Introduction:
Logic and Literary Form

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Abstract Although literature and logic share a number of surprising symmetries and historical contacts, they have typically been seen to occupy separate disciplinary spheres. Declaring a subfield in literary studies—*logic and literature*—this introduction outlines various connections between literary formalism and formal logic. It surveys historical interactions and reciprocal influences between literary and logical writers from antiquity through the twentieth century, and it examines how literary theory and criticism have been institutionally shadowed by a logical unconscious, from the New Criticism and (post)structuralism to recent debates about historicism and formalism. It further considers how the subfield of logic and literature, in its constitutive attention to form, is neatly positioned to cut across these debates, and it sketches ways of reading at the interface of aesthetics, philosophy of literature, and literary studies that might be energized by an appeal to logical contexts, ideas, and methods.

Keywords   logic, literary history, theory, aesthetics, form

Literary formalism and formal logic: were ever two modes of ordering the world so uncannily alike yet so fundamentally distinct? Both advocate structural over empirical and historical methods in the analysis of language, from the arrangement of words and phrases to the meaning of sentences. Both use shared terms to analyze the effects of linguistic or symbolic structures: *form*, *sense*, *reference*, *description*, *truth*. Yet to borrow a distinction from the early modern philosopher and mathematician Blaise Pascal ([1658] 1963: 512), logic would seem to work largely according to *l'esprit de géométrie*, resolving ordinary language into the protocols of mathematics and other formal systems of reasoning and demonstration, while literary formalism acts more along the lines of *l'esprit de finesse*, developing literature's creative resistance to technical standards and to redescription by means of formula or paraphrase.

Nonetheless, the wider areas of intellectual inquiry and imaginative practice within which these formalisms are nested—logic and literature—share a number of surprising symmetries and historical contacts. From the pun on Scholastic logic in Geoffrey Chaucer's "Summoner's Tale" to the inductive patterns undergirding Walt Whitman's verse to the impact of Ludwig Wittgenstein's logic on Don DeLillo's early novels, the essays in this special issue will show how literary writers have often borrowed concepts and methods from logic for creative reuse. Logicians have also turned to literary ideas and categories for expression and clarification, from Immanuel Kant's ([1770] 2004: 42–48) attempt to bridge logic and aesthetics, to George Boole's ([1854] 1958: 30) elucidation of logical syntax through examples from *Paradise Lost*, to Gottlob Frege's ([1892] 1948) musings on poetry's place in a system of reference. Despite their historical correlations and formal similarities, however, a gulf has long separated literary formalism and formal logic. Robust critical traditions have developed to examine literature in relation to other areas of philosophy and science, but the disciplinary intersection of logic and literature, albeit closely connected to these traditions, has received comparatively scant attention. An assumption of historians of logic would seem to hold quite generally, namely, that "literary discourse . . . does not provide a sufficient amount of argumentative material" for logic qua "reflection upon principles of validity" (Kneale and Kneale 1971: 1).

We aim to bridge the gulf by showcasing the efforts of scholars working in an interdisciplinary mode across literature and philosophy with a particular emphasis on logical topics. The essays in this issue investigate formal affinities and resonances among different areas of logic and literature, trace historical interactions and reciprocal influences between literary and logical writers, and model ways of reading in philosophy and literature that might be energized by an appeal to logical ideas or methods. The special issue covers

several periods, from medieval debates about logic, rhetoric, and grammar through the development of symbolic logic in the nineteenth and twentieth centuries. By representing work that has begun to address historical and theoretical commonalities across a wide range of objects, we aim to declare a scholarly subfield—*logic and literature*—and set some possible parameters for further investigation.

To that end, the essays are animated by considerations of what the cross-fertilization of ideas and practices has meant for these fields in the past, and might mean for literary and philosophical disciplines in the present. Given the resurgence of debates about form in literary studies, what could philosophical logic gain from literary accounts of form, and vice versa? Further, what could recent discussions around literary form's transhistorical portability add to historical accounts of logic and logical form? More generally, if literary and narrative theories have in the latter half of the twentieth century taken (structuralist) linguistics as their metalanguage of choice, what might be gained from provisionally assigning (or restoring) philosophical logic to that role?[1] Can we productively compare literary modes of close reading and narrative analysis to logical systems of inference and proof? Does an appeal to logical paradox help in clarifying ambiguity, vagueness, or "ironic logic" in poetry?[2] Do logical dilemmas aid in sharpening our understanding of conflict in drama or indecision in novels? How do reciprocally useful terms like *figure*, *mood*, and *tense* help us think across literary and logical concerns? Finally, how do we reconcile logic's apotheosis of reason and rationality with literature's alliance with imagination and affect?

1. Logic and Literature through History

The logical and the literary have been linked since antiquity. In this section, we offer a historical sketch that highlights these connections. This is hardly a history of philosophical logic per se, a task that has been voluminously undertaken in synoptic studies like I. M. Bocheński's (1961) *History of Formal Logic* and William and Martha Kneale's (1971) *Development of Logic*, in collections like Leila Haaparanta's (2009) *Development of Modern Logic* and Dov Gabbay and John Woods's eleven-volume *Handbook of the History of Logic* (2004–14), as well as in accessible social histories of logic like Michael Shenefelt and Heidi White's (2013) *If A, Then B*. Nor does this sketch always hew to familiar canons of Anglo-American literary history. Instead, we describe some signal events

1. We are indebted to Jesse Rosenthal (2017: 11–17) for the insight about linguistics as the "principal metalanguage of narrative theory" in this period, which he discusses in accounting for novel theory's "reliance on intuition" (11).
2. For the term *ironic logic* used to describe John Donne's poetry, see Brooks (1947) 1970 (211).

in the history of logic insofar as they intersect with literary concerns, offering a schematic overview of some rich and various connections between these fields.

Such connections stretch back at least to ancient Greece. Aristotle is almost universally held to occupy a foundational place in logic's history, having invented the syllogism and set the stage for millennia of logical inquiry in the collection of works that came to be known as "the *Organon*"—the "tool" or "instrument of science" (Kneale and Kneale 1971: 23). Indeed, the "singularity of Aristotle" (Shenefelt and White 2013: 38–40) is a constant of histories of logic in the West (e.g., Kneale and Kneale 1971: 23–100). Most of what is canvassed below follows roughly in the Aristotelian lineage. Yet to accept that Aristotle was the first to study formal validity—"validity *in virtue of form*" (Shenefelt and White 2013: 40)—is not to deny the thriving logico-rhetorical traditions of other ancient cultures. Indian logic is the prime example, beginning in the first century AD, achieving its fullest expression through the work of Buddhist scholars like Diṅnāga in the sixth century and gradually reaching China (which had its own prehistory of logical inquiry), Tibet, and Japan. The influence of Indian systems of reasoning has also been conjectured in the later logical and mathematical contributions of Boole and Augustus De Morgan, who were to some extent aware of these materials via the mathematician H. T. Colebrooke's writing on the "Indian syllogism" (Ganeri 2001: 4–7).[3]

Some of the earliest and most sustained examinations of logic and literature actually come from Aristotle's teacher, Plato. In the *Cratylus*, Plato (1997: 110) bases a protological account of reference on careful readings of names in Homer's *Odyssey*, distinguishing "the names humans call things and those the gods call them."[4] It is fitting, then, that Aristotle (1987: 51) would follow Plato in ascribing to poetry the same power to determine the "probability and necessity" of "universals" that he does to the syllogism, precisely because poetry "assigns names" to the world. A similar line of inquiry was pursued, centuries later, when Aristotle's medieval commentators in the Arabic tradition—Al-Farabi, Avicenna (Ibn Sina), and Averroes (Ibn Rushd)—systematized the equation of poetry and logic by uniting the *Poetics* and *Prior Analytics* in the so-called poetic syllogism, a syllogism with at least one figurative premise. Averroes ([c. 1150] 1977: 84) writes that poetry is never not "syllogistic" because it conjoins otherwise disparate figurative imagery to

3. For discussion and representative materials, see Ganeri 2001 and Shenefelt and White 2013 (35–38).
4. For Plato's nascent contributions to formal logic, and his inaugural thinking in the meta-discipline now known as "philosophy of logic" in the *Theaetetus* and *Sophist*, see Kneale and Kneale 1971 (7–12, 17–22).

arrive at its realizations and truths. From Andalusia to modern-day Afghanistan, thinkers in the Arabic tradition took Aristotle's ideas and extended them in new directions, at once preserving the ancient Greek tradition and helping shape the course of medieval logic in the West.[5]

A largely independent Greek tradition that preexisted Aristotle and, in many ways, came to be seen in opposition to him (and his successor school, the Peripatetics) was represented by the Stoics (and their predecessor school, the Megarians), whose important contribution in the current context was to give formal shape to matters of choice and consequence emanating from ordinary argumentative settings like law courts. Especially in the work of Chrysippus (third century BCE), Stoic philosophy generated syllogisms composed of propositions with conditional forms (like *modus ponens* and *modus tollens*), deploying the connectives *if*, *then*, *and*, *or*, and *not* (see generally Kneale and Kneale 1971: 12–16, 113–76; Shenefelt and White 2013: 73–97). Although from the disciplinary perspective of logic these ideas were not formalized until the nineteenth century (Shenefelt and White 2013: 86), they afford a logical lens on literary representation insofar as many dramatic or novelistic plots might be illuminated by such conditional schemata: consider protagonists in the plays of William Shakespeare or the novels of Jane Austen who face what the Stoics called a *dilemma*. These traditions also gave us notorious paradoxes (e.g., liar, heap) that spurred both logical reflection and literary (especially poetic) elaboration in the Middle Ages and in the late nineteenth and twentieth centuries (Kneale and Kneale 1971: 114, 227–28; Bocheński 1961: 131–33). They also held strong to the connection between logical forms and wider practices of argument and persuasion in the field of rhetoric.

Via intermediaries in later antiquity like Cicero, who Latinized much of logic's lexicon (Kneale and Kneale 1971: 177–78), and Porphyry and Boethius, whose translations and commentaries were important for its revival in the early Middle Ages, the logicians and logical schools of ancient Greece bequeathed an institutional legacy that is enduringly relevant to literary history. This is the classical model of education known as the *trivium*, which enshrined the study of logic (or dialectic, alongside grammar and rhetoric) in Western curricula for centuries (Williams 1961: 130).[6] Medieval treatises and manuals of logic were written for use in such instruction, from Alcuin of York's eighth-century *Dialectica* to John of Salisbury's twelfth-

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5. See Bocheński 1961 (9–17, 416–50) and the relevant essays in Gabbay and Woods 2004 and Dutilh Novaes and Read 2016.

6. For an overview of logic's transmission through Roman and medieval texts, see Kneale and Kneale 1971 (177–297). On medieval logic generally, see the essays in Gabbay and Woods 2008 and Dutilh Novaes and Read 2016. For literary connections, see studies like Greene 2014.

century *Metalogicon*, an important English touchstone and incidentally the first medieval work completed with the whole *Organon* back in view (Kneale and Kneale 1971: 198, 225).

An instruction in logic, largely for the purpose of training students in argumentation and debate, provided raw material for some of the earliest extant literary manuscripts in England and France. Written in Latin, Alain de Lille's early thirteenth-century *Plaint of Nature* ([c. 1202] 1980) blends poetry with Aristotelian logic to categorize what he perceived to be a contradiction in human nature (homosexuality). The Middle English poem *The Owl and the Nightingale* (Cartlidge 2001) presents a comic debate between two birds who follow medieval codes of disputation, which were derived from logic. The canonical English writers of the fourteenth century—Chaucer, the Gawain Poet, William Langland, John Gower—deploy logic far less systematically than someone like de Lille.[7] However, logic was so fundamental to medieval learning that even Langland, who was likely not highly educated, could toy in *Piers Plowman* with a range of categorical and theological paradoxes that echo "a basic logic textbook" (Galloway 1992: 90–91). The late Middle Ages saw logic flourish not only in elementary education but also among Scholastic philosophers: Peter Abelard, Thomas Aquinas, Duns Scotus, and William of Ockham extended Aristotelian logic into complex investigations of selfhood, divinity, and language. Whether through the trivium, which remained foundational for pedagogy, or by means of Scholastic philosophy, logic thus shaped the discourse of a broad assortment of authors into the early modern period. William Shakespeare's work bears a residue of logical training.[8] John Milton, who received advanced training in logic at Christ's College, Cambridge, wrote a textbook entitled *Artis Logicae* ([1672] 1982) that followed the French logician Petrus Ramus in advancing a number of critiques against Aristotelian logic as it functioned in Renaissance education.[9]

In much of the early modern period, however, medieval logic lost its authoritative place, and the character of logic changed as its projects were criticized, disregarded, and even forgotten. Perhaps expressing contempt for the efforts of the Scholastics before him, Kant ([1781] 1998: 106) declared that logic had not only made no progress since Aristotle but had exhausted itself with him. Logical approaches certainly had a place in early modern philosophy, especially in the deductive method of René Descartes, whose *cogito* flirts with the structure of syllogism, and in *Logique, ou L'art de penser* (1662) (the so-called *Port-Royal Logic*), an enormously influential epistemological

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7. For more on Chaucer and philosophy, see Lynch 2000 and Miller 2004.
8. On Shakespeare and logic, see Joseph 1949 and Murray, Skulsky, and Braun 1975.
9. On Milton's studies in logic, see Clark 1948. For Milton's uses of Ramist logic in his literary works, especially *Paradise Lost*, see Arnold 2006 and Wilson 2010.

treatise by Antoine Arnauld and Pierre Nicole. Yet the period from roughly the mid-seventeenth century to the early nineteenth was a low point for innovation and interest in logic sensu stricto—formal, deductive logic.[10] A significant exception was Gottfried Wilhelm Leibniz, whose logical contributions (confined to unpublished manuscripts and so not appreciated until the twentieth century) both laid some groundwork for mathematical logic and anticipated the inductive logic program of Rudolf Carnap (Hacking [1975] 2006: 134).[11] Leibniz's work also furnished a later bond between Bertrand Russell and T. S. Eliot. In the lacuna left by formal logic arose the empirical and inductive philosophies of Francis Bacon (author of the pointedly titled *Novum Organum* [1620]), John Locke, Thomas Hobbes, and David Hume, who all objected to Aristotle's perceived overreliance on the abstract process of logical deduction to explain the world and proposed what they thought of as new logics—of scientific method, human psychology, politics, and so on.[12] Such critiques of Aristotle extended into the late eighteenth century and particularly the Scottish Enlightenment, in the work of thinkers such as Isaac Watts, William Duncan, Thomas Reid, Dugald Stewart, and George Campbell (McKerrow 1987: 167–72).

Further, and relatedly, this period also saw the development of the modern concept of probability, according to Ian Hacking's ([1975] 2006) influential account, at first in letters between Pascal and the mathematician Pierre Fermat on how to divide the stakes of a truncated game of chance, and continuing in the work of mathematicians from Christiaan Huygens and Jacob Bernoulli in the seventeenth century all the way to Pierre-Simon Laplace in the early nineteenth. Where logic enters the doldrums, probability captures attention in a variety of fields, including mathematics, economics, jurisprudence, and theology, and maintains its vitality into the nineteenth-century growth of statistical thinking and beyond.[13] For Hacking ([1975] 2006:

10. Theodore Hailperin (2004: 343) comments of Henry Aldrich's *Artis Logicae Compendium* (1691)—almost contemporaneous with Milton's treatise—that it was "the last book emphasizing the *formal* aspects of logic that appeared in England for over a hundred years."

11. On Leibniz's contributions, see Kneale and Kneale 1971 (320–45), Sullivan 2004, and Hailperin 2004 (324–37).

12. See Schuurman 2001 for an overview of Locke's place in the new seventeenth-century logic, emphasizing Locke's "massive assault on scholastic logicians" and his *Essay Concerning Human Understanding* as an alternative "logic of ideas," "more subject-oriented, . . . less formal, and . . . focused more on epistemological and psychological questions" (445). See Shenefelt and White 2013 (157–84) for an account of the rise of inductive thinking as one consequence of the emergence of middle classes across Europe, with a corresponding emphasis on everyday judgment, experiential inference, vernacular languages, and the "equality of reason" (163).

13. Some of the classic studies on the historical, philosophical, and scientific significance of probability and statistics include Hacking (1975) 2006, 1990; MacKenzie 1981; Shapiro 1983; Porter 1986; Stigler 1986; Krüger, Daston, and Heidelberger 1987; Krüger, Gigerenzer, and

31–39), probability required an understanding of evidence that is importantly distinct from testimony, authority, or logical demonstration—inductive or "internal evidence" (33), the "evidence of things" (32) that "points beyond itself in a non-deductive way" (34). On this nondeductive terrain, probability shows itself as a Janus-faced concept, divided between an aleatory definition, "concerning itself with stochastic laws of chance processes," and an epistemic one, "dedicated to assessing reasonable degrees of belief in propositions quite devoid of statistical background" (12). A measure of the distance of these developments from traditional logic might be seen in Hacking's (63–72) analysis of Pascal's wager on God's existence. Framing the wager as an inaugural exercise in decision theory—a matter of mathematical expectation rather than syllogistic reasoning—Hacking argues that Pascal "showed how aleatory arithmetic could be part of a general 'art of conjecturing'" and "made it possible to understand that the structure of reasoning about games of chance can be transferred to inference that is not founded on any chance set-up" (63). In the early modern period, then, we witness key developments in probabilistic inference and inductive thinking, from the *Port-Royal Logic*, where Pascal's wager was first reported, to Hume's *Treatise on Human Nature* (1738) and *Enquiry Concerning Human Understanding* (1748), where the so-called problem of induction is advanced—a problem that in Hacking's ([1975] 2006: 176–85) account could not have been developed without the concept of evidence furnished by modern probability. We also find idiosyncratic experiments that do not have any bequest to the tradition, such as the *Opus Maximum* of Samuel Taylor Coleridge.[14] Although many of these concepts will later rejoin the philosophical mainstream as inductive logic, in the main "one cannot but marvel," as Bocheński (1961: 257) says about the effacement of the Scholastic tradition in the seventeenth and eighteenth centuries, "at the extent to which the understanding of logic has disappeared."

The subsequent reinvigoration of logic in the nineteenth century is often retrospectively seen as ushering in its second golden age. Logic was revivified in large part from the soil of mathematics, from algebra and geometry—that "paradigm of deductive system-building" (Kneale and Kneale 1971: 4)—rather than from speculative and idealist philosophies conducting metaphysical and epistemological inquiries under the banner of "logic" (as in G. W. F. Hegel's *Science of Logic* [1816]) (Kneale and Kneale 1971: 355, 411). The signal contribution to what we now think of as formal logic was made in Victorian

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Morgan 1987; Daston 1988; Gigerenzer et al. 1989; and Franklin 2001. For an early critique of Hacking's historiography, see Garber and Zabell 1979.

14. On Coleridge's logic, see Milnes 2008.

England by Boole ([1847] 1998), who in *The Mathematical Analysis of Logic* first used "algebraic formulae . . . to express logical relations" (Kneale and Kneale 1971: 404). For instance, one of the categorical propositions in the traditional Aristotelian square of opposition (the E proposition: "no *X*'s are *Y*'s") could be expressed in Boole's terms by an equation ("$xy = 0$") indicating "that the logical product of the selection of all objects from class *X* and from class *Y* is empty or null" (Jacquette 2008: 345).[15] Boole's ([1854] 1958) *Investigation of the Laws of Thought* amplified these breakthroughs well beyond the syllogism and also applied logical algebra to probability theory, contributing to the Victorian era's increasing preference for quantitative methods in practical settings (for example, using probability to determine the veracity of witnesses or juries).[16]

It should be acknowledged that De Morgan's ([1847] 2014) *Formal Logic* appeared almost concurrently with Boole's pathbreaking work, making related inroads into symbolization and the logical foundations of probability, and rediscovering a group of rules (some known to the Stoics) for describing the logical equivalence of compound propositions (Shenefelt and White 2013: 90).[17] Yet Boole remains the crucial figure in the history of logic for developing a more generalized system than had existed since Aristotle, one that "could algebraically symbolize the combination of any subject term with any predicate term in any categorical proposition" (Jacquette 2008: 333). That system's commitment to form is essential to its novelty and its power: "The triumph of the new logic" of Boole and De Morgan, Andrea Henderson (2014: 83) writes, "was precisely to make the formal, ungrounded character of language a matter of explicit principle." By means of the crucial cogs now known as Boolean operators (*not*, *and*, *or*), this formal system could comprehend "logical relations combinatorially . . . in any of an indefinitely large number of mathematical combinations involving any choice of predicates" (Jacquette 2008: 334).

Boole's contributions were in his time more familiar to fellow travelers in logic and mathematics than to the general public, although his logic of classes (or terms) bears an intriguing relationship to a society undergoing shifts on the terrain of social class.[18] Logic was more usually understood either as a general aid to reasoning, in a broadly Aristotelian vein, or in terms of the

15. On Boole, see generally Kneale and Kneale 1971 (404–20), Jacquette 2008, and Hailperin 2004 (349–61, 373–75).
16. See Boole's (2012) Keith Prize Essay for 1857, "On the Application of the Theory of Probabilities to the Question of the Combination of Testimonies or Judgments."
17. On De Morgan's logic, see Hobart and Richards 2008, Hailperin 2004 (346–49, 361–66), and Valencia 2004.
18. Indeed, the terms *class*, *set*, and *member* might be thought to take on new valences in the nineteenth century, in the same way that the term *individual* received a new sense (as a singular

inductive and probabilistic methods key to scientific inference. Synoptic histories like Robert Blakey's *Historical Sketch of Logic* (1851) and Isaac Todhunter's *History of Mathematical Probability* (1865), in themselves significant in marking the established Victorian interest in these topics, accorded only superficial attention to contemporary developments. Regardless, followers of Boole began to refine his system (Jacquette 2008: 343) in works including William Stanley Jevons's *Pure Logic* (1864), John Venn's *Symbolic Logic* (1881) (which used a schema of overlapping circles, now known as Venn diagrams, to visualize logical classes and propositions), Charles Sanders Peirce's logical essays, and Hugh MacColl's *Symbolic Logic and Its Applications* (1906).[19] Jevons was also the first to input Boolean algebra into a mechanical form in a simple machine, the "logic piano," described and built in the 1860s (Kneale and Kneale 1971: 421), which anticipated the widest practical legacy of Boole's work. His binary system (using only 0s and 1s) undergirds the electronic circuits of computers (Jacquette 2008: 373–75), enabling the algorithms that allow us to coauthor this introduction on screens miles apart.[20]

In the Victorian period, transits between the literary and the logical in its technical acceptation were few.[21] More prominent — and more tractable for literature whether as direct inspiration or ambient influence — were broader understandings of logic in scientific, inductive, and empirical terms, heirs to the early moderns described above. John Stuart Mill's *System of Logic* ([1843] 2006) is an exemplary text in this regard, dealing thoughtfully at the outset with matters of formal logic while attempting to join the two halves of his system — nonformal inference ("inductive") and the syllogism ("ratiocinative"). If Mill's synthesis has been seen as muddled (Kneale and Kneale 1971: 371–77), it was still culturally vital. George Eliot was well acquainted with Mill's treatise (Pinney 1963: 150n3), as was her partner George Henry Lewes. Informally adopted by the *Literae humaniores* (Greats) reading list at the

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noun) partly from logic in the late seventeenth and early eighteenth centuries (Williams [1976] 2014: 116).

19. For a summary account of Venn, see Van Evra 2008a. Venn's diagrams were not the first to schematize logical classes: the mathematician Leonhard Euler developed a representation of the Aristotelian square of opposition, later refined by J. D. Gergonne (Kneale and Kneale 1971: 349–52, 420–21). On MacColl, see Rahman and Redmond 2008, and on Peirce see Hilpinien 2004.

20. Shenefelt and White (2013: 205–24) make a historical argument about the development of symbolic logic concurrent with industrial mechanization, which showed "how unthinking things could be cleverly arranged to achieve an intelligent result" (222). They also point out (94–97) that the logic underlying computer circuits ultimately reaches back to the insights of Chrysippus and the Stoics.

21. Although not inexistent: De Morgan's two children, Mary and William, were (very) minor novelists, and MacColl wrote a quirky utopian novel, *Mr. Stranger's Sealed Packet* (1889).

University of Oxford (Walsh 2000: 313), Mill's text would have come across the desk of writers, including Walter Pater, Gerard Manley Hopkins, and Oscar Wilde. Walter Bagehot (1873: 589) observed that "half the minds of the younger generation of Englishmen [had] been greatly coloured by" Mill's *Logic*.[22]

Relatedly, the continuing importance of the science of probability also afforded connections between the literary and the logical in the eighteenth and nineteenth centuries. At the end of what Lorraine Daston (1988) describes as the era of "classical probability," with Laplace as its apex, approaches to probability that were at once more empirical and more subjective came into view. With the work of Adolphe Quetelet's *Sur l'homme et le développement de ses facultés* (1835) and Siméon-Denis Poisson's *Recherches sur la probabilité des jugements* (1837), probability began to be fitted as a tool for comprehending masses of statistical information. Thus Venn's *Logic of Chance* ([1866] 1888: vii, x), a treatise on probability as "a branch of the general science of evidence which happens to make much use of mathematics," implicitly sets itself against Boole and De Morgan by taking account "of laws of things and not of the laws of our own minds in thinking about things."[23] Venn's elaboration of what we now term *frequentist* probability—a mathematical approach that "combines individual irregularity with aggregate regularity" (4)—is everywhere attuned to the multitudinous mayhem of Victorian life. With a quotation from Alfred Tennyson's *In Memoriam* on its title page and a commitment to the complex and changeable character of experience as one domain in which probability rules (74–95), Venn's logic has rightly been called "evolutionary" (Eden 1998). Unlike the dry Boole, Venn's instances of what was tractable under the "logic of chance"—births, illnesses, and deaths; marriages, crimes, and suicides; harvests, fires, and shipwrecks; all manner of games—bring this terrain of inquiry into contact with any number of literary themes and plots. That Thomas Hardy named a character after Venn in his novel *The Return of the Native* (1876) is only the most visible instance of the influence of this branch of logic.

Alongside the opening up of inductive logic and probability, the nineteenth century extended and intensified the tradition described above of using the term *logic*, in relation to grammar and rhetoric, to characterize investigations into reasoning in general. An important transitional figure is Richard Whately, in literary circles remembered for reviews disparaging Henry Fielding and lauding Jane Austen, but more prominent in this con-

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22. On Mill's logic, see Wilson 2008.
23. By contrast, Boole ([1854] 1958: 44) allies logical symbolization with what he terms "mental operations": "The laws of the symbol and of the mental process are identical in expression."

text as author of the connected treatises *Elements of Logic* ([1826] 1829) and *Elements of Rhetoric* (1828).[24] Following on a tradition maintained principally at Oxford, Whately's *Logic* held firm to Aristotle and defended syllogistic reasoning, especially in formal terms, against the critiques that had been leveled at it from Bacon through the Scottish Enlightenment (McKerrow 1987: 172–85). Whately ([1826] 1829: 1, 7) saw logic as both a "Science" and an "Art" of reasoning and deprecated those who "regarded the Syllogism as an engine for the investigation of nature." He thus played a "central role in revitalizing the study of logic in England" and enabled its subsequent placement "on a firm mathematical and scientific foundation" (McKerrow 1987: 164, 184). But although his work was frequently updated and reprinted—*Logic* came out in nine editions to 1850 (McKerrow 1987: 166)—he did not fully engage with the developments in formal logic for which he paved the way. Ironically, Whately's influence might best be seen in the many examples of a loose approach to reasoning that he had hoped to firm up. These include primers, guides, introductions, and digests that bear some relation to logical material, part of an explosion of popular science writing in the period. A review of "Logic and Logical Studies in England" (Hanson 1872) in the 1870s encompassed fifteen such books. If texts like Boole's *Laws of Thought*, Mill's *System of Logic*, and Venn's *Principles of Empirical or Inductive Logic* (1889) occupied the high ground in the Victorian intellectual landscape, and accessible introductions like Jevons's *Elementary Lessons in Logic* (1870) a middle territory, the wider plains were populated by works that freely combined material on rhetoric and grammar: James Gilbart's *Logic for the Million* (1851) and *Logic for the Young* (1855), Alexander Ellis's *Logic for Children* (1872), and Alfred Swinbourne's *Picture Logic* (1875).

It is against this background that we might place a curiouser contribution to Victorian logic after (and in the vein of) Boole. Working on various aspects of mathematics in relative isolation at Oxford, Charles Dodgson published several contributions to logic under his better-known pseudonym, Lewis Carroll. Although Carroll's logical works are later than his literary experiments, his serious investment in puzzles and paradoxes in the *Alice* books has earned them the respect of logicians from Russell and G. E. Moore to W. V. O. Quine and beyond (Moktefi 2008: 459–60). In *The Game of Logic* (1886) and *Symbolic Logic* (1896), the first part of an incomplete series subtitled "A Fascinating Mental Recreation for the Young," Carroll's ([1886, 1896] 1958) playfulness is often in evidence. Among Carroll's main contributions were his innovative logical diagrams. Where Venn used intersecting circles

24. On Whately's rhetoric and logic in relation to prior traditions, see Ehninger 1963, McKerrow 1987, and Van Evra 1984, 2008b.

to represent classes and propositions, Carroll offers a subdivided square, in effect an elaborate board game with grey and red counters that shift around to mark whether a class is empty or not. Carroll came to see his diagrams as superior to Venn's in their explicit representation of the universe of discourse and their capacity for dealing with higher-term problems (Moktefi 2008: 471–80; Abeles 2007). In briefer contributions to the journal *Mind*, "A Logical Paradox" (1894) and "What the Tortoise Said to Achilles" (1895), he also made important contributions to the study of hypotheticals (Moktefi 2008: 488–97). If often deemed "an 'unconscious' logician" who "considered logic as a game, and . . . intended his work for children" (466), Carroll nonetheless stands as a rare instance of the exact coincidence of literature and logic, and his work has recently elicited more sophisticated interpretations (e.g., Henderson 2014).

For all this movement in the direction of popularization in the Victorian era, it was philosophical logic's continued reinvention of itself as a metalanguage for mathematics that would have the greatest impact on subsequent modernist literature. On one hand, mathematical logic complemented modernism's drive to find or build a language that could convey meaning and share perception "clearly and exactly" (Hulme [1910] 1994: 68), epitomized in the imagist adage that poetry should only ever employ "the *exact* word" (Lowell 1915: vi). On the other, this new logic complemented modernists' fascination with the limits of language, the points where representation breaks down into riddle, absurdity, and "live paradox" (Chesterton [1911] 1988: 53). Examples run the gamut from the occult numerology of Aleister Crowley's *Book of Lies* (1912) to the wordplay of René Magritte's *Trahison des images* (1928). One of the earliest connections between these seemingly incompatible modernist goals was made by Roger Fry ([1909] 1996: 93), who attributed a "clearness of logical structure" and "logical exactitude" to nonfigurative paintings by Henri Matisse, Paul Cézanne, and Pablo Picasso.

An essential intellectual-historical distinction between Aristotelian and mathematical logic is that, while the former pervaded elementary education up through the turn of the twentieth century, the latter required highly advanced training and would have been systematically studied only by those who sought it out at universities. Nonetheless, a number of writers working in the early twentieth century did confront logic in its new, mathematical guise.[25] Virginia Woolf, who attended Russell's public lectures and was attuned to modern trends in philosophy, famously made Mr. Ramsay

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25. Through groups like the Cambridge Apostles and later the Bloomsbury Set, logicians were also keyed into trends in modernist art, sometimes to strange effect, as when Russell claimed that one of his "febrile nightmares" had made its way into Eliot's *Waste Land* (Monk 1996: 442).

an expert in symbolic logic in *To the Lighthouse* ([1927] 1989). Perhaps in a nod to Fry, Mr. Ramsay's effort to get from "Q . . . on to R" (34–35) complements Lily Briscoe's own struggle to finish her abstract painting.[26] Both Henry James and James Joyce engaged with a range of contemporary ideas in logic and mathematics, as Kristin Boyce (2010) and Megan Quigley (2015: 21–62, 103–46) have demonstrated.[27] Gertrude Stein dabbled in logical philosophy at Radcliffe College in the 1890s and then, a decade later, befriended Alfred North Whitehead, with whom she frequently discussed his and Russell's *Principia Mathematica* (1910–13), calling it the "great book" (Stein [1933] 1998: 807).[28] Poets as different as Robert Frost and Wallace Stevens encountered this new logic when they audited courses with Josiah Royce just as he was revising Harvard's philosophical curriculum to favor logic over metaphysics, spurred by Peirce's lectures.[29]

Among modernists, Eliot presents a special case because of his advanced study of mathematical logic. Between 1909 and 1916, Eliot studied for a graduate degree in philosophy at Harvard, including a year-long course on logic in 1913–14. The second half was taught by Russell himself, who had come to Harvard to promote *Principia Mathematica*, the apex of a nineteenth-century movement known as logicism, which surmised that logic might be able to axiomatize certain aspects of arithmetic and ultimately, following Frege's *Foundations of Arithmetic* (1879) and David Hilbert's *Foundations of Geometry* (1902), to formalize the foundations of all mathematics. Eliot's copious notes on Russell's lectures demonstrate a highly sophisticated understanding of Russell's writings, which Eliot (2014: 654; 2015: 268) praised as "an admirable influence for the formation of style . . . of *English* prose or verse" and "a greater contribution to our language than they are to mathematics." Eliot's notes show an especially keen interest in the inconsistencies—the vicious circles, unwarranted reductions, and shaky axioms—that plagued Russell's supposedly flawless system, and this diagnosis of Russell's logic proved prescient, as logicians have by and large rejected *Principia* and its logicist premise.[30]

26. Woolf's connection to logic also looks back to the Victorians: her father's elder brother, James Fitzjames Stephen, was John Venn's first cousin. For a more sustained look at Woolf's understanding of contemporary philosophy, see Banfield 2000.
27. For other connections between modernist novelists and logic, see also Hagberg 1994 and Zhang 2014.
28. Hoff 2010 provides a more detailed look at Stein's investments in logic and mathematics. See also Winant 2016.
29. For an extensive survey of Frost's philosophical education at Harvard, see Lentricchia 1994 (77–123).
30. Bocheński 1961 (399–401) gives a good summary of these flaws. Kurt Gödel's "incompleteness theorems" decisively proved that no finite set of axioms could possibly encompass an

The most notable example in this regard is Wittgenstein, who developed and then later renounced his own all-encompassing logical system in *Tractatus Logico-Philosophicus* ([1922] 1974). Wittgenstein described his *Tractatus* as "literary" (Monk 1991: 177) and equated philosophy with poetry (Wittgenstein 1984: 53). He presents the rare case of a logician thinking about his own work as analogous to literature, and indeed Wittgenstein has influenced literary history in myriad ways over the last century. If much of this work has privileged Wittgenstein's posthumously published *Philosophical Investigations* (1953) and its specific rejection of logic, recent efforts by Michael LeMahieu (2013: 231–54), Andre Furlani (2015), and others have breathed new life into our understanding of the impact Wittgenstein's logic had on a sweep of mid-century authors wide enough to include both Saul Bellow and Samuel Beckett. LeMahieu (2013: 86–116, 155–88) has demonstrated the unrecognized relevance of logical positivism (a movement that began with Vienna Circle thinkers like Carnap and Moritz Schlick and drew on Wittgenstein's *Tractatus*) to the narrative experiments of postmodernists like John Barth, DeLillo, and Thomas Pynchon. LeMahieu's work suggests further avenues for investigating logical elements in more contemporary texts like David Foster Wallace's *Broom of the System* (1987) and David Markson's *Wittgenstein's Mistress* (1988), which both depict Tractarian logic as an isolating, solipsistic force.[31]

Logic's value for many postwar novelists—as with modernists like Eliot and Joyce before them—has thus been "hidden in plain sight" (LeMahieu 2013: 5), often revealing itself only through archival research. The same cannot be said for postwar poets, who have often deployed logical categories and procedures as structuring devices, from Inger Christensen's use of logical puzzles to question the reliability of language in *It* (1969) to Emmanuel Hocquard's application of logical categories to a series of perceptions in *Theory of Tables* (1991) to Rosmarie Waldrop's (1993: 97) connection between "a venerable old law of logic" and "the idea of woman" in *Lawn of Excluded Middle.* The Language poets, drawing equal inspiration from Stein and Wittgenstein, regularly lingered at the crossroads between poetic and logical concerns, with volumes like Lyn Hejinian's *Cell* (1992) and Michael Palmer's *At Passages* (1995) testing language's syntactical limitations as a vehicle for consciousness. The crucial text in this vein is Susan Howe's *Pierce-Arrow* (1999), which plumbed the life and mind of Peirce, the pragmatist philoso-

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infinite mathematics. See Hofstadter 1979, who also has an account (89–102) of how Russell's failure became implicated in modernist aesthetics. See Blevins 2017 for a fuller consideration of Eliot's early poetry and logic.

31. Wallace, who wrote a thesis on modal logic at Amherst College, went on to publish a technical book on mathematical and logical notions of infinity: see (2003) 2010.

pher and logician. In verse and prose teeming with logical structures and antinomies, Howe probes what she calls "the secret affinity between symbolic logic and poetry" (ix). Looking back on Peirce's work through the lens of her own project, she claimed he had been trying "to diagram the logical structure of reality" and that "his logical graphs, and also his calculations, are like poems" (Howe and Swensen 2000: 379).

One last, somewhat distinct tradition that we would be remiss not to mention is science fiction. Following in the footsteps of nineteenth-century texts like Edwin A. Abbott's *Flatland* (1884), Carroll's *Tangled Tale* (1885), and H. G. Wells's "Plattner Story" (1896), a wide array of twentieth- and twenty-first-century authors have worked to turn abstruse, logico-mathematical subjects into narrative structures and devices of plot. Stories like Russell Maloney's "Inflexible Logic" (1940), which satirizes probability theory, and Raymond Smullyan's "Epistemological Nightmare" (1981), which mocks the notion of proof, engage with logic and mathematics to comic effect. Other narratives like Isaac Asimov's "Liar!" (1941), Gordon Dickson's "Monkey Wrench" (1951), and Frederik Pohl's "Schematic Man" (1969), which all use logical paradoxes to question the potential of artificial intelligence, introduce a more serious and persistent science-fiction moral: that the ability to parse such paradoxes can serve as a dividing line between human and machine. Other texts like Rudy Rucker's *White Light* (1980) and David Zindell's *Neverness* (1988) use similar set-theoretical paradoxes to generate whole new cosmologies and subtend mystical or even beatific experiences for their characters.

In canvassing links between logic and literature from Aristotle to Zindell, we have not aimed to be comprehensive but, rather, to collate some intriguing points of contact between these two disciplines and to provide a transhistorical scaffolding for future work. The essays in this issue link these fields and trace lines of affiliation in ways that we have only been able to gloss. Yet such an admission speaks to the rich conceptual underpinnings shared by literature and logic, spanning both of their histories. At the same time, it indicates just how much remains to be mined at this still mostly unheralded disciplinary nexus.

2. Literary Criticism and the Logical Unconscious

In naming a subfield *logic and literature*, one might reasonably ask why this self-conscious pairing has appeared relatively late on the scene, especially considering the volume of contributions at the intersection of literature, science, and philosophy in the last few decades. Why, given logic's centrality to the liberal arts curricula of the nineteenth-century universities that first sheltered

departments of English and modern literature, would logic become a methodological non sequitur in these same departments? What influence did logical ideas and terms retain in literature departments into the latter half of the twentieth century? A possible answer, we'll suggest in this section, might be sought in the postures of literary criticism as it professionalized in British and North American universities in the mid-twentieth century. Even as the New Criticism and (post)structuralism borrowed concepts and methods from logic, they presided over an eclipse in that discipline's significance for the practice of literary analysis, respectively by shielding their objects from subordination to contextual materials or extraliterary concepts, and by privileging linguistics as a master discourse for interpretation or inquiry. Yet what might be termed the *logical unconscious* continued to shadow literary criticism. Following this discussion, we will suggest how the return of logic and literature stands to intervene in critical debates about historicism and formalism, old and new.

One approach to understanding logic's relative absence in literary criticism is to consider the institutional history of the university. Logic was included in English Dissenting academies as part of the study of belles lettres from the seventeenth century into the nineteenth (Azad 1988: 122). As early as 1750, Scottish universities began folding rhetoric and belles lettres into the remits of chairs in logic and metaphysics; as professor of logic at Glasgow, for instance, Adam Smith lectured on both rhetoric and belles lettres (Turner 2014: 408n42). Over the ensuing hundred years, this Scottish model of studying "polite literature" alongside rhetoric and logic became standard for higher education in the United States (Turner 2014: 106). In what Gerald Graff (1987: 36) calls the "preprofessional era" (roughly 1825–75), "literature was subordinated to grammar, etymology, rhetoric, logic, elocution, theme writing, and textbook literary history and biography—everything, a later generation would complain, except a truly literary study." Small wonder, then, that when the first chairs of English were established in the latter decades of the nineteenth century they often renamed (or emerged from) such mixed positions in rhetoric, belles lettres, and logic. This was the case, for instance, with the English chair at Aberdeen, which divided from Alexander Bain's Regius Chair in Logic (Martin 2000: 269–71, 273–86). The first professional teachers of modern literature, on both sides of the Atlantic, were thus trained in a curriculum that emphasized literary study, classical languages, and history, as well as mathematics and logic, and the earliest efforts at legitimating English studies worked at once against that grain (resisting the opposition of academic classicists) and with it (emphasizing scholarship and specialist research modeled on the sciences, especially philological and historical approaches).

The New Criticism set itself against these early methods, against the suspicion that "the knowledge offered us in even the most highly developed literary forms has something factitious and illusory about it," as Allen Tate (1968: 150–51) put it, and the assumption that literary analysis should operate via pseudo-scientific methods reliant on the terminology of physics ("influences, conceived in terms of forces, causes, and effects") or biology ("organic periods," "growths and developments"). Logic was the most disavowed of such methods in crafting the opposition between new critics and traditional literary historians. Tate mentions logic alongside grammar and rhetoric as not "much pursued today, except by specialists" (33). Yet the New Criticism's recourse to logical terms was frequent, both by critics who would oppose affective and psychological response to the stern abstractions of science and by those who would co-opt logic's principles of formal coherence and universality for literary criticism.

Early stirrings in the first vein (the affective-psychological) include George Santayana (1900: 261) in "The Elements and Function of Poetry," who opined that "logical thoughts dominate experience only as the parallels and meridians make a checker-board of the sea," "guid[ing] our voyage without controlling the waves," and Robert Graves (1925: 117–38) in "The Illogical Element in Poetry," who defended associative and fantastic forms of poetic thinking unanalyzable by Aristotle's heirs.[32] The most prominent of what John Crowe Ransom (1941) called "psychological" (as opposed to "logical") critics was I. A. Richards. His work started out on a semantic note in *The Meaning of Meaning* ([1923] 1989), coauthored with C. K. Ogden (who the year before published his translation of Wittgenstein's *Tractatus*). Richards returned with insistence to topics that share a border with logic in *The Philosophy of Rhetoric* (1936) and *Interpretation in Teaching* (1938), the latter arranged according to the medieval trivium.[33] He often appealed to a quasi-logical lexicon—*sign, reference, sense, intention, validity, necessity, statement*—if only to distinguish poetry's psychological-affective from its cognitive-propositional content. Indeed, *form* and *content* embody a vital relation in Richards's work (e.g., 1929: 214–22). In *Practical Criticism* (1929: 207) he contrasts the machinery of logic, that "apparatus of inter-engaging and overlapping symbols for handling and elucidating sense, . . . equipped with automatic safety devices and danger signals in the form of contradictions," with the folk technology of "handling feeling" by "introspection" and self-report. It was Richards's lifelong quest to systematize the latter.[34] In *Principles of Literary Criticism*—

32. See Childs 2013 for Graves's influence on the New Criticism.
33. In this treatise, the section titled "Logic" is notably last and least. See Fry 2000 (189–90).
34. As Yohei Igarashi (2015: 496) has shown, this could paradoxically involve the psychological critic in a field that has some kinship with logic, statistical analysis, "to minimize the unruly,

dubbed "a machine for thinking" ([1924] 2002: vii)—he rejects the imputation of an "intellectual scheme" to a poem like Eliot's *Waste Land*, "a logical scheme [that would be], at best, a scaffolding that vanishes when the poem is constructed" (274).[35] For poetic "statements" exist "for the sake of their effects upon feelings" and "to challenge their truth or to question whether they deserve serious attention *as statements claiming truth*, is to mistake their function" (180), and so to ignore poetry's reliance on "logical irrelevance and nonsense" (181). Richards ([1926] 1935: 65) extended this concept of "statement" still further in *Science and Poetry*, contrasting its justification by "the fact to which it points" with poetry's "pseudo-statement," "a form of words which is justified entirely by its effect in releasing or organizing our impulses and attitudes." His student William Empson's *Seven Types of Ambiguity* (1930) could be seen to continue this project in the sense that its central category—*ambiguity*: "a poetic device in logical structure" (Ransom 1941: 103)—undercuts philosophical analysis.

In the second vein (the more avowedly logical), Eliot is a key mediating figure, supplying the impulse to shelter poetic tradition from mere historical context, to treat of poetry in its structures and relations and not in simple impressions or emotional responses. It is telling that Eliot quibbles with Richards's notion of pseudo-statement, worrying that this concept makes poetry sound like "an ordinary false judgment," and wondering how categories of "true and false can be applied in pseudo-judgments" so that the poet can avoid simple contradiction and blatant inconsistency (Constable 1990: 227). Elsewhere, rejecting a vulgar understanding of criticism as "an arid cleverness building theoretical scaffolds upon one's own perceptions or those of others," Eliot (2014: 270) declares a "true generalization" as one in which perceptions "form themselves as a structure; and criticism is the statement in language of this structure." Such structures are, again, tacitly logical, as are many of Eliot's own critical approaches and devices. Henderson (2014: 99n39) has observed that Eliot's most famous notion, the objective correlative, likely derives from "the protocols of modern logic."

As the New Criticism evolved beyond the foundational contributions of Eliot and Richards, its equivocation over the role of logical terms and ideas in criticism only became more pronounced. Cleanth Brooks opens *The Well Wrought Urn* with an essay on paradox ([1947] 1970: 3–21) and closes it with a dismissal of paraphrase, which would make logical (rather than imaginative)

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subjective, and affective—in a word, human—interpretive tendencies that disrupt the analysis of a poem."

35. See Ransom 1941 (15–22, 44–50) for an appraisal of Richards that discusses both these quotations at length.

coherence of a poem, resolving contradictions rather than leaving "incongruities" (209) in tension. Brooks repeats Richards's image, alerting us to internal structure rather than affective response: paraphrases are "scaffoldings which we may . . . throw about the building," not to be confused with "the internal and essential structure of the building itself" (199). Likewise, William K. Wimsatt in *The Verbal Icon* (1954: 201–20) includes a chapter considering style's "logical and counterlogical" elements, and a logical term of art (*fallacy*) links his and Monroe Beardsley's coauthored essays on the pitfalls of critical methods centered on intention and affect. Finally, when Ransom (1938: 327, 329) inquires after "what exactly is the proper business of criticism" and issues desiderata for a "more scientific, or precise and systematic" professional activity, he stakes a claim on logical territory. Ransom contrasts "prose logic" with poetry's unparaphrasable "irrelevances" (348), the "differentia, residue, or tissue" (349) that resist generalization, using a medieval Latin term for one of the predicables defined in Aristotle's *Topics*. "*Strictly* two things are said to differ," as Boethius's translation of Porphyry's *Isagoge* (or introduction to the *Organon*) puts it, "whenever they differ because of a specific difference [*differentia*], as a man differs from a horse"—perhaps as poetry from prose—and are thus "something different-in-essence" (Warren 1975: 42–43).[36]

    If the New Criticism sets the stage for the literary forgetting of logic in the latter half of the twentieth century by attending to a text's internal relations and modeling its study on rhetoric and grammar, structuralism cements this textualist methodology with its rhetorical strategies of reading and its elevation of linguistics to a position of dominance. One need not look far in this loose critical canon of work for disavowals of logic—of the dubious universality of the logos. In early structuralist statements, engagement with the work of logicians serves to cordon off the territory proper to literary criticism (or poetics, or semiology). Tzvetan Todorov (1981: 18) approvingly cites Frege to declare literature as "a discourse that, precisely, cannot be subjected to the test of truth." Roland Barthes ([1966] 1987) declares, in *Critique et vérité*, that "structural analysis . . . can only be done as a function of logical models," but by this he means models grounded in linguistics—in "a general theory of signs" (54) through which one might come to read according to "a certain logic of symbols" (58). Jacques Derrida's ([1967] 1998) early work engages with the logical tradition via figures like Edmund Husserl and Peirce, who is praised for "go[ing] very far in the direction that I

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36. Elsewhere Ransom (1941: 42) is less extreme: "Poetical discourse does not deny its logical structure as a whole, but it continually takes little departures from it by virtue of the logical impurity of its terms." That he was aware of the provenance of these categories can be seen in a writing primer (1943: 111) that discusses "differentia," "species," and "genus."

have called the de-construction of the transcendental signified" (49) by way of establishing that "semiotics no longer depends on logic" (48). The goal of such engagement is, of course, to wrench the inquiry away from logic and the legacy of Western metaphysics that has "always assigned the origin of truth in general to the logos" (3). Derrida's commitment to nonbinary thinking has been useful for literary criticism precisely by evading the law of noncontradiction when defining key concepts: writing, which undercuts the "logic of identity" with a "logic of supplementarity" (215), the latter only comprehensible as "the nonlogical logic of a game" (259); metaphor, understood as "the logic of contamination and the contamination of logic" ([1972] 1981: 149); genre, governed by a "principle of contamination, a law of impurity" (1980: 59); and many others.

Modern logic after Boole emphasized language's formalism to the extent of acknowledging "the arbitrary and conventional nature of even logical language" (Henderson 2014: 83). Poststructuralism revels in this arbitrary formalism in the interests of linguistic "undecidability" even as it jettisons logic's commitment to exploring the rules of validity within the confines of such a system. This fundamental shift away from the tradition of logic after Aristotle has several facets. In place of truth we find verisimilitude (*vraisemblance*), as the standard of internal validity gives way to a less rigorous expectation of internal consistency according to other laws, norms, and codes (see Genette [1968] 2001; Todorov [1968] 1977, 1981: 17–20; Culler 1975: 131–60). "Critical verisimilitude" (Barthes [1966] 1987: 35) now adjudicates the rightness of a given claim.[37] In place of identities in the study of formal sign systems, language among them, we find differences. Finally, the very structures of logical demonstration are made the object of play. Where logic comes to truth via form, poststructuralism plays with the form of truth: paradox, tautology, contradiction, demonstration—all become so many rhetorical or stylistic devices. We are far from Aristotle when "nontruth is the truth" (Derrida [1972] 1981: 168).

After such relentless theoretical attrition, it is unsurprising that a compendium like *The Norton Anthology of Theory and Criticism* (Leitch et al. 2010: 2732) would make more room for *logocentrism* in its index than *logic*, and that direct invocations of the logical tradition would seem marginal or reactionary.[38] At the same time, logic haunts our discipline in a more incidental way, in the

37. Debunking the tenets of critical verisimilitude in the 1960s—objectivity, literalness, taste, and clarity—Barthes ([1966] 1987: 48) remarks that "the formal language of logic" is the only one in which "one would have the right to talk of 'clarity.'"

38. For instance, Siegfried J. Schmidt's (1976) application of argumentation theory to literary criticism or Frederick Turner's (2015) appeal to consider the trivium in poetic practice and criticism.

frequent yet anxious appeals to "the logic of" a given phenomenon, a trend that seems to have become more prominent in the wake of (post)structuralism and remains in vogue today. The phrase often implies the necessity of its own entailments: it holds itself apart, stable as a gesture of rhetorical self-reliance, portable as a critical mantra that is its own warrant for validity. What was invigorating about appeals to structure in the postwar era was that they called for extensive analyses and taxonomies; what is sometimes leaden about these invocations of logic is that they need not be followed by such demonstrations. The construction finds its way into titles that might disavow a connection to the synthetic project of the logical tradition even as they remain allied to its general aim, namely, giving a formal language and shape to some set of phenomena. We have in mind broad theoretical interventions like Fredric Jameson's *Postmodernism, or, the Cultural Logic of Late Capitalism* (1990) and Pierre Bourdieu's *Logic of Practice* (1992); theoretical contributions to narratology from Claude Bremond's *Logique du récit* (1973) to David Herman's *Story Logic* (2002); literary-critical monographs like Walter Benn Michaels's *Gold Standard and the Logic of Naturalism* (1987), Ronald Schleifer's *Modernism and Time: The Logic of Abundance in Literature, Science, and Culture, 1880–1930* (2000), and Tim Armstrong's *Logic of Slavery: Debt, Technology, and Pain in American Literature* (2012); and broader cultural critiques like Michael Bader's *Arousal: The Secret Logic of Sexual Fantasies* (2003) and Kate Manne's *Down Girl: The Logic of Misogyny* (2018).

If inaugural critical trends in the twentieth century ensured the attenuation or repression of logic as a familiar field of reference for literary criticism, dismissed in both historical and formal senses, it is striking how the subfield of logic and literature is making a return on both fronts. We see work that extends historicist methods, moving out from literature and science or mathematics to consider logic as a body of contextual influence, techniques, and terms, and this may be the primary driver for the resurgence of interest in these topics. We also see work that finds in logic a repository of formal patterns and analogical structures. In this respect, as a discourse whose historical development is at every point bound up with its formal innovations, logic is neatly positioned to cut across recent debates about historicism and formalism.

Indeed, the movement loosely described as *new formalism* could be seen to enlist logic in several ways. It eschews the more traditional (Coleridgean) notion of "form as organic and totalizing" (Levinson 2007: 565), ideologically toxic for many critics (Wolfson 2006: 6–7), and proselytizes a return to certain New Critical practices that will engender a subsequently rejuvenated account of formalism. New formalists reject "idealizing impulses" (Levinson 2007: 560) that see texts as intrinsically coherent or unified, emphasizing

instead a fragmentary sense of a work's "complexity" to revivify attention to internal relations, structures, and properties (e.g., Levine 2015: xiii; Altieri 2001: 264–65; Nemoianu 2006: 56; Wolfson 2006: 14). In lieu of unitary form, new formalists deploy a kind of bespoke logic that involves processes like "classifying," "conceptualizing," "naming," and "indexing" (Kramnick and Nersessian 2017b: 168; Levinson 2017: 155). These are then used to investigate localized formal phenomena (themselves logical, or at least mereo-logical), for instance how textual details can "regroup . . . empirical reality" (Levinson 2007: 567). This logical undercurrent to new formalism also sur-faces in more overt ways, as in Jonathan Kramnick and Anahid Nersessian's invocations of Carnap (2017a: 655) or Marjorie Levinson's reliance on Quine's use/mention distinction (2007: 561, 565–66).

Further, as new formalists have striven to show that "formalism *is* histori-cism" (Macpherson 2015: 385), they have turned toward logic as a discourse that helpfully marries formal ideation to historical concreteness. Wolfson and Brown's seminal *Reading for Form* (2006) contains several essays that at once utilize logical concepts and juxtapose developments in literary and logical history, from Virgil Nemoianu's (2006: 62–63) effort to link new formalism's displacement of older formalisms with the ascendance of "fuzzier" logics over the "strict logic" of the past, to D. Vance Smith's (2006) claim that using "supposition theory" to parse logical paradoxes functions as a medieval pre-cursor for close reading, to Ronald Levao's (2006: 120–22) exploration of logical contradictions in *Paradise Lost*. In Levine's *Forms* (2015), which links a New Critical understanding of literary form to "other kinds of form" (11) constructed and enforced by societies—carceral enclosures, communication networks, political hierarchies—a less technical concept of logic becomes a metalanguage for sorting different iterations of form, which are all taken to have their own "formal logics" (23), or intrinsic properties and relations. Various conceptions of logic thus illuminate the new-formalist commitment to "form" as at once historical and structural. These continuities in what we have termed the *logical unconscious* of literary criticism also disclose the extent to which our critical debates are recapitulating the declarations and disavow-als of previous movements, from New Criticism to (post)structuralism.

3. Logic and Literature: Toward a Subfield

What, then, counts as logic and literature? Which areas have been explored to date, and which avenues remain to be pursued? Since questions of inclusion and exclusion are especially thorny when dealing with a discipline built on rules for classifying and sorting, we offer the following taxonomy with two caveats. First, we envision the subfield, loosely drawing on a logical

concept, as operating by intensional definition. That is to say, instead of a list of all the scholarly objects that might be classed in the subfield, we offer instead some attributes or properties that such objects might evince. Perhaps the following could be visualized as a set of Venn diagrams in which more central work in the subfield would be marked by more overlapping classes. Second, we intend *logic and literature* as an enactive label. We hope to signal lines of attraction to these topics, methods, and concerns (whether historical, formal, or analogical) in scholarship that might not self-consciously advertise itself as such, and to prompt more explicit engagement in the future.

Perhaps most crucial to the subfield would be work that engages the key topics in logic as the study of rational inference, and the historical figures and movements by whom relevant advances in such study have been made. Here the main line is formal deductive logic, from Aristotle's syllogistic to Boole's symbolic to later propositional and predicate logics. This mode of inquiry, directly connecting literary and logical concerns, has only lately begun in earnest, with some of the earliest efforts coming from aforementioned work in medieval studies like Andrew Galloway's "*Piers Plowman* and the Schools" (1992) and Smith's "Medieval *Forma*: The Logic of the Work" (2006), which each examine how the widespread study of logic by even moderately educated individuals ensured a reaction to logical topics in medieval literature. More recently, a group of book-length studies of logic and literature have emerged. LeMahieu's *Fictions of Fact and Value* (2013) demonstrates the unheralded importance of logical positivism for several postmodernist authors. Quigley's *Modernist Fiction and Vagueness* (2015) investigates modernist encounters with a notion of vagueness derived from late nineteenth- and early twentieth-century logical discourse. Henderson's *Algebraic Art* (2018), which undertakes a wide-ranging inquiry into Victorian mathematics, includes a chapter on Lewis Carroll's literary uses of symbolic logic (62–92) and, more generally, considers logic's contribution to Victorian culture's curiosity about "exactness," "order," and "formal structure" (36, 68, 169).[39] Daniel Wright's *Bad Logic* (2018) explores how the Victorian marriage plot puts characters in the position of reasoning about desire and love, often in ways that evoke and evade the protocols of modern logic. Taken together, these four volumes mark a clear surge of interest in logic and literature as complementary subjects.

Related to this cluster would be what has been called *informal logic*, the study of inference and judgment in a looser sense that does not enlist formal rules for validity and is often styled an art rather than a science of thinking—from the *Port-Royal Logic*, subtitled *L'art de penser*, to Bernoulli's *Ars Conjectandi* to

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39. The key analysis of Carroll's logic in *Algebraic Art* was originally published in 2014.

countless popular texts with titles like *The Art of Reasoning*. Historically, this group is a negative image of the tradition that runs from Aristotle to Boole, and it dovetails with inquiries in philosophy, rhetoric, and mathematics that became distinct from logic even if they emerged from its soil. The early modern period is key here, when the field called *logic* "dealt with 'concepts' rather than terms, 'judgments' rather than propositions, and 'reasoning' rather than arguments, and . . . saw all of these fundamental explanatory categories as grounded in contents or operations of the mind" (Falkenstein and Easton 1997: i). Literary manifestations of judgment and reasoning take on a different cast when set against such an understanding of logic, from the seventeenth-century emergence of mathematical probability to Boole's treatment of the concept within the province of logic, and from Bacon's defense of induction to Mill's debate with William Whewell about scientific inference (Snyder 2006), and beyond. Reflections on the theoretical interest of such developments for literary understandings of probability and causality appear in Robert Newsom's *Likely Story* (1988) and Brian Richardson's *Unlikely Stories* (1997), although the rich vein of recent work on these topics is certain to add texture to our understanding of such concepts. Much critical work fleshing out these connections is anchored in the eighteenth century, including Douglas Lane Patey's seminal study *Probability and Literary Form* (1984), Rüdiger Campe's comparative work *The Game of Probability* ([2002] 2012), and Jesse Molesworth's *Chance and the Eighteenth-Century Novel* (2010). The nineteenth century has wide-ranging studies of related topics on both sides of the Atlantic—J. Jeffrey Franklin's *Serious Play* (1999), Jason Puskar's *Accident Society* (2012), and Maurice Lee's *Uncertain Chances* (2012)—and later work has taken up probabilistic and statistical concerns, including Jesse Rosenthal's *Good Form* (2017), Emily Steinlight's *Populating the Novel* (2018), and Michael Tondre's *Physics of Possibility* (2018). Collections like Adam Grener and Rosenthal's special issue of *Genre*, "Narrative against Data in the Victorian Novel" (2017), augur more to come in this vein, and Devin Griffiths's *Age of Analogy* (2016) also marks a turn toward more overt considerations of the logic of scientific inference. A related account of explanatory reasoning that Peirce termed *abductive* has informed the analysis of detective fiction by Arthur Conan Doyle and Edgar Allan Poe (see the essays in Eco and Sebeok 1983). Studies of twentieth-century literature include Leland Monk's *Standard Deviations* (1993) and Julia Jordan's *Chance and the Modern British Novel* (2010).

Beyond an engagement with the traditions of formal and informal logic, strands of inquiry in philosophy and literature—analytic aesthetics, ordinary language philosophy, and possible-worlds theory—sometimes engage with

the logical tradition in a broad sense.[40] The tradition of analytic aesthetics has been forging links between logic-facing philosophy and aesthetic theory for decades, with the germinal anthology often cited as William Elton's *Aesthetics and Language* (1954), though the authorizing principle behind this approach can be traced as far back as Wittgenstein's own early comfort with speaking of logic and art in the same breath. A signal contribution would be Beardsley's *Aesthetics: Problems in the Philosophy of Criticism* ([1958] 1981), which sought to marry New Critical principles for the analysis of literature to the taxonomic rigor of logical philosophy. Beardsley provides the historical basis for later work in analytic aesthetics on literature specifically, like Stein Haugom Olsen's "Literary Aesthetics and Literary Practice" (1981), M. W. Rowe's "Poetry and Abstraction" (1996), Peter Lamarque and Olsen's *Truth, Fiction, and Literature* ([1994] 1997), Lamarque's "Logic and Criticism" (1996), and, more recently, Peter Swirski's *Literature, Analytically Speaking* (2010).

An even richer commerce has developed between ordinary language philosophy, which uses principles from logical positivism to analyze so-called ordinary language, and literary criticism. The primary force in this regard has been Stanley Cavell, whose work in analytic and logical philosophy has been wedded to consideration of literary texts since *Must We Mean What We Say?* ([1969] 2002) and *The Claim of Reason* ([1979] 1999). It is Cavell's account of Wittgenstein that spurs Marjorie Perloff's *Wittgenstein's Ladder* (1996: 16–17) and Charles Altieri's "Wittgenstein on Consciousness and Language: A Challenge to Derridean Literary Theory" (1976), as well as the latter's more recent efforts like "Tractatus Logico-Poeticus" (2007) and *Reckoning with the Imagination* (2015), which includes an appendix on logic and grammar (88–90). From Garry Hagberg's *Meaning and Interpretation* (1994) and *Art as Language* (1995) to Toril Moi's *Revolution of the Ordinary* (2017), work invoking Wittgenstein and ordinary language perspectives has marked a flourishing area of intersection between philosophy and literature. As noted earlier, writings on Wittgenstein and literature are legion, as evidenced by many collected volumes like the special issue of *New Literary History* titled "Wittgenstein and Literary Theory" (Cohen 1988), Kenneth Dauber and Walter Jost's *Ordinary Language Criticism* (2003), John Gibson and Wolfgang Huemer's *The Literary Wittgenstein* (2004), and LeMahieu and Karen Zumhagen-Yekplé's *Wittgenstein and Modernism* (2017).

One last niche in the history of logic-facing philosophy and literature involves literary-theoretical encounters with possible-worlds theory, a twentieth-century development in modal logic that posits truth conditions under alternate domains (other possible worlds). For a coterie of theorists and

40. For a schematic overview of analytic philosophy and literary criticism, see Lamarque 2001.

critics working mostly in and around the 1990s, possible-worlds theory became a useful tool for theorizing the constructed status of fictional worlds and studying narrative world building more generally. Key texts in this regard include Umberto Eco's *Lector in Fabula* (1979), Thomas Pavel's *Fictional Worlds* (1986), Marie-Laure Ryan's *Possible Worlds, Artificial Intelligence, and Narrative Theory* (1992), Ruth Ronen's *Possible Worlds in Literary Theory* (1994), and Lubomir Doležel's *Heterocosmica* (2000). Related (if sometimes in opposition) to possible-worlds semantics are studies of counterfactuals and other conditionals in literature and history, from Hilary Dannenberg's *Coincidence and Counterfactuality* (2008) to Andrew Miller's essays on the "optative" (2007, 2012) to Catherine Gallagher's *Telling It like It Wasn't* (2018).

Yet more broadly, we might also note that literary study proceeding under the banner of digital humanities is allied with logic insofar as its data mining tools are fundamentally reliant on the categories of symbolic logic and the analytical tools of probability and (Bayesian) statistics. Indeed, quantitative formalist methods hearken back to Victorian logic and statistics, with its language of sets, classes, and members (Williams 2017: 28–29, 32–35); the inception of close reading in the twentieth century has been linked with the early statistical genre of word frequency lists, in the Basic English project of Richards and Ogden (Igarashi 2015); and in recent decades, Boolean operators have been tacitly guiding (and perhaps shaping) our research since full-text search became standard in the 1990s (Underwood 2014). If work in this field is not typically addressed to the logical concerns in its background, there might nevertheless be scope for such studies in the future. This would be an ironic riposte to the New Criticism's general dismissal of inductive or empirical approaches to literature, even though Richards (1929: 207) was prescient about a "logical machine" whose language "can now be used to improve and extend itself, and may in time be made self-running and even fool-proof."

This rough taxonomy is avowedly open-minded about the relative merits of historicist, formalist, analogical, empirical, and other approaches to logic and literature. If illuminating lines of affiliation and influence can be discovered between logical developments and literary domains through history, it is also the case that logical forms furnish some of the most durably transhistorical models for literary structure, sequence, and classification. (It would be as valid, so to speak, to investigate the place of Ramus in Milton or Mill in George Eliot as to read a modernist sonnet along the lines of Stoic paradoxes.) By the same token, literary scholarship might also have something to contribute in the opposite direction. The history of logic, in many ways like the history of pure mathematics, sometimes appears as a parade of objective truths branching out from one source, Aristotle, with several intriguing eddies and meanders off to the side. Literary inquiry might complement or

complicate such a narrative and add texture to logic's social, cultural, and institutional histories.

4. Summary of Contributions

R. D. Perry's essay investigates Chaucer's tactical forays into medieval logic with a comical case study on the subcategory of logical paradoxes known as "impossibles" (*impossibilia*), adduced to explain a scatological joke in "The Summoner's Tale." Perry brings out Chaucer's engagement with a group of fourteenth-century logicians known as the Merton Calculators, and with Scholastic logic more broadly, revealing how medieval logic treats problems whose formal qualities, such as narrativity and exemplarity, are arguably more vividly instantiated in literature. Johanna Winant picks up this inquiry into form in the nineteenth century, declaring Whitman's poetic catalogs as the logical form known as *enumerative induction*—a simple, everyday mode of probable inference from particular instances of a given class to generalizations or predictions about the entire class. Intervening in the debates about literary formalism we discussed above, Winant argues for an account of form indifferent to whether it makes or mars order. Where "content is formal," whatever shape a poem bears can be seen to do philosophical work, as Whitman's inductive lists do in giving conceptual heft to an inclusive vision of citizenship and democracy (65). Turning to the twentieth century, three essays extend considerations of literature's logical form into the novel, pivoting in various ways on Wittgenstein's *Tractatus*. Kristin Boyce sets the stage by considering Frege's investigation of logical form and notation—read by the lights of (different readings of) the *Tractatus*—alongside the formal innovations of contemporaries like Henry James. Outlining two ways of understanding the say/show distinction, Boyce argues that the turn to formal logic at the inception of the analytic tradition, often thought to have intensified the division between philosophy and literature, is actually better understood to make possible a renewed conversation between them—"a conversation organized by questions about form" (89). Megan Quigley picks up on the so-called resolute or austere reading of the *Tractatus*, in which the propositions of that text are meant to be discarded (as "nonsense") once understood, in a sort of philosophical therapy. She argues that the same strategy might be adopted to read Woolf's first novel *The Voyage Out*, which likewise plays with form and deploys the conventions of the bildungsroman and marriage plot to overcome them. The early projects of Wittgenstein and Woolf, in this view, are path-clearing pedagogical exercises that afford a fresh reinvestment in the ordinary. In a related account of influence, Michael LeMahieu reads the early work of DeLillo in light of his debt to Wittgenstein, revealed in inter-

views, archival materials, and what he dubs "novels of logic" (125). In its deployment of Wittgensteinian tropes—tautology, unsayability, silence, "the mystical"—DeLillo's *End Zone* in particular typifies a style in which a diminution, simplification, or "logical reduction" of language leads to a corresponding amplification of effect. Semantics gives way to syntax, meaning makes way for materiality, saying cedes place to showing. Andrea Henderson's afterword offers further methodological reflections on the field of logic and literature, commenting on the essays and suggesting future directions for study. Finally, Charlie Tyson reviews Daniel Wright's *Bad Logic: Reasoning about Desire in the Victorian Novel* (2018), and David Kurnick reviews Henderson's *Algebraic Art* (2018).

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