinous parts, and debates about it at the mid-twentieth century brought these deformations into focus in the context of close reading's perceived scientism. In his essay "Four Master Tropes," Burke suggested that metonymy and synecdoche shade into one another by how they relate quality and quantity. Synecdoche allows for a substitution in either direction, a "*connectedness* between two sides of an equation," while metonymy allows only for the "reduction" of quality to quantity.[361] Burke's

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[360] Moretti, *Canon/Archive*, 295.

[361] Burke, "Four Master Tropes," 428. Italics his.

argument operates at a characteristically high level of abstraction here, but contemporaneous criticisms of close reading often turned on seeing its synecdochic qualities as metonymic ones in Burke's sense, a kind of synecdoche that only moved from quality to quantity. Ransom thus saw the need to defend the poetic knowledge produced by New Criticism by distinguishing between two "kinds" of synecdoche. Responding directly to Burke's essay, Ransom wrote that while the poet, and by extension the critic, utilizes synecdoche "to see that his object is unique" (this would accord with Brooks's move from a small poem to the "largest symbolizations possible"), scientific synecdoche establishes a flattening numerousness, "taking those facts which are *reduced* to the scheme...and rejecting the others."[362]

However, despite the complex and at times contradictory ways the New Critics viewed modern scientific knowledge—Wellek argued fervently that they were "enemies of science"—earlier proclamations, such as Ransom's that "criticism must become more scientific, or precise and systematic," nourished the idea that the development of close reading was intimately entwined with attempts to scientize literary study.[363] This was the view Olson took when he

[362] Ransom, "The Irish, the Gaelic, the Byzantine," 528-529. Italics mine. Ransom and Burke exchanged a series of letters between 1939 and 1942 about Burke's essay, summarized in David Tell, "Burke's Encounter with Ransom: Rhetoric and Epistemology in 'Four Master Tropes,'" *Rhetoric Society Quarterly* 34.4 (2004): 33-54.

[363] John Crowe Ransom, "Criticism, Inc.," 329; René Wellek, *A History of Modern Criticism: 1750-1950*, vol. 6, *American Criticism, 1900-1950* (New Haven, CT: Yale U. Press, 1986), 151. Mark Jancovich, *The Cultural Politics of the New Criticism* (Cambridge: Cambridge U. Press, 1993) similarly argues that New Critical ideology and practice, emerging from an economically agrarian and politically conservative context, directly opposed modern technocratic society's valuing of scientific positivism as the principle form of knowledge. For an in-depth overview of how the New Critics variously invoked scientific rigor as an ideal for critical practice while also setting them

mocked the New Critics for attempting to bring "literary study to a condition rivaling that of the sciences," and the conclusion to Bush's 1948 MLA address, where he proclaimed, "though the [New] critics have censured [historical] scholarship for aping science, their own aims and methods seem much more deserving of the charge."[364] Thus by 1953, Holloway could declare that

> the lineage of "close reading" as a critical method is impure; deriving in part from a keener sense of the distinctiveness of poetry, which was an asset; and in part from excessive though perhaps half-conscious respect for science, which was a liability. And the particular form that this hindrance seems to have taken, is a notion that the unravelling of complexity is the one and essential and characteristic form of close reading, and therefore you cannot have too much of it.[365]

According to Holloway, scientism led close reading as a method "away from the poem," obscuring any sort of principle that would "equip one to collect just what is proper to collect, and to leave exactly all the rest"—a corrupted close reading is too "distant" from the poem, one might paraphrase, unable to usefully differentiate among the multitude of interpretations it

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against each other, see Gerald Graff, "What Was New Criticism? Literary Interpretation and Scientific Objectivity," *Salmagundi* 27 (Summer-Fall 1974): 72-93.

[364] Elder Olson, "William Empson, Contemporary Criticism and Poetic Diction," in Crane, *Critics and Criticism*, 45; Bush, "The New Criticism," 20.

[365] Holloway, "The Critical Intimidation," 480.

produces.[366] In 1956 Ihab H. Hassan similarly reflected: "Ironically enough, the Formalist approach, once motivated by a desire to remain close to the literary work, seems to be degenerating into an irrelevant and intricate pastime, one that an IBM could probably simulate with equal interest."[367] Hassan treated the "closeness" of close reading as the ironic origin of a method that a 1950s IBM computer could seemingly replicate—ironic because the very scientism that close reading was intended to combat had coopted it, and ironic because the metaphor of "closeness" betrayed just how "distant" from the text the resulting interpretive claim could be.

Pointed critiques of scientism in distant reading tend to hone in on either the way invocations of scientific realism depend on naive conceptions of it or how the logics of accumulative neoliberalism and technocapitalism have encroached on the "traditional" humanities. So Barbara Herrnstein Smith assesses that much of the enthusiasm over distant reading tends to be articulated in positivist terms that have already "been effectively challenged by a century of empirical and theoretical work in the history, sociology, and philosophy of science."[368] "For all the talk of 'paradigm shifts' among digital humanists," Smith writes, "the notion of science to which they appeal tends to be fundamentally pre-Kuhnian."[369] North sees

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[366] Holloway, "The Critical Intimidation," 481, 483-84.

[367] Ihab H. Hassan, "Criticism as Mimesis," *The South Atlantic Quarterly* 55.4 (1956), 475.

[368] Barbara Herrnstein Smith, "What Was 'Close Reading?'" *Minnesota Review* 87 (2016), 68.

[369] Smith, "What Was 'Close Reading?,'" 68. See also her essay "Scientizing the Humanities: Shifts, Collisions, Negotiations," *Common Knowledge* 22.3 (2016): 353-372 and Tom Eyers, "The Perils of the 'Digital Humanities': New Positivisms and the Fate of Literary Theory," *Postmodern Culture* 23.2 (2013), https://muse.jhu.edu/article/537059/summary.

the project of distant reading as the logical destination of a trajectory that began with the neoliberalization of English departments in the 1970s—a process that, according to North, insisted on the goals of specialized knowledge-production to the detriment of older forms of literary criticism that strove toward self-cultivation.[370] In these two historical registers, scientism in distant reading looks quite different from the scientism that Holloway and others perceived in close reading, if not only for the basic reason that New Critical conceptions of science are necessarily "pre-Kuhnian" and close reading predates the neoliberalization of the American university. However, both sets of discourses (scientism in close and distant reading) notably deploy a scalar rhetoric of multitude where the critique is not of some mismatch between textual and interpretive "size," but of an overwhelming and trivialized multitude of textual elements and their meanings.

The more polemically staged critiques of scientism in distant reading accuse it of "outsourc[ing] reading of books to lower-level workers," unduly promoting "project-based learning and lab-based research over reading and writing," and making the "rookie mistake" of "confus[ing] more information for more knowledge."[371] Yet, Fiedler in 1950 compared "those

[370] North, *Literary Criticism*, 109-116. See also Richard Grusin, "The Dark Side of Digital Humanities: Dispatches from Two Recent MLA Conventions," *Differences* 25.1 (2014): 79-92, and Brian Connolly, "Against Accumulation," *J19* 2.1 (2014): 172-179.

[371] Respectively, Lindsay Waters, "Time for Reading," *The Chronicle Review* 53, February 9, 2007, http://chronicle.com/article/Time-for-Reading/10505/; Daniel Allington, Sarah Bouillette, and David Golumbia, "Neoliberal Tools (and Archives): A Political History of Digital Humanities," *Los Angeles Review of Books*, May 1, 2016, https://lareviewofbooks.org/article/neoliberal-tools-archives-political-history-digital-humanities/; and Timothy

'close analyses'" to "tabulations of imagery," both being "machines for the mindless to manipulate," Erich Heller in 1958 spoke of "the close reader's laboratory," full of "key-words and key-phrases," and Barzun that same year referred to "the astringent use of close reading" and its resulting "confusion of loose data."[372] When Andrew Kopec argues that unlike close reading, which values "the critical inquiry of a solitary scholar," distant reading prefers "the quintessential form of postindustrial work: the team," he echoes Fiedler's mid-century sentiment that the "closeness" of New Critical methods engendered a type of specialization that was "atomizing": "the act of total criticism becomes merely a sum of all these ventures, the end-product of a bureaucratized 'team.'"[373] Indeed, Fiedler's ideal criticism was one that would be "free to leap...to make the seminal generalization, even when the generalization cannot be statistically supported"—a characterization that today might easily be read as a call for close over distant reading but was, for Fiedler, in fact posed *against* close reading.[374] Watt, for instance, began his case for James's paragraph's synecdochic representativeness by 1) calculating the average word length of its sentences, 41, in order to show its proximity to

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Brennan, "The Digital-Humanities Bust," *The Chronicle of Higher Education*, October 15, 2017, https://www.chronicle.com/article/The-Digital-Humanities-Bust/241424.

[372] Respectively, Leslie A. Fiedler, "Toward an Amateur Criticism," *The Kenyon Review* 12.4 (1950), 565; Erich Heller, *The Ironic German: A Study of Thomas Mann* (Boston: Little Brown and Company, 1958), 101; and Jacques Barzun, "The Scholar-Critic," *Contemporary Literary Scholarship: A Critical Review*, ed. Lewis Leary (New York: Appleton-Century-Crofts, Inc., 1958), 7-8.

[373] Andrew Kopec, "The Digital Humanities, Inc.: Literary Criticism and the Fate of a Profession," *PMLA* 131.2 (2016), 332; Fiedler, "Toward an Amateur Criticism," 565.

[374] Fiedler, "Toward an Amateur Criticism," 572.

"James' average of 35" and 2) counting the frequency of intransitive and transitive verbs (14 to 6). "I detail these features," Watt explained, "only to establish that in this passage, at least, there is a clear quantitative basis for the common enough view that James's late prose style is characteristically abstract."[375] In this sense, Fiedler's negative conception of close reading—statistically supported generalization—is identical to Piper's positive conception of distant reading (or in his terms, computational literary study), which seeks to develop a "science of generalization."[376]

That we find scalar conceptions of "close reading" in the late 1940s and through the 1950s dovetailing with scalar conceptions of "distant reading" in the past two decades suggests that scale is not only a conceptual distinction deployed analytically but also a rhetorical maneuver, one that masks distinctions of size and multitude, distance and magnification. Mid-twentieth century debates over "close reading" at the term's inception focused on the relationship, and sometimes disjunction between two kinds of scale: the scale of the text and the scale of the resulting interpretive claim. Skepticisms were thus often directed in one of two ways. On the one hand, they doubted close reading's capacity to shift between the micro and macro levels of interpretation, with respect to a small scale of textual evidence (a line, a poem, a passage) by simply presupposing synecdochic relations. On the other hand, they remarked upon the sheer metonymic multitude of textual details (a "confusion of loose data," as Barzun put it) that seemed to proliferate under close reading's procedures. Here, the scale of textual evidence was still small in size but large in number, and the problem was not that corresponding

[375] Watt, "First Paragraph," 255-256.

[376] Piper, *Enumerations*, 9.

interpretations were too big but that they were too many.

Tracing the history of the term "close reading" consequently reorients contemporary debates over close and distant reading away from questions of analysis along a single scale—one cannot begin with the word, then zoom out to the sentence, the paragraph, the book, five thousand books, literary history—and instead towards questions raised by the different kinds of scales involved in reading and research. In this framework, Alan Liu's call to "discover technically and theoretically how to negotiate between distant and close reading"[377] is less a matter of reconciling different scales of analysis, but of theorizing the ways in which different kinds of scale rhetorically deform, and by extension enable, our interpretive, descriptive, and explanatory work.

[377] Alan Liu, "The State of the Digital Humanities: A Report and a Critique," *Arts and Humanities in Higher Education* 11.1-2 (2012), 27.

Coda. Toward a Narrative Theory of Scale

The preceding chapters have examined how concepts which we employ to think about continuity and discontinuity across multiple spatio-temporal scales (zoom, hierarchy, evidence) are themselves discursively composed of different kinds of scale and scale models. Moreover, although these different kinds of scale can speak to time and temporal processes, they themselves are largely conducted via a metaphorics of space (distances, sizes, envelopes, multitudes). I want to conclude, then, with a set of reflections on a highly visible way scale is recognized and signaled in narrative prose fiction, which is via large time spans. The depiction of geological, astronomical, and evolutionary time scales in novels is amenable to this kind of analysis precisely because, as Gérard Genette observes (and borrows from Roland Barthes), one central way narrative time is conceptualized is through its metaphorization in terms of space: units of textual length like lines, pages, and chapters.[378]

In Genette's *Narrative Discourse*, the distinction between story time and narrative time—respectively, the time of events being narrated and the time of narrating—produces a set of four relations, or what he calls "movements."[379] Scenes, as exemplified by dialogue, are passages where narrative time is roughly equal to story time, while summaries refer to when narrative time is less than (i.e. compresses) story time. Ellipses are explicit or implicit indications of time

[378] Gérard Genette, *Narrative Discourse: An Essay in Method*, trans. Jane E. Lewis (Ithaca, NY: Cornell U. Press, 1980), 87-88. Genette partially credits this "procedure" to Barthes discussion of hierarchical levels in historical discourse. See Roland Barthes, "The Discourse of History," trans. Stephen Bann, in *Comparative Criticism 3: A Yearbook*, ed. E. S. Shaffer (Cambridge: Cambridge U. Press, 1981), 7-9.

[379] Genette, *Narrative Discourse*, 94-95.

lapses, such with the phrase "many years passed," and pauses are descriptive passages where the flow of story time is suspended. Thus, many of the strategies and conceits employed by texts depicting deep time, such as time travel and time leaps, necessarily involve variations of ellipsis and summary.[380] Indeed, if for Genette, Marcel Proust's *À la recherche du temps perdu* is almost all scene and little-to-no summary, then John Huntington identifies Olaf Stapledon's science fiction work *Last and First Men* (1930)—a book tracing the fates and vicissitudes of eighteen successive species of humanity across two billion years—as *Recherche*'s antithesis, nearly all summary with nary a scene.[381]

One quickly encounters, however, a critical dead end if narrative time scales are solely a matter of quantitatively coordinating markers of diegetic time (implicit or explicit) with page quantities and word counts. As Ted Underwood points out, determining narrated duration largely depends on one's choice of diegetic frame or level:

> suppose you meet the monster in *Frankenstein* (1818) and he begins to tell his tale. Is narrated duration now the hour or so it takes him to talk, or the month he's describing? We decided it's the month. If the edges of his story fall outside our frame of 250 words, we're inside his narrative. On the other hand, if a character says something about her whole childhood in a short passage of dialogue...we count it as the minute or two the

[380] Ursula K. Heise, "Science Fiction and the Time Scales of the Anthropocene," *ELH* 86.2 (2019): 275-304.

[381] John Huntington, "Remembrance of Things to Come: Narrative Technique in *Last and First Men*," *Science Fiction Studies* 9.3 (1982), 257.

dialogue would take to speak.[382]

For Underwood, then, "duration depends on [textual] scale," and for the purpose of his statistical study it depends on the specific textual scale of "250 words, a little less than a page."[383] Yet the problem he identifies is not a matter of textual scale measured in units of words or pages (and hence open to distant reading), so much as one of distinguishing how textual and temporal scales are discursively and hierarchically constructed in the text.

After all, even if one marvels at Stapledon's attempt to span two-billion years in *Last and First Men*, it seems harder to imagine anyone marveling at just how much time he compresses into the fourteen-word sentence: "the whole period to be covered by this chronicle is about two thousand million."[384] Yet one's sense and accounting of temporal scale in *Last and First Men* derives in no small part from such individual statements—"in this chapter we must cover about one hundred and fifteen thousand years," "we have watched the fortunes of eight successive human species for a thousand million years"—which in themselves neither compress nor elide diegetic time (summary and ellipsis) but self-reflexively mark that the text will or has done so.[385]

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[382] Ted Underwood, "Why Literary Time is Measured in Minutes," *ELH* 85.2 (2018), 345.

[383] Underwood, "Why Literary Time," 345.

[384] Olaf Stapledon, *Last and First Men*, in *Last and First Men & Star Maker: Two Science-Fiction Novels by Olaf Stapledon* (New York: Dover Publications, Inc., 1968), 142. Fredric Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions*, (London: Verso, 2005) points out that Stapledon's style of iterating geological, evolutionary, and astronomical time "leaves the basic structure of the sentence unchanged, so that we attempt to combine it with the content of quite ordinary narratives" (126).

[385] Stapledon, *Last and First Men*, 73, 206.

If elliptical phrases like "millions of years passed by" are performative, then these reflexive statements constitute a periperformative frame in which the various narrative compressions and elisions can be coherently coordinated (and made coherent) in terms of scale.[386] In short, they allow Poul Anderson to outline Stapledon's "logarithmic" method, which "gets us used to one order of magnitude before moving on to the next…[with] each order occup[ying] about as much wordage as the last," or what Charles Tung describes as "the novel's basic formal procedure of zooming out."[387] What is being zoomed out from, however, is not necessarily a point in diegetic time but the different discursive and hierarchical relations between, say, sentence and chapter, sentence and book.

So in *Narrative Discourse Revisited* Genette expands his original four-fold distinction to include, as a fifth type of movement (and second type of pause), the "reflexive digression": "digressive, extradiegetic, and in the nature of commentary and reflection instead of narration."[388] Yet as Genette quickly admits, the distinction between a descriptive and reflexive pause is tenuous at best. What he foregrounds, instead, is the way these pauses signal moments

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[386] Stapledon, *Last and First Men*, 179. Periperformatives refer to or describe performative utterances. See Eve Kosofsky Sedgwick, *Touching Feeling: Affect, Pedagogy, Performance* (Durham, NC: Duke U. Press, 2003), 67-91. This model of constructing narrative time scales accords with Michael North's point in *What is the Present?* (Princeton, NJ: Princeton U. Press, 2018) that "in fictional narrative...tenses in general do not refer to positions in some preexisting temporal continuum, but instead serve to constitute that continuum (127).

[387] Poul Anderson, "Star-flights and Fantasies: Sagas Still to Come," in *The Craft of Science Fiction,* ed. Reginald Bretnor (New York: Harper & Row Publishers, 1976), 28; Charles M. Tung, *Modernism and Time Machines* (Edinburgh: Edinburgh U. Press, 2019), 189.

[388] Gérard Genette, *Narrative Discourse Revisited*, trans. Jane E. Lewis (Ithaca, NY: Cornell U. Press, 1988), 36-37.

when narrative discourse "interrupts itself to give up its place to another type of discourse," a descriptive or commentarial discourse that one can situate in the broader framework of modernity and its continuous recycling of reference as self-reference.[389] Thus, we might approach a narrative theory of scale not in terms of ratios and measurement, but of discursive interruptions, patternings, and juxtapositions.

For instance, Virginia Woolf's original structure for *The Years*—a chronicle of the fictional Pargiter family from 1880 to the "present" of 1937—was what she variously described as an "Essay-Novel" or "Novel-Essay."[390] Its chapters, detailing the interactions of the Pargiters, would be interlaced with essays tracking the broader social and historical reverberations of those personal interactions.[391] In its final published form, as Grace Radin shows in detail, the essays are not entirely gone so much as transmuted, forming the backbone of a "reverberative structure" of small descriptive phrases that echo and recur from chapter to chapter.[392] Stapledon, too, insisted on the non-narrative discursive elements that composed both *Last and First Men* and its

[389] Genette, *Narrative Discourse Revisited*, 37. On the "performance of scale" as a reflection of reference's turn to self-reference, see Mark Seltzer, *The Official World* (Durham, NC: Duke U. Press, 2016), 36.

[390] Virginia Woolf, *The Pargiters: The Novel-Essay Portion of The Years*, ed. Mitchell A. Leaska (New York: New York Public Library & Readex Books, 1977), 9.

[391] Genette's principle examples of reflexive "interruptions" are the "essay-chapters" that begin each book of Henry Fielding's *Tom Jones* (1749). Genette, *Narrative Discourse Revisited*, 36.

[392] See Grace Radin, *Virginia Woolf's The Years: The Evolution of a Novel* (Knoxville: The U. of Tennessee Press, 1981). For an account of how Woolf's essay and novel sections in *The Pargiters* invert their usual respective alignments with factual and fictional discourses, see Randi Saloman, *Virginia Woolf's Essayism* (Edinburgh: Edinburgh U. Press, 2012), 138-168.

unofficial sequel *Star Maker* (1937). "It is an essay in myth creation," Stapledon wrote of the former, and of the latter, which covers a longer but more indeterminate range of (possibly hundreds of) billions of years: "judged by the standards of the Novel...it is no novel at all."[393] Woolf appeared to recognize these affinities, writing to Stapledon in 1937: you are grasping ideas that I have tried to express, much more fumblingly, in fiction. But you have gone much further, & I can't help envying you."[394] Stapledon speedily replied, praising *The Years* while lamenting the contrast between Woolf's "art" and his "own pedestrian method."[395] Indeed, even though H. G. Wells's *The Time Machine* (1895) appears an obvious influence on Stapledon's writing, it was Wells's nonfiction work *Outline of History* (1920), with its synoptic and repetitive descriptions of civilizations and cultures across centuries, that made a more stylistically formative impression.[396]

On the one hand, the exchange of letters between Woolf and Stapledon is a polite and distanced exchange. It appears that the two had never met, and Stapledon expressed dismay at missing his one chance to meet her when both were invited to a deputation at the House of

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[393] Stapledon, *Last and First Men*, 9 and Stapledon, *Star Maker*, 250.

[394] Virginia Woolf to Olaf Stapledon, 8 July 1937, cited in Robert Crossley, *Olaf Stapledon: Speaking for the Future* (Syracuse, NY: Syracuse U. Press, 1994), 248-249. For an account of their shared views about literature as a vehicle to articulate pacifist politics and their familiarity with contemporary advances in astronomy, see Holly Henry, *Virginia Woolf and the Discourse of Science: The Aesthetics of Astronomy* (Cambridge: Cambridge U. Press, 2003), 108-140.

[395] Olaf Stapledon to Virginia Woolf, 15 July 1937, cited in Crossley, *Olaf Stapledon*, 433, n. 61.

[396] Crossley, *Olaf Stapledon*, 190, 198. Heise, "Science Fiction" points out that other model discourses for Stapledon included Charles Darwin's evolutionary theory and Oswald Spengler's comparative cultural history (291).

Commons and Woolf decided not to go.[397] Yet despite notes of measured humility and self-deprecation, this brief, felicitous moment of intransitive encounter registers a shared recognition of how their narrative constructions of scale—whether it is the scale of billions of years or decades—both principally involved the need to interrupt or syncopate the discursive tempos of narrative fiction.[398] I have suggested that these interruptions might be usefully conceptualized in terms of Genette's reflexive and descriptive pauses, moments that read more like essayistic reflections or self-accounting observations. Moreover, their juxtaposition suggests that narrative representations of extremely large or small time scales are not necessarily fundamentally different from more traditionally realist middle scales, but contort and make visible the discursive operations that underlie both.[399]

"One cannot imagine a parsec [roughly 19 trillion miles]," wrote the British biologist and polymath J. B. S. Haldane, "but one can think of it, and think of it clearly."[400] But if Haldane asked his readers to "get the million habit by remembering that we wash ourselves daily in a bath containing about ten million drops of water," Frank Luther Mott observed, in his study of best-selling books, "what an easy word 'million' has become! Most of us are 'millionaires,' not in

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[397] Crossley, *Olaf Stapledon*, 251.

[398] I take the phrase "intransitive encounter" from Nan Z. Da, *Intransitive Encounter: Sino-U.S. Literatures and the Limits of Exchange* (New York: Columbia University Press, 2018), which she calls "a mode of apprehending the lightness of contact in a very close world" (11).

[399] Or as Heise, "Science Fiction" concisely puts it: "part of scaling up the imagination in narrative means rediscovering how we scaled it down during the rise of the novel in the first place" (301).

[400] J. B. S. Haldane, "On Scales," in *Possible Worlds and Other Essays* (London: Chatto and Windus, 1927), 2.

the sense of riches, but in our free and unthinking use of big figures."[401] Which is to say, Haldane draws a distinction between scale as something opaque to qualitative modes of description, but more open to quantitative ones. Literary-critical analysis demonstrates, with its own precision and clarity, the ways in which imagining and thinking inform and constitute one another. In this sense, *The Years* (with its relatively modest time scale of decades) is in its basic narrative temporal structure no different from Liu Cixin's epic science fiction trilogy *Remembrance of Earth's Past* (2008-2010), which spans tens of millions of years beginning from the Chinese Cultural Revolution and concluding with the heat death of the universe. In both one finds an alternation of summary and scene, narrated in the third-person, with chapter breaks marking elliptical leaps forward in time.

And if in *The Years* Woolf's nearly six-decade sojourn ends with the calm yet uncertain potential of daybreak—"the branches rustle[d] as they rose slightly, and fell, and shook a wave of green light through the air"—one finds, 19-million years later in *Death's End* (the last book of Liu's trilogy), a similar terminus.[402] A crystallized moment of ambiguous possibility observed not through the door of a London townhouse, but "through the door of the universe": "a drop of dew took off from the tip of the grass blade, rose spiraling into the air, and refracted a clear ray of sunlight into space."[403] These are moments that are, if anything, closest to Genette's descriptive pauses. However, their function in relation to the narrative construction of temporal

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[401] Haldane, "On Scales," 5. Frank Luther Mott, *Golden Multitudes: The Story of Best Sellers in the United States* (New York: The Macmillan Company, 1947), 9.

[402] Virginia Woolf, *The Years* (New York: Harcourt, Inc., 1939), 434.

[403] Liu Cixin, *Death's End*, trans. Ken Liu (New York: Tor Books, 2016), 602.

scale is not located via some discernible ratio between narrative time and story time, but instead as instances of description that bound and enclose what Liu calls "this miniscule world of life."[404] They do not depict drastic changes of scale or indicate vertiginous scaling procedures. They take part in the transformation of making fictional worlds legible as scaled ones.

[404] Liu, 602.

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