

LITERATURE IN THE AGE OF MATHEMATICS:
GENDER AND THE MULTIPLICITY OF MODERNITY

BY

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DISSERTATION

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Abstract

This dissertation investigates mathematics as a multivalent metaphor in twentieth-century fiction and theory and as a powerful cultural force integral to the development of competing modernist paradigms. Though it appears that writers such as Ezra Pound, T.S. Eliot, and Wyndham Lewis deploy mathematical metaphors to reinforce the qualities of abstraction, objectivity, and detachment typically associated with modernist writing, I argue instead that mathematics offers early-twentieth-century writers a new lexicon for describing and explaining subjective experience. Particularly for a diverse range of modern women writers, including, for example, Edna Ferber, Charlotte Perkins Gilman, H.D., Mina Loy, and Gertrude Stein, mathematics enables an alternative mode of self-expression through which to communicate their political, professional, and sexual desires. I trace the emergence of mathematics as a means to construct new models of gender and racial identity as well as to channel emotional expression into a more culturally authoritative form. Thus, rather than a context-free, gender-neutral domain, mathematics plays an integral role in cultural formations of identity and difference within an emerging technoscientific society. As a whole, my project approaches scientific developments not as mere context to the rise of literary modernism; instead, I show how modernist modes of writing arise in conjunction with and in some cases in dialogue with developments in applied and theoretical mathematics. Bringing together these seemingly distinct fields of knowledge sheds new light on the interrelationship of science and subjectivity as it unfolds within literary modernism.

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Table of Contents

Introduction.....	1
Chapter 1: The Subject of Accounting: Bookkeeping Women in American Literature, 1885-1925.....	32
Chapter 2: Mathematical Modalities in Modernist Fiction: Frances Newman, Mina Loy, and H.D.....	72
Chapter 3: “Numbers Have Such Pretty Names”: Gertrude Stein’s Mathematical Poetics.....	118
Chapter 4: Between Metaphysics and Method: Mathematics and the Two Canons of Theory	161
References.....	194

Introduction

She insisted that Fanny crack her own mathematical nuts. She said it was good mental training, not to speak of the moral side of it.

—Edna Ferber, *Fanny Herself* (1917)

She remembered with mortification that her own chest and her own waist and her own hips had almost exactly the same circumference.

—Katherine Newman, *The Hard-Boiled Virgin* (1926)

She would be so embodied in long parallelograms and in square and cube and rectangle. She wanted those things.

—H.D., *Nights* (1935)

Numbers have such a pretty name. It can bring tears of pleasure to ones eyes when you think of any number...

—Gertrude Stein, *The Geographical History of America* (1936)

For a discipline that has long held its status as the purveyor of objectivity, mathematics emerges with remarkable frequency in late nineteenth- and early-twentieth century American literature as a means to describe and interpret subjective experience. The application of mathematics to social and human phenomena, particularly in its turn-of-the-century instantiations, is almost always interpreted, however, as dehumanizing and reductive; to “number” someone is to strip them of their unique identity. We need look no further than Elmer Rice’s hollowed out protagonist Mr. Zero in his 1920 play *The Adding Machine* to find evidence of “the weight of vast numbers and monolithic impersonal institutions” that traditionally have been understood to afflict many a modernist hero and further disempower the modernist heroine.¹ And yet, in equally many (if not more) instances, including the above examples, mathematical modes of description and analysis play an integral role in the *construction* of modern selfhood rather than its subjection to nightmare visions of disempowerment, regimentation, and depersonalization. For modern heroines in particular, mathematical rhetoric enables

new ways of conceptualizing embodiment, emotion, sexuality, morality, and self-expression, offering a new affective register that both defines them as individuals while also alluding to some kind of generalizable, collective female experience.² While scholars have focused primarily on the use of mathematical imagery in the work of numerous male authors, particularly modernist writers such as Ezra Pound, T.S. Eliot, and Wyndham Lewis, I reveal a concurrent tradition of women's engagement with various aspects of mathematics, stretching from the late nineteenth through the mid-twentieth centuries. I investigate the complex ways in which a number of American women writers such as Charlotte Perkins Gilman, Edna Ferber, Frances Newman, H.D., Mina Loy, and Gertrude Stein rely on mathematical rhetoric as a means both to critique patriarchal literary and cultural traditions and to imagine alternatives to, and in some cases reinforce, existing notions of gender and ethnic identity. Rather than a context-free, gender-neutral domain, mathematics—in a variety of forms and applications—plays a crucial role in cultural formations of identity and difference within an emerging technoscientific society.³

The Mathematics of Modernism, Revisited

The tendency to perceive mathematics as operating above or outside of culture has contributed to the scholarly consensus that modernist representations of mathematics are merely an abstract aesthetic exercise, one tool among others in a broader agenda of formal innovation. Conceived of as an aftereffect or symbol of modernist experimentation, critics tend to approach these mathematical references as reflexively bound up with qualities of abstraction, objectivity, and detachment, creating a feedback loop between traditional notions of mathematical practice and modernist poetics. A

much more compelling and complex picture of this “mathematical turn” emerges, however, if we approach the modern American writer’s penchant for mathematics from a socio-cultural perspective, taking into consideration not only the internal, historical developments within mathematics and its increasing application within other scientific and social enterprises, but also the affective, material, and experiential dimensions of mathematical thought and praxis. The abstract mathematics of modernism turns out to have particular historical, cultural, and material referents. These referents indicate both an emerging model of subjectivity expressed through quantitative rather than qualitative terms as well as a new and important way in which modernism’s self-referential focus on form simultaneously engages political and social experience.⁴ This is not to enter the longstanding debates—incisively glossed by scholars such as Marianne DeKoven and Astradur Eysteinnsson—about whether modernist formal innovation *in and of itself* is politically progressive or reactionary, since to do so would be to once again stabilize and codify modernist writing and thus disregard decades of criticism aimed at revealing its contradictory, multivocal, and varied forms.⁵ Instead, this dissertation emphasizes the ongoing interactivity between formal techniques and socio-political positioning. More specifically, I consider both how certain narrative and rhetorical strategies, particularly those conversant with mathematical concepts and terms, encode a gendered and racialized political discourse, as well as how the political and social cachet of mathematical information offered late nineteenth- and early twentieth-century writers a new mode of agency.

I do not intend, then, to approach the literary texts in this dissertation simply as a catalogue of responses to the social applications of mathematics within early twentieth-century American culture, or, more generally, to suggest this “mathematical

turn” as simply a response to modernity. The writers on whom I focus certainly reveal literature and poetry’s capacity to interpret the cultural dimensions of science, but they also find in mathematics a new language for negotiating modern literature’s internal crisis of representation—a crisis, as Pericles Lewis writes in *The Cambridge Introduction to Modernism*, “in what could be represented and a crisis of how it should be represented” (2). For the writers considered in this dissertation, I suggest that their deferral to mathematical symbolism indicates the simultaneous desire to transcend the limitations of linguistic forms of representation and at the same time fortify literature’s representational and cultural authority. I argue further that these mathematical references are crucial to our understanding of some of modernist writing’s most contradictory impulses: the tensions between object and subject, wholeness and fragmentation, emotion and reason, individual expression and collective action, elitism and populism, and tradition and “making it new” that foreground the modernist crisis of representation. Rather than offer a resolution of these tensions, I show how they are constitutive of a particular modernist poetics and how mathematical expression complicates easy distinctions between the different halves of these dialectical oppositions. To this end, I investigate both what this preoccupation with mathematics reveals about the internal dynamics of modernist writing as well as how the literary, theoretical, and historical texts under consideration here enable a critical reexamination of our modernist metanarratives, or the history of our own critical approaches to this literary historical period. As I discuss at greater length in Chapter 4, our conceptions of mathematics play an integral role both in the modernist literary imaginary as well as in the development of a number of twentieth-century theoretical frameworks.

Before examining the historical, cultural, and material dimensions of mathematics to which these modern women writers refer, I first consider existing critical perspectives on modernist scientism and how certain entrenched notions of mathematics limit our understanding of both its capacity to signify—to say something about external reality—and the role women writers play in realizing its signifying potential. Indeed, critics tend to interpret the appropriation of scientific and mathematical metaphors by modernist writers in one of two ways: either as a resistance to previous movements such as sentimentalism and aestheticism or as a reaction to emerging demands within literary studies for disciplinary demarcation and pressures to professionalize in ways that mirror the sciences. Both explanations also tend to be situated within a masculinist framework, wherein writers either eschew effeminacy through their rejection of previous literary modes or reestablish masculine mastery by modeling their writing on science. Scientific and mathematical references thus appear to reinforce images of masculine authority and expertise and to signal the disavowal of the feminine, further anchoring traditional and exclusionary versions of modernism. Susan Squier points to Andreas Huyssen's now well-known *After the Great Divide: Modernism, Mass Culture, Postmodernism* (1986) as "one of the first to suggest that the modernist commitment to scientificity may originate in a masculine reaction-formation against feminized mass culture," a correlation Squier believes rests on the "hitherto unexamined relations among modernism and science, which has itself been understood as an equally, and unproblematically, masculine territory" (301). But even within more recent examinations of modernism and science, and even within those that include the work of women writers, this modernism/masculinity/mathematics nexus resurfaces in one form or another.

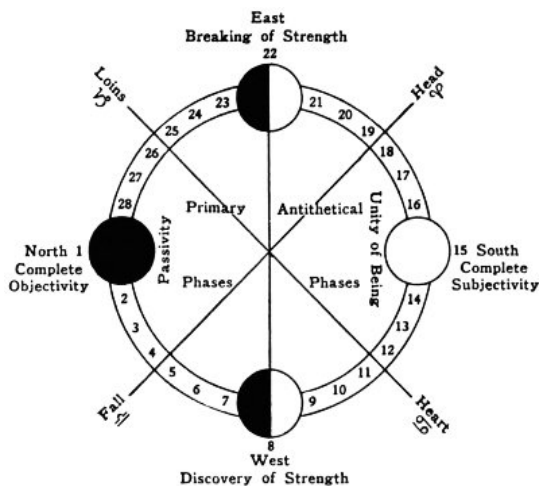
Miranda Hickman, for example, focuses on the geometric preoccupations of Vorticism, a British artistic movement spearheaded by Wyndham Lewis and Ezra Pound, whose influence on Anglo-American modernism, Hickman argues, extends beyond its short-lived run between 1913-1915. Quoting from Lewis, Hickman connects Vorticist “geometrics” to a larger artistic effort to resist “feminine” modes of writing:

[G]eometric figures come to be coded within the project of Vorticism’s formation so as to serve an early twentieth-century project of combating effeminacy.... Within the Vorticist context, the geometrics come to stand for the ‘sternness and severity,’ the ‘mastered, vivid vitality’ that will counteract effeminacy and serve the project of disavowal. (87-8)

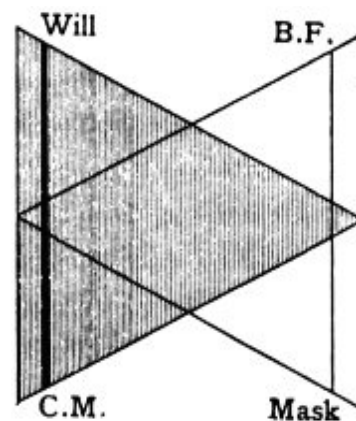
Vorticism’s “geometric gestures,” she adds, emerge in the later modernist work of Pound, H.D., and Yeats to promote “other kinds of precision, discipline, vigilance, aggression, and force” (88). For Ann Ardis, these qualities of mastery, precision, and discipline—“the signature rhetoric about the scientific precision of poetic observation”—are reflections of the external “pressures of ‘scientific’ professionalism” that are “driving the consolidation of modern disciplinary boundaries at the end of the nineteenth century” (174). While acknowledging women writers’ participation in the cultivation of professional expertise, Ardis also upholds the link between scientific rhetoric and a territorial male modernism: “literary modernists sought to (re)establish the cultural authority of literature on firmer grounds in the 1910s . . . by privileging poetry, appropriating the discursive authority of science, and thereby reconstituting the literary field as a ‘masculine’ domain (17). Both Hickman and Ardis’s perspectives point to the cultural perception of science’s certitude and authority as a cure-all or cover-up

for male writers' anxieties about their professional status and authorial personas as thoroughly credentialed, "expert" writers.

These readings of modernist scientism are particularly persuasive given the wealth of self-diagnostic, non-fiction essays produced by writers such as Pound, Eliot, Lewis, and Yeats that define and promulgate their versions of modernism. Indeed, it has proven difficult, as Deborah Jacob observes, to "*rechart* or *rethink* the definition of modernism in terms other than those modernism narrated/laid out for itself" (277). From Lewis's manifestos in *Blast*, for example, critics find some of the most explicit rejections of sentimentality, or "*pretty language*" as Lewis refers to it: "We stand for the Reality of the Present—not for the sentimental future" ("Manifesto I" 7). Such statements are accompanied by celebrations of the purifying, hygienic language of geometry, the "clean arched shapes and angular plots" that can correct "the grotesque anachronisms of our physique" (25). Similarly in *A Vision* (1925), Yeats illustrates the fragmentation of the self through quantitative charts and geometric diagrams that divide, rank, and number the various facets of human personality:



The Great Wheel, *A Vision*, 81



The Four Faculties, *A Vision*, 77

Geometric diagramming and figuration become not simply reflective but *constitutive* of modernist notions of identity; the internal complexities and the physical and psychological divisions of the self are to writers such as Yeats best described through a spatial distribution rather than a linguistic construction. These pseudo-scientific diagrams also reinforce visually cultural perceptions of science's diagnostic authority and its ability to measure the human subject objectively.

Pound and Eliot's essays also call on mathematics, and science more generally, as models of emotional restraint and impersonality—qualities that scholars have come to see as the hallmarks of their literary criticism. Stressing emotion as an after-effect of precise intellectual methods, Pound writes, "Poetry is a sort of inspired mathematics, which gives us equations, not for abstract figures, triangles, spheres, and the like, but equations for the human emotions" (SR 14). Eliot urges a similar kind of critical distance between writers and their material such that their work might avoid personal inflections: "The progress of an artist is a continual self-sacrifice, a continual extinction of personality....It is in this depersonalization that art may be said to approach the condition of science" (TIT 7). In drawing these analogies between science and art, Pound and Eliot appear to project an image of the modernist writer as objective, detached, authoritative, methodical, and professional—an image that is slow to recede in our narratives of modernism. Pound repeatedly states that the artist and the scientist follow a similar methodology: "The difference between art and analytic geometry is the difference of subject-matter only" (GB 91). Or, as he recapitulates in another essay: "The difference between science and art is not a difference of method, but of subject matter. Art is the scientific spirit applied to soul, observing, collating, noting (SA 166). More than a description of his own or others' writing, Pound prescribes a recursive,

formalized writing technique. Eliot likewise argues that the scientist and the poet are both beholden to traditions and principles and occupy the same professional latitude: “A poet, like a scientist, is contributing toward the organic development of a culture: it is just as absurd for him not to know the work of his predecessors or of men writing in other languages as it would for a biologist to be ignorant of Mendel or De Vries” (CON 84). For these male writers, the rhetoric of science and mathematics serves more as a means of authorial self-fashioning than as a description of the characteristics or subjects of their own fiction and poetry. And yet, critics tend to allow these self-described qualities to stand in for the whole of the author’s work, often overlooking the distinctions between their fictional and non-fictional modes of writing and the contradictions *within* their non-fictional essays.⁶

While I do not want to deny that these male writers were drawn to the sciences for the reasons that Hickman and Ardis persuasively propose, I am less interested in how these writers live up to the “poet as scientist” image they seek to project and much more intrigued by how these writers use scientific terms and concepts, particularly those of mathematics, to explore questions of subjectivity, embodiment, and emotional expression. We have not sufficiently considered why these mathematical metaphors and diagrams in the work of these male writers are so often intertwined with discussions of spirituality, inspiration, emotion, personality, and identity. Little attention has been paid, for example, to Lewis’s reflections on the relationship of form and emotion: “It is no more ridiculous that a person should receive or convey an emotion by means of an arrangement of shapes, or planes, or colours, than they should receive or convey such emotion by an arrangement of musical notes” (GB 81). Or more boldly stated: “I SHALL DERIVE MY EMOTIONS SOLEY FROM THE ARRANGEMENT OF

SURFACES” (GB 28). Yeats similarly proposes a connection between mathematical and emotional expression: “there is immense confidence in self-expression, a vehement self, working through mathematical calculation, a delight in straight line and right angle” (V 120). Their scientific and mathematical expressions convey more than simply “precision, discipline, vigilance, aggression, and force,” but also reflect moments of ambiguity, exploration, transcendence, and feeling.⁷ As readers of modernist texts, we must tread carefully the thin line between emotional detachment and the transference or cathexis of emotions onto new symbolic registers. Indeed, there is more to this modernist attraction to mathematics than an attempt to poach or draw from a culturally authoritative discipline; instead, I explore both the ways in which writers deploy mathematical terms and tropes to develop a new rhetoric of the self as well as the literary and cultural influences that led writers to see mathematics as a productive representational model for interpreting modern subjectivity.

Scholars of late nineteenth- and early-twentieth century literature and culture stand to gain a fuller sense of how mathematics functions as an alternative grammar of self-expression and introspection by examining this phenomenon in the fiction and poetry of modern American women writers. More often than their male counterparts, who tend to reserve their scientific analogies for their non-fictional writings, women writers incorporate mathematics primarily into their fiction, and thus in some respects *enact* the art/science analogies that became the “stuff” of many modernist manifestoes. I focus particularly on selected works by Charlotte Perkins Gilman, Edna Ferber, Frances Newman, H.D., Mina Loy, and Gertrude Stein, both to move beyond masculinist interpretations of science’s role in the modernist imaginary and to explore how these women writers inventively repurpose the “masculine” subject of mathematics

for feminist ends. I build on the work of scholars such as Marianne DeKoven, Michael Kaufmann, and Susan Squier (to name only a few) who complicate separatist, gendered models of modernism, by showing how these women writers not only draw on mathematical tropes, but openly embrace them as a means of representing their professional, psychological, and sexual desires.

As the opening epigraphs reveal, writers such as Ferber and Newman approach mathematical analysis as both a self-disciplining and self-measuring tool—a method for achieving a certain feminine ideal—and also an essential skill for first-wave feminist goals of economic and social autonomy. As I show in Chapter 1, writers such as Ferber, Gilman, and Cather depict women calculators or bookkeepers who use their quantitative skills to assume subject positions traditionally reserved for men, while also, in many instances, relying on these same skills to reinforce existing racial and economic taxonomies. For writers such as H.D. and Stein, as the epigraphs reveal, it is the mathematical objects themselves that effect change in the characters, evoking cathartic emotional responses from the narrators. As I investigate in Chapter 2, modernist women writers like H.D. deploy geometric tropes to explore female sexuality apart from hetero-normative, monogamous, and reproductive sex and as independent from male desire. In Chapter 3, I explore Stein's interest in the connections between mathematical thought and human cognition, as well as the potential for mathematical terms, like ordinary language, to be representational and expressive. Rather than a threat to human agency, then, the idioms of geometry, arithmetic, and logic provide these women writers a variety of ways of constructing selfhood in and for their characters, and more specifically, of reshaping and reinforcing certain gender and ethnic constructs within early twentieth-century American culture.

Origins of the Mathematical Subject

While a robust and thriving discipline well before the turn-of-the-century, mathematics in the late nineteenth and early twentieth centuries continued to solidify its privileged status within scientific as well as public spheres. Mathematical books, lectures, and figures became a newspaper fixture, and it was not uncommon to find articles proclaiming the “mathematization” of early 20th-century American culture. A Columbia University professor made headlines for claiming in his 1907 lecture that “Ours, not Euclid’s, is the golden age of mathematics,” a claim followed by a list of the field’s accomplishments: “Six international congresses of mathematics have been held in less than ten years. Fifty thousand mathematical books and memoirs have been produced during the last generation. Mathematics, though the oldest of the sciences, is at the same time in a sense the youngest, flourishing to-day as never before” (“Exalts”). Particular fields *within* mathematics also garnered public attention; Bertrand Russell and Alfred Whitehead’s widely popular *Principia Mathematica* volumes (1910-13), for example, signaled growing interest in the logical foundations of mathematics. The emergence of Cubist visual art and modern, minimalist architecture in the early decades of the twentieth-century inspired other artistic and popular representations of geometry perhaps more so than even concurrent and arguably interrelated developments in non-Euclidean geometry.⁸ Niels Bohr and Werner Heisenberg’s discoveries in quantum mechanics highlighted the mathematical underpinnings of twentieth-century theoretical physics. In addition to its application within other sciences, the establishment of the U.S. Census Bureau in 1902, the expansion of the health and life insurance industries, and the growing need for accountants and bookkeepers within “Taylor-made”

management schemes are just some examples of the increased visibility of social applications of mathematics. A 1910 *New York Times* article, for example, touts arithmetic as “the muse of the coming era” and details the lecture of a Chicago University professor who touts the creative, even poetical, potential of mathematics. “The adding machine,” he declares, “is the latest rival of Dante and Milton” (“Modern Muse”). Such claims for the cultural significance of mathematics were perhaps nowhere better demonstrated than in its successful applications within World War I intelligence and defense operations, particularly its use in solving problems of ballistics and submarine detection. One 1918 headline tellingly credits the discipline rather than its practitioners as the true war hero: “Mathematics Locates German Supercannon,” and was thus regarded, as one historian of mathematics writes, “of vital importance in determining the outcome of the war,” revealing “the power of mathematics in a most emphatic manner to the unsuspecting public” (Slaughter 189). If mathematics solidified its place in the public imaginary as a zeitgeist of the twentieth century, the growth of applied mathematics, and particularly the increasing production and dissemination of statistics within political, economic, and social institutions, also produced real material effects on people’s lives and their conceptions of themselves. It is these experiential aspects of the “mathematization” of society that are all too often overlooked in our metanarratives of modernity.

The effects of social quantification were of course not experienced universally or in the same way by people of different racial, ethnic, and national backgrounds. In fact, quantitative practices, particularly in the eighteenth and nineteenth centuries, were often deployed by white elites to cloak exploitative and often inhumane practice under the guise of objectivity, or, in effect, to constrain or delimit the subjectivity of racial and

ethnic others. A prime example of this is The Three-fifths Compromise of 1787, or the culmination of debates between the Southern and Northern states over how slaves should be counted—either as whole or fractional persons—concluding with the designation of slaves as “three-fifths of a person.” While concerns over federal taxation and representation motivated the three-fifths rule, individual states adopted blood quantum laws to regulate the voting rights of African and Native Americans and to prohibit interracial marriage. Blood quantum, or the fractional quantity of one’s particular ancestry, served as irrefutable “proof” of one’s belonging to a racial category, reinforcing the idea, as Werner Sollors writes, that “‘race’ was foremost a mathematical problem” (114). An 1886 Virginia statute determined, for example, “that every person having one fourth or more of negro blood shall be determined a colored person, and every person not a colored person having one fourth or more of Indian blood shall be deemed an Indian.”⁹ This deferral to mathematics as a supposedly objective indicator of embodied racial differences would continue to legitimize not only political and legal determinations, but also the late-nineteenth- and early twentieth-century “sciences” of eugenics, craniometry, and IQ testing.¹⁰

These particular instances of human measurement and the history of social quantification in the U.S. more broadly are of course also inextricable from the institution of slavery. The “business” of slavery and the plantation system it enabled depended on the careful accounting, record keeping, and crude calculation of human value, naturalizing the representation of racial others as numbers and prices. The records and ledgers of slave owners and traders reflect, as Walter Johnson writes, “a human history hidden by the numbers they record in their account books” (59). The conflation of what one is “worth” with one’s self-worth marks one of slavery’s most

corrosive psychological affects, as Paul D of Toni Morrison's *Beloved* well illustrates: "now he discovers his worth, which is to say he learns his price. The dollar value of his weight, his strength, his heart, his brain, his penis, and his future" (262). While mathematical rhetoric became a powerful tool for determining and delimiting one's identity—and indeed for defining and preserving whiteness as a whole number—its use could also be subversive, enabling subaltern voices to gain representational agency and expose patterns of racial injustice.

Though I intend to consider more fully this convergence of African-American history, literature, and social quantification in future versions of this project, it bears mentioning a few examples of the subversive use of math as an important antecedent to the feminist appropriations of mathematics that I trace in this dissertation. To be sure, scholars have certainly acknowledged the scientific methods employed by African-American writers and activists such as Ida B. Wells, W.E.B. DuBois, George Edmund Haynes, and Richard R. Wright, Jr.. Yet few have looked specifically at their use of statistics in relation to a broader history of social quantification. A closer examination of Wells' 1895 *The Red Record: Tabulated Statistics and Alleged Causes of Lynching in the United States*, her essays "Class Legislations" and "Lynch Law," and DuBois' 1899 *The Philadelphia Negro: A Social Study* reveals the use of statistics to highlight a range of racial conditions, inequalities, and potential political strategies. In these cases, the numbers give recognition to the otherwise nameless victims of racial discrimination and serve as a powerful rhetorical tool for substantiating the realities of racial prejudice. It is perhaps this awareness of the interrelationship of numbers and individual representation that led DuBois to write in his journal: "mathematics is identity." These examples are also important reminders that numbers could give as well as take away.

But of course no essential values or truths inhere within the numbers themselves. I do not intend in any way to demonize or even necessarily to celebrate mathematics; rather, following the insights of cultural theorists of science such as Brian Rotman, Michel Serres, and Bruno Latour, whose work I focus on in greater detail in Chapter 4, I urge the awareness of mathematics as a culturally embedded set of practices and ourselves as agents and practitioners of the field, responsible for its ethical and just applications. The use of mathematics to establish the scientific credibility of eugenic ideas, for example, is precisely the danger when math is seen as a disembodied, context-free model of objective truth.

It must be noted that the examples of social quantification I have been tracing are themselves connected to a much longer history; the systematic application of mathematics to explain social rather than physical phenomena can be traced back to the Middle Ages, most notably with the emergence of double-entry bookkeeping around the 13th century.¹¹ But what distinguishes the period of the late nineteenth and early twentieth centuries, I argue, is the increasing prevalence of quantitative methods to individuate—to describe an individual's health, behaviors, desires, and self-image. More specifically, developments in the life insurance industry and the emergence of the new sciences of psychology, psychiatry, and sexology during this period shifted the application of mathematical methods from a means not only of describing populations and persons, but also a way of describing the qualities or internal make-up of individuals.

The life insurance industry expanded rapidly in the beginning the twentieth century. By 1904, 106 life insurance companies existed, a number that would more than double in the next decade, steadily increasing to 708 new companies by 1937.¹² To meet

this increasing demand for insurance, companies sought to establish more systematic, standardized methods of determining eligibility and premiums. First applied in the context of life insurance in the 1880s, the “human life value” concept—a calculation of one’s projected life earnings—served as the economic basis of 20th-century life insurance and promoted the idea that one’s life is, as Theodore Porter writes, “subject to statistical laws”¹³ (227). One’s life, or, really, the measure of one’s mortality, was expressed as the sum of a series of statistically analyzed risk factors, including “build, family history, physical condition, personal history, habits, occupation, habitat, and moral hazard” (Porter 236). It was then up to a medical director or clerk to evaluate each factor of the applicant, “adding 20 percent for a risky occupation and 25 percent for a marginally elevated blood pressure, then subtracting 10 percent for an excellent family history, until, at the conclusion of the exercise, one had a single number expressing the relative risk associated with this particular life” (236).¹⁴ Insurance assessment thus contributed significantly to the sense that one’s personal history and health was an aggregation of variable numeric values. The statistical practices that merged life insurance and medical evaluation sought to measure not so much external factors but one’s internal states, impulses, preferences, and dis/abilities.

Like actuarial science, the developing fields of psychology, psychiatry, and sexology also capitalized on the authority of mathematics, with the intent not only to lend legitimacy to their findings, but also to categorize and qualify the spectrum of human emotions and sexual responses. To explore the pioneering work of scholars such as Havelock Ellis, Cesare Lombroso, Otto Weininger, and Magnus Hirschfeld, whose work is foundational to the scientific study of the human psyche and sexuality, is to observe a compendium of tables, graphs, charts, and statistical figures that measure

anything from physical features to menstruation cycles and degrees of sexual attraction. The obsessively self-measuring heroine of Frances Newman's *The Hard-Boiled Virgin* offers a useful comparison to the female subjects of Ellis and Lombroso's studies, who are subject to measurement from their limbs to their senses—whose thighs, for example, “exceed that in the men by 1 ¼ inches” and whose delicate tactile sense averages 2.87mm on the right hand and 3.12 on the left (Ellis 49, 117). These reports seek to establish highly specific numerical norms—indeed, up to one-hundreth of a millimeter—for gendered bodily characteristics.

On the other hand, Magnus Hirschfeld (1868-1935), a German physician and early sexologist, was drawn to mathematical data as a way not only to validate homosexual identity but also to prove the sheer variety of sexual expressions, or what he called “transitions.” Hirschfeld observed at least sixteen different sex characteristics (from physical build to handwriting), each of which could be masculine (M), feminine (F) or somewhere in between (M+F), amounting to at least three forms; he thus concluded that there could be no less than 3^{16} or 43,046,721 sexual transitions (qtd in Kennedy 123). Though this large number attempts to “prove” the vast range of sexual preferences, it also reflects the pressure to define and support one's claims mathematically. Similarly, in Weininger's 1904 “Sex and Character,” he expresses human sexual identity as a composite of proportional male and female characteristics. Given any individual “A” of “B,” he explains, where “each of the factors a, a', b, b' must be greater than 0 and less than unity,” one arrives at the resulting formula:

$$A = \sum \frac{aM}{a'W} \quad B = \sum \frac{bW}{b'M} \quad (8).$$

Weininger even suggests a formula for calculating the strength of sexual attraction between two people, where K stands for “all the known and unknown laws of sexual affinity,” t stands for sexual “reaction-time,” and a and b the sexual characteristics:

$$A = \frac{K}{a-b} t^t \quad (37).$$

All these formulas seek to isolate specific physiological and behavioral elements as independent factors operating within a numeric model of personhood. One’s sexuality, according to many turn-of-the-century sexologists, was the sum of expertly measured, objectively quantifiable factors. The classification of sexual “norms”—for which sexology is largely responsible—was as much statistical as ideological.

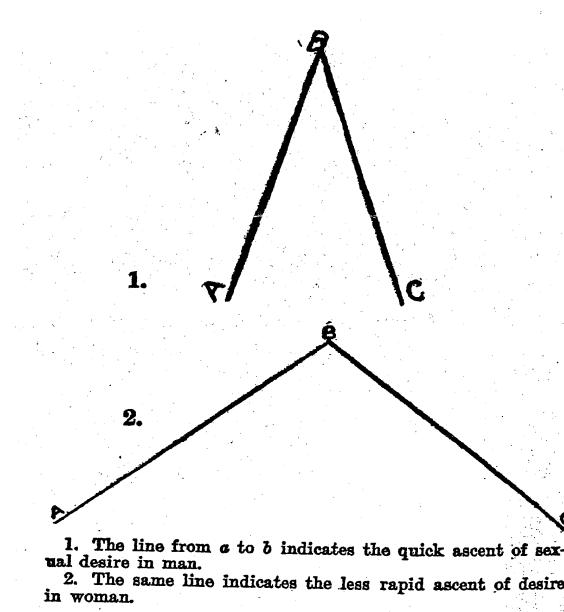
Rather than see this mathematization of the behavioral sciences as inherently reductive or misguided, however, it is important to consider how this recourse to quantitative data helped to sanction scholarly research on subjects previously considered the purview of religion, philosophy, and morality. It also enabled the expression of not just taboo topics, but also the emotional and affective experiences that modernist culture ostensibly eschewed. Otniel Dror argues that numeric data became the primary means for describing and legitimizing laboratory research on human emotion in the late nineteenth and early twentieth centuries:

[T]he numeral representation of emotions created a new type of emotion. The new emotion-as-number provided an alternative medium for the circulation and expression of emotions...It empowered experimenters who wished to study, provoke, and release dangerous emotions inside the laboratory—without corrupting or disrupting knowledge production. It created an emotion that did not threaten the laboratory’s self-representation as an emotion-free space. (359)

But it was not only that researchers could *represent* emotional responses through numbers, but also that numbers were seen as uniquely capable of *interpreting* emotion's physiological effects: "emotion was a pattern written in the language of biological elements that one monitored in, or sampled from, the organism—translated into a sequence of numbers...The correlation between experience and expression, between subjective and objective, rapidly assumed a numeric foundation" (Dror 362). The idea that mathematical information could be expressive highlighted the increasingly tenuous distinction between the subjective and objective that came to define later modernist literature. The distinctions between internal and external, lab and home were also blurred by the invention of portable affect-gauging devices—technologies responsible for translating physiological responses into numeric data (Dror 367). During the interwar period, the introduction of such devices as the Lie Detector, Affectometer, Emotograph, Emotion-Meter, Stressometer, Psycho-Detecto-Meter, Ego-meter and Kiss-O-meter enabled both professionals and non-specialists to generate numerical and graphical outputs of their inner emotional states (Dror 367). Numbers thus functioned both as a crucial mediator between the scientific community and a supposedly emotion-phobic culture and as a medium through which internal feelings could be externalized and actualized.

Increasing public interest in psychology and sexology spurred a wave of popular fiction and self-help manuals, many of which also sought credibility through an appeal to quantitative data and the creation of simplified mathematical rubrics for self-analysis. In his 1908 self-help manual, titled *Self-Measurement: A Scale of Human Values with Directions for Personal Application*, William DeWitt Hyde writes: "If we are to measure ourselves we must have a scale which shall apply to human nature with something of

the definiteness with which bushels apply to wheat, yards to cloth, acres to land, and dollars to stocks and bonds.”¹⁵ Hyde thus creates a chart, wherein each positive or negative personality trait is given a numeric value so that one can add up his or her overall score; one simply adds “all the plus numbers you are entitled to; add all the minus numbers you deserve; and subtract the total of the minus numbers from the total of the plus numbers. Either way will show you as plainly as lines and figures where you stand and what you amount to” (22). A score of +3 is given to qualities such as “vitality” and “devotion” while “health” and “intelligence” earn a +1, and one must subtract 2 for “ostentation” and “hypocrisy.”¹⁶ While some focused on pop-psychology, others like Margaret Sanger attempted to educate readers on topics such as sexual development and marital sex. In her 1926 *Happiness in Marriage*, Sanger offers a graphical representation of the differences between male and female sexual arousal in an attempt to convey such responses as a measurable phenomenon, traceable from point to point through time:



(Sanger, “Happiness in Marriage” 128).

Though such representations might appear antithetical to expressions of passion and intimacy, the discourses of mathematics helped women in particular to forge a new medium of sexual expression, unburdened by the language of sentiment and bolstered by the authority of science. As Dale Bauer argues, “co-extensive with a general shift in sexology, psychology, and sociology” is the “transition from the sentimental to the postsentimental, from the feminization of American culture to its sexualization” (17). In many ways, the scientific and mathematical basis of these emerging behavioral sciences enabled a logical, easily defensible motivation for this transition from self-expression to sex expression.

Though I have been focusing here mostly on statistical and arithmetic applications, the writers on whom I focus certainly also draw on geometric figures and terms to describe emotional, sexual, and embodied experience. Geometry might seem an even more abstract form of math than that of arithmetic or applied mathematics, and yet its apparent manifestation in early-twentieth-century art and architecture, for example, rendered its material foundations much more visible. The most apparently geometric of these movements was Cubism, which emerged in Paris around 1907 and quickly became a widespread international phenomenon lasting well into the next decade. Though some artists, including Picasso, were wary of drawing connections between their work and geometric applications, a shared interest in the properties of spatial representation and manipulation as well as Cubism’s depiction of objects as geometric solids (such as cubes, cones, and cylinders) made such associations inevitable and have proven fruitful to future generations of artists and mathematicians.¹⁷ Though literary critics have explored the overlapping methodologies of Cubism and modern American poetry—namely the self-conscious focus on methods of representation, the

breakdown of external and subjective reality, and the depiction of multiple, simultaneous perspectives—it is cubism’s frequent depiction of the human and typically female form as a composite of geometric shapes that I see as an important yet understudied influence on the poetry of Gertrude Stein and Mina Loy and the fiction of H.D. and Frances Newman.¹⁸ The desire, as H.D. writes in the opening epigraph, to be “embodied in long parallelograms and in square and cube and rectangle” not only conjures iconic cubist paintings such as Picasso’s “Nude Woman” (1910) or Jean Metzinger’s “Tea Time” (1911), but also reveals a mutual interest in thinking specifically about the body as both internally and externally constituted, as both malleable and finite, and more generally about space as embodied and relational. The cubist and modernist interest in the “geometric body” offers another example of how an overemphasis on abstraction can obscure the materialist foundations of modern artistic and scientific expressions.¹⁹

In what follows, I examine not only the ways in which a number of modern writers respond to the increasing application of mathematics to human experience, but also the various ways in which these writers draw on math to construct and constrain certain subject positions and to negotiate shifting stylistic and generic preferences. Chapter 1 focuses on the recurring portrait of the bookkeeping woman in the fiction of Mary Wilkins Freeman, Frances Harper, Willa Cather, Sinclair Lewis, Elmer Rice, Charlotte Perkins Gilman, and Edna Ferber. These writers use the figure of the female keeper of accounts not only to explore the implications of women’s historical relocation from the home to the office, but also to represent an emergent female subjectivity. Within this new model of subjectivity, rationality and fiscal discipline explicitly replace sentimentality and consumption as principal feminine characteristics. Particularly in

Gilman's *What Diantha Did* and Ferber's *Fanny Herself*, the heroines adopt a mathematical sensibility, guiding their lives not by instinct or emotion—as do so many women in nineteenth-century sentimental fiction—but by channeling emotional expressions through numeric representations and defining their identities in terms of their quantitative skills. At the same time, I explore how these writers depict bookkeeping and deploy quantitative description to preserve and justify certain racial, ethnic, and class taxonomies.

Chapter 2 argues that modernist women writers, notably H.D., Mina Loy, and Frances Newman, consider mathematics as deeply connected to Western masculinist epistemology and thus crucial to any critique or transformation of existing social, economic, or political relations. In their prose as well as their poetry, these women use mathematical terms both as metonymies for patriarchal models of power and as devices for articulating distinctly female experiences, particularly those of embodiment, sexuality, and perception. Chapter 3 focuses solely on Stein's numerous and varied representations of mathematics as a way to understand the ideological motivations of her literary experimentation and to resolve recent debates over whether she is a "true" modernist or a prescient postmodernist. For these modernist writers, and for Stein in particular, mathematics is not simply an aesthetic tool, but an integral component of structures of meaning and authority.

Many of these early twentieth-century women writers thus anticipate the cultural analyses of mathematics offered by contemporary science studies scholars such as Brian Rotman, Michel Serres, and Bruno Latour, who see mathematics, like language, as a historically contingent system of signs. My final chapter places these science studies scholars in dialogue with poststructural theorists to understand the crucial role

that mathematics plays in the critique of metaphysics as well as its ongoing connections to questions of representation, objectivity and subjectivity, and materiality and embodiment—areas of inquiry that are foundational to modernist innovation and which continue to structure many of the current theoretical conversations taking place across divergent but overlapping realms of theory. If theorists such as Rotman, Serres, and Latour remind us that mathematics is culturally and historically embedded, the writers on whom I focus offer an important index of how exactly it functions within particular cultural, material, and semiotic practices.

“After the Great Divide”

In exploring both these literary and theoretical histories, my project argues that literature and mathematics become mutually enabling discourses, particularly in the early decades of the twentieth century. On the one hand, mathematics offers writers an authoritative vocabulary for describing and interpreting social phenomena and as a means to extend the boundaries of literary representation. On the other, literature serves as a crucial interpreter of the historical aspects of mathematics, tying the field irrevocably to a cultural milieu. In some sense, then, both fields confer authority on the other; writers and critics seek to renew the power of language through its ability to interpret mathematics and the role it plays in shaping human experience, particularly at a time when anxieties about literature’s relevance within an emerging technoscientific culture are manifest. Mathematicians and theoretical physicists, notably Russell, Whitehead, and Bohr, on the other hand, were beginning to recognize the interdependency of mathematics and language, an interrelation necessary for the formation and transmission of mathematical knowledge, not to mention the meta-mathematical communications, rich with linguistic metaphors and analogies, that Brian

Rotman reminds us are so much a part of the everyday business of doing mathematical research. More than just methodological overlaps, however, Stein's work also reminds us that writers and scientists were interested in similar epistemological questions, particularly concerning the limits of representation, determinacy, and realism.

Ultimately, my hope is that this project challenges the methodological tendency to approach scientific developments—and particularly developments in twentieth-century applied and theoretical mathematics—as mere context to the development of modernist modes of writing rather than as co-constructive discourses, so that we can continue to explore the ongoing overlaps between these seemingly oppositional fields.

Recent publications indicate an ongoing interest in thinking about the convergence of mathematical and literary studies. Kathleen Woodward's *Statistical Panic: Cultural Politics and Poetics of the Emotions* (2009), for example, tracks the relationship between particular “structures of feeling” within 1960s American literature and culture and the “science, practice, and deployment of statistics” (8). Woodward challenges the familiar oppositions of reason and emotion, mathematics and feeling, by revealing connections between statistical information and powerful emotional responses of uncertainty, fear, insecurity, and even boredom. Similarly, Melanie Benson's *Disturbing Calculations: The Economics of Identity in Postcolonial Southern Literature, 1912-2002* (2008), examines the “calculating fixations” that proliferate in twentieth-century Southern literature, revealing “southerners' tendencies to measure, divide, and value themselves and the Others against whom they find balance” (1). Benson's work is certainly critical to my own interests in exploring the socio-historical dynamic between mathematical expression and gendered and racialized conceptions of selfhood, though her work, informed by psychoanalytic and postcolonial theories, diverges in its

particular focus on how these “moments of mathematical reckoning” signal the dehumanizing forces of capitalism and the concomitant development of a narcissistic, fetishistic desire for the signs and symbols therein (5). I thus see my own project building off of Benson’s concluding remarks, which “leave[s] open the possibility that these prevailing calculations of a master narrative might be resisted, disturbed, or rewritten” (26). Both Woodward and Benson’s work reflect an emerging interest in how American literature of the twentieth century represents and interprets the interplay of applied mathematics and human experience.

A January 2011 article in *The Chronicle of Higher Education*, titled “The Statistical Turn in Literary Studies,” also reflects a growing interest in using statistics and other quantitative measures as a method of literary analysis. Within what author Jeffrey Williams calls the “statistical turn,” literary critics “treat literature as a body of empirical facts about which one gains knowledge through quantitative means” (2). The article refers to work by scholars such as Franco Moretti, whose recent book *Graphs, Maps & Trees* (2005) utilizes statistical and graphical methods to chart, for example, generic patterns of novels from several countries over a 160-year period. Other scholars such as Kenneth Roemer and Lynn Bloom have developed electronic databases from which they compile inventories and make determinations based on quantities and frequencies of certain subjects or authors. Some might see these methodological trends as a discomforting reemergence of a scientific model of literary study, similar to the foundations of earlier and now outmoded movements such as Russian formalism and New Criticism. Or, perhaps also relatedly, some might consider these studies as a sign of the ever fragile state of the humanities within a culture that appears to value—particularly in our current economic downturn—the efficiency, practicality, and

applicability that the sciences and business fields are assumed to deliver. However, I see these studies as not only leading the way toward new avenues of research in the humanities, but also as crucial examples of how interdisciplinary investigations can enhance disciplinary self-understanding. Indeed, I approach these studies, including my own, as one important means of explaining the ongoing relevance of the humanities amidst threats to and economic and administrative devaluations of its critically important role in and outside of academia. To better understand the interdisciplinary nature of literary studies—our connectivity to so many other forms of knowledge and intellectual praxis—is to more fully understand what our discipline has to offer its students and scholars alike.

¹ See Daniel Fuchs, "Saul Bellow and the Modern Tradition." *Contemporary Literature* 15.1 (1974): 75.

² Beginning with Sandra Gilbert and Susan Gubar's *The Madwoman in the Attic*, critics have long debated about whether literary modernism divides neatly along gender lines, such that we might speak of "male" and female" modernisms. Critics such as Marianne DeKoven, Bonnie Kime Scott, and Shari Benstock have complicated simple reactionary or separatist models of modernism and challenged the perception that "a collective female experience resulted in a homogeneous women's literature" (Benstock 32). I share this same sense of the multi-faceted, idiosyncratic nature of modern women's literature and experience (and for my purposes, their quite different approaches to and uses of distinct fields of mathematics). At the same time, I seek to show how this turn to mathematical tropes indicates the desire to both define and transcend individual experience, or to borrow Michael Szalay's phrase, the "conflicting impulses toward individual agency and collective affiliation" (3). Contrary to the notion that women writers mimicked the style of their male counterparts or developed their own unified aesthetic program, I show how women writers helped formulate the aesthetics we've come to associate with canonical modernism, but used them toward quite different political and ideological ends.

³ When using the umbrella term "mathematics," I am quite aware of its generality and inability to capture the distinctions among different fields of mathematics, which are as varying and specialized as any other scholarly discipline. The authors on whom I focus certainly draw on different fields of mathematics—most notably, geometry, logic, arithmetic, and applied mathematics—and these differences matter to both my readings of their effects within the individual texts and to an understanding of the particular historical, subdisciplinary contexts to which these idioms refer. Nonetheless, it is often useful to refer to "mathematics" in this general sense as an aggregate term for these particular subfields. This aligns with the *Oxford English Dictionary* definition of mathematics as "the science of space, number, quantity, and arrangement, whose methods involve logical reasoning and usually the use of symbolic notation, and which includes geometry, arithmetic, algebra, and analysis" ("Mathematics," 3rd Edition, July 2010, Def. 1).

⁴ Scholars such as Michael Szalay and Tamar Katz offer useful models for how one might approach modernist formal innovations and early twentieth-century social and political developments as co-constructive rather than an reaction-formation between an intact collection of responses and a set of static political and social events. See Szalay's *New Deal Modernism: American Literature and the Invention the Welfare State* (Duke, 2000) and Katz's *Impressionistic Subjects: Gender, Interiority, and Modernist Fiction in England* (U of Illinois, 2000).

⁵ While there are too many critical re-readings of modernism as monolith to name here, a number of relatively recent book-length studies reflect this investment in destabilizing modernism as a reified, cohesive form and in expanding its traditional parameters, including Lisa Botshon and Meredith Goldsmith's, eds., *Middlebrow Moderns: Popular American Women Writers of the 1920s* (Northeastern, 2003), Ann Ardis's *Modernism and Cultural Conflict, 1880-1922* (Cambridge, 2004), Michael Szalay's *New Deal Modernism: American Literature and the Invention the Welfare State* (Duke, 2000), Marjorie Perloff's *21st-Century Modernism: The "New" Poetics* (Blackwell, 2002), Elizabeth Harrison and

Shirley Peterson's, eds., *Unmanning Modernism: Gendered Re-Readings* (Tennessee, 1997), and Lisa Rado's, ed., *Rereading Modernism: New Directions in Feminist Criticism* (Garland Press, 1995), to name only a few.

⁶ Michael Kaufmann makes a similar argument about H.D. in his 1997 essay "Gendering Modernism: H.D., Imagism, and Masculinist Aesthetics," stating provocatively that "masculinist modernism's first poet was a woman" (59). Kaufmann goes on to demonstrate that H.D. explores in her poetry many of the same conceptual, aesthetic, and methodological strategies that her male contemporaries advocate for primarily in their non-fiction. See *Unmanning Modernism: Gendered Re-Readings*. Elizabeth Harrison and Shirley Peterson, eds. U of Tennessee Press, 1997, 59-72.

⁷ The work of many male modernist writers has long been interpreted not only as anti-sentimental, but also as emotionally restrained or detached, and their mathematical analogies have only helped to fuel this perception. More recently, a few scholars have begun to challenge the notion of the unfeeling male modernist. Robert Dale Parker suggests a rethinking of emotional restraint—such as we see in Ernest Hemingway's fiction, for example—as itself a strong feeling or emotional response. Justus Nieland's *Feeling Modern: The Eccentricities of Public Life* explores the "affective registers—sympathy, intimacy, and comedy" that mediate the public, performative writings of poets such as Wyndham Lewis, E.E. Cummings, and Mardsen Hartley in an effort to "complicate persistent claims about male modernists' supposed antisentimentality (23). Nieland considers more broadly how modernism "seeks to turn its own aesthetic innovations into rival technologies for shaping and structuring collective affects, instrumentalizing emotion through form" (21). We might thus approach modernist formal and aesthetic innovations as in themselves emotionally resonant; the modernist writer's self-conscious considerations of how to capture, represent, isolate, or even eschew emotion reveals the powerful and often contradictory desires to establish and define the place of emotion within literary expression and to find new ways of evoking feeling and response. In future developments of this project, I hope to build on Nieland's insights to consider how mathematical analogies and tropes provide writers such as Pound, Eliot, and Lewis with methodological and rhetorical tools for exploring what Raymond Williams calls "structures of feeling," or the relations between collective experience and personal expression.

⁸ Credited with introducing the world to non-Euclidean geometry, the work of Carl Gauss, János Bolyai and Nikolai Lobachevsky proved that there are multiple consistent models for the basic geometric axioms—findings that seriously undermined the notion that mathematics describes a stable and objective 'reality.' As Rhonda Shearer argues "new thoughts of space, as curved and higher dimensional, induced from non-Euclidean and *n*-dimensional geometries, continued growing in popular interest from the late nineteenth until the early twentieth century" and these developments had a profound affect on the visual and literary arts (145). Though artists such as Picasso publicly dismissed a connection between his work and geometry, a critic and close companion to Picasso said that he had "meditated upon geometry" and others artists and poets such as Guillaume Apollinaire explicitly connected their work to emerging interests in this "new space" known as the "4th dimension" (qtd. in Shearer 146).

⁹ See Deborah A. Rosen, *American Indians and State Law: Sovereignty, Race, and Citizenship, 1790-1880*. Lincoln: University of Nebraska Press, 2007, 95. Also, Peggy

Pascoe, *What Comes Naturally: Miscegenation Law and the Making of Race in America*. Oxford: Oxford University Press, 2010.

¹⁰ For a more in-depth analysis of the history of scientific racism, see, for example, Stephen Jay Gould's *The Mismeasure of Man*. New York: W.W. Norton & Company, 1996.

¹¹ See Alfred Crosby's *The Measure of Reality: Quantification in Western Europe, 1250-1600*. Cambridge: Cambridge University Press, 1997, and Mary Poovey's *A History of the Modern Fact: Problems of Knowledge in the Science of Wealth and Society*. Chicago: University of Chicago Press, 1998.

¹² J. Owen Stalson, *Marketing Life Insurance: Its History in America*. Harvard University Press, 1942, p. 562.

¹³ For more on the history of the human life value concept, see Alfred Hofflander, *The Journal of Risk and Insurance*, Vol. 33, No. 3 (Sep., 1966), 381-391.

¹⁴ Porter points out that "the measurement of blood pressure," the value we now accept as a prime indicator of our personal well-being, "came into medicine not as a consequence of disinterested medical research or of the concern of physicians for their individual patients. Rather, it arose as part of the effort by life insurance companies to develop better and more objective means of mortality prognosis" (242).

¹⁵ William DeWitt Hyde, *Self-measurement: A Scale Of Human Values With Directions For Personal Application* (New York: B. W. Huebsch) 1924, 9.

¹⁶ This tradition of taking score of oneself is still very much alive and well in contemporary lifestyle magazines such as *Glamour* or *Men's Health*, which provide readers with a series of questions or a quiz that yields a final numeric "score," reflecting one's psychological, emotional, and/or physical fitness. For a discussion on the use of numbers in contemporary psychological and self-help practices, including online dating systems, see Eva Illouz, *Cold Intimacies: The Making of Emotional Capitalism*. Cambridge: Polity Press, 2007.

¹⁷ See, for example, Dan Pedoe, *Geometry and the Visual Arts*. New York: Dover Publications, 2011, Matila Ghyka's *The Geometry of Art and Life*. New York: Dover Publications, 1977, John Milner's *Kasimir Malevich and the Art of Geometry*. New Haven: Yale University Press, 1996, and Rhonda Roland Shearer's "Chaos Theory and Fractal Geometry: Their Potential Impact on the Future of Art." *Leonardo* 25:2 (1992): 143-152.

¹⁸ See, for example, Jacqueline Vaught Brogan's *Part of the Climate: American Cubist Poetry*. Berkeley: University of California Press, 1991, and Thomas Vargish and Delo Mook's *Inside Modernism: Relativity Theory, Cubism, Narrative*. New Haven: Yale University Press, 1999.

¹⁹ Rhonda Shearer points out that Picasso and another pioneer of Cubism, Georges Braque, describe their methods as intuitive and tactile and that both used a variety of concrete tools to experiment with spatial representation. As Braque writes, "there is in nature a tactile space...what attracted me and what was the governing principle of Cubism, was the materialization of this new space which I sensed" (146). Picasso also used "balls of wax or clay 'to feel the roundness of space,'" and he "always kept on hand some large balls of clay with which to make experiments' in dimensional effects" (146).

Chapter 1:
The Subject of Accounting:
Bookkeeping Women in American Literature, 1885-1925

Within modernist criticism, mathematics appears to have two faces. On the one hand, critics tend to explain the realist and modernist appeal to mathematical themes and concepts as part of a collective, deliberate effort by writers to subvert sentimental modes of fiction and thereby distinguish themselves from prior literary traditions. On the other hand, scholars often identify the quantification of society as a source of the individual's feelings of detachment, disenchantment, and objectification—an instigator of the artifices of modern life. Both perspectives converge on the notion that mathematics and subjectivity are fundamentally at odds with one another. This chapter, however, argues for the dynamic interrelation of math and subjectivity through the particular case of women's historical and literary investment in the practice of bookkeeping, or the skill and activity of recording, calculating, and interpreting financial transactions. I trace the historical and educational developments that led to women's involvement in and eventual dominance over the field of bookkeeping by the 1930s as a way to contextualize the recurring but understudied trope of the bookkeeping woman that emerges in the fiction of writers such as Mary Wilkins Freeman, Frances Harper, Willa Cather, Sinclair Lewis, Elmer Rice, Charlotte Perkins Gilman, and Edna Ferber. These writers depict primarily middle-class white women who perform mathematical tasks as household accountants, shopkeepers, office bookkeepers, and business professionals, and as such, point to an increasingly professionalized domestic sphere as well as the development of a particular form of feminized labor. I am interested not only in the ways in which the discourse of mathematics offers women a set of skills for navigating emergent economic and

professional opportunities and provides a culturally authoritative means of self-advocacy—that is, in how quantitative practices confer subjectivity—but also in how such practices are deployed to constrain or delimit subjectivity, particularly as a means to preserve certain racial, ethnic, and class taxonomies. Rather than simply an exploration of the effects of an increasingly techno-scientific culture on literary formations, I show how writers capitalize on the cultural authority of mathematics to enable certain ideological and subjective positions.

I focus particularly on Charlotte Perkins Gilman's first novel *What Diantha Did* (1910) and Edna Ferber's *Fanny Herself* (1917), two bildungsroman featuring heroines whose penchant for quantification catalyzes their professional success and personal fulfillment. The use of mathematics as a means for women to become unstuck—building on Jennifer's Fleissner argument about the “stuckness in place” that plagues naturalist heroines—carries a great deal of ideological significance in itself.¹ These numerically oriented heroines challenge the age-old correlation of masculinity with mathematical reasoning—a particularly significant gesture in the context of turn-of-the-century debates over women's suffrage, wherein women's capacity for logical reasoning, rational behavior, and professional stamina were fundamental to the very terms of the national debate.² As a paradigm of objectivity and rationality, mathematics serves as an ideal tool for these authors to create an alternative model of female subjectivity, one based on qualities that appear to subvert their association with excessive emotionality and careless consumption and to reject sentimental, domestic models of femininity.

But while both Gilman and Ferber turn to the language of math as an alternative to the language of sentiment, neither completely substitutes one discourse

for the other. In fact, this recourse to mathematical symbolism functions paradoxically as a narrative strategy for dealing with affect and emotion—a way of channeling or displacing affective responses onto numeric representations. Scholars such as Suzanne Clark, Amy Kaplan, Ann Ardis, and Lauren Berlant, have shown sentimentalism to be an ongoing political and rhetorical strategy, dynamically interlinked with the development of realist and modernist modes of writing. I build on their insights by considering not only how sentimentalism motivates or reveals itself in these other modes, but also more specifically how early twentieth-century writers, and Gilman and Ferber in particular, deploy the “objective” language of mathematics to convey subjective and affective experience—the ways, that is, in which they cloak the sentimental in realist garb. Rather than reinforcing the familiar opposition of science and sentiment, both Gilman and Ferber consider them as importantly intertwined.³

While both writers represent bookkeeping and quantitative reasoning as emancipatory tools for women’s self-realization, they also, to varying degrees, rely on an exclusionary and hierarchical model of new womanhood in which mathematical expertise is not only implicated but also deployed to justify and rationalize white racial privilege. Scholars such as Gail Bederman, Louise Newman, Martha Patterson, Dana Seitler, and Francesca Sawaya (to name only a few) have demonstrated this co-construction of late nineteenth- and early twentieth-century feminism and racist, nativist ideologies, using Gilman’s work in particular as a prime example of how “sexual equality was a racial necessity”(Bederman 145). Seitler examines more specifically how Gilman’s “fictions of progress” serve as crucial indices of “early-twentieth-century feminism’s campaign to free white women from masculine hegemony through a commitment to popular science, specifically ‘eugenic discipline’” (64). Though *What*

Diantha Did makes only cursory reference to eugenic ideas, the novel's focus on numerical data as a means of establishing and maintaining social order speaks to the increasing application of mathematics to solve social "problems," legitimize popular science, and validate racial difference.⁴ Gilman's frequent deferral to statistical reasoning and pseudo-mathematical logic in her 1908 nonfiction essay "A Suggestion on the Negro Problem," signals both her alliance to eugenic "science" and her appeal to mathematics as the purveyor of reason and paradigm of civilized society.⁵ Ferber, however, exhibits much more ambivalence toward mathematical analysis, recognizing quantitative skills as professionally advantageous, but also fearing the loss of individual expression in a number-crunching business world. Ferber's protagonist feels compassion for and even identification with the less privileged manual laborers she encounters in urban New York and Chicago, and yet Ferber is intent on establishing the exceptional nature of Fanny's skills and distinguishing her expert labor from that of the non-white and immigrant domestic servants. While the practice of bookkeeping might appear to offer transcendence from markers of gender, race, and class by linking "authority to training rather than inherited status," both authors elide questions of educational access and institutional power structures that preserve white middle-class privilege, in effect solving problems of inequality by leaving racial and working-class others out of the equation.⁶ We thus stand to gain a fuller sense of bookkeeping as both a literary trope and an historical phenomenon by asking not only who's counting but also who counts.

I.

In the following brief overview of the history of women's entry into bookkeeping, I explore how Freeman, Cather, Lewis, Harper, and particularly Gilman and Ferber,

grapple with the implications of women's historical relocation from the home to the office. By placing these literary texts in this historical context, I examine the ways in which these writers participate in cultural debates about women's access to positions and professions previously reserved for men and increasingly critical in delineating social status. The mathematical practices these narratives depict not only animate anxieties about shifting gender and ethnic divisions of labor but also become an important means to renegotiate gendered, racial, and economic power relations within an emerging technoscientific culture.

In the period after the American Revolution, women's knowledge of basic arithmetic and bookkeeping became a subject of public concern. Evidently aware that many women could not evaluate their family finances or property values, prominent statesmen such as Benjamin Franklin and Benjamin Rush advocated women's education in arithmetic and bookkeeping so that they could assist their families in business ventures.⁷ "Some knowledge of figures and bookkeeping," Rush declared in 1787, "is absolutely necessary to qualify a young lady for the duties which await her" (70). Over the next few decades, well-known female educators, including Emma Willard, Almira Phelps, and Catherine Beecher, established schools for women and curricula that emphasized instruction in arithmetic and some higher forms of mathematics such as algebra and trigonometry. In attempts to preserve a gendered hierarchy within the field, some educators were opposed to teaching women geometry, deeming it unnecessary and even corrupting.⁸ Nonetheless, young women continued to study higher mathematics, particularly in preparation for becoming secondary school teachers, and by the 1890s girls were not only following the same curriculum as boys but were more often enrolled in public high school science courses (Tolley 149). Advocates of

women's math education, however, continually met opposition from educational administrators who considered mathematical training unnecessary to women's eventual role as homemakers.

The emergent field of domestic science, beginning with Catherine Beecher's widely reprinted 1841 *A Treatise on Domestic Economy*, played a role in women's educational development by providing a persuasive social and moral basis for their scientific training, while also reinforcing the domestic impetus for such development. Beecher considered bookkeeping an emancipatory tool for women to achieve greater independence: "if a woman has never kept any accounts, nor attempted to regulate her expenditures by the right rule, nor used her influence with those that control her plans, she has no right to say how much she can or cannot do" (173-4). But she also emphasized the strictly domestic applications of math instruction: "How strange it appears that so many ladies take charge of a husband's establishment without having had either instruction or experience in one of the most important duties of their station" (188). Despite the popularity of Beecher's text at the time of its publication, domestic science did not become a widespread model for high school and collegiate curricula until the end of the nineteenth century, the period during which women also began to enter the professional workforce. The appeal and growth of domestic science and its emphasis on vocational training thus emerged in large part as a response to anxieties over women's relocation from the home to the office and threats to the masculine profile of scientific knowledge.⁹

Mary Wilkins Freeman's 1885 story "An Old Arithmetician" uses the trope of mathematics to explore this fraught relation between domesticity and professionalism and the constraining expectation that maternal proclivities should take precedence over

all other pursuits. The story depicts an aging woman, Mrs. Torry, who obsessively works on arithmetic problems, often to the neglect of her household responsibilities, including watching over her adolescent granddaughter Letty. While her compulsiveness might be interpreted as typical behavior for naturalist heroines, as Jennifer Fleissner's reevaluation of naturalism might suggest, I see this turn toward calculation as a means for the heroine to participate in and contribute to a world beyond the domestic, a new plot device for women to avoid becoming "stuck in place." Indeed, solving arithmetic problems brings purpose to Mrs. Torry's otherwise isolated existence and gives her a sense of individuality and self-worth: "There'll be something' in 'em that everybody else 'ain't got; somethin' that growed, an' didn't have to be learned. I've got this faculty; I can cipher...it's a *gift*" (611). She becomes so absorbed in one particularly difficult problem that she fails to keep track of her granddaughter, who becomes lost while traveling by train with a classmate. Distraught, Mrs. Torry denounces her arithmetic practices as all-consuming and alienating: "I didn't know nothin' but them figgers, an' now Letty's lost, an' it's my fault" (614). Even though she appears to reach an epiphany about the dangers of valuing individual endeavors over family or community—of "a-lettin' my faculty for cipherin' get ahead of things that's higher an' sacreder"—she struggles against the urge to return to the problem, unable "to help thinkin' about that awful sum now after all that's happened" (614). Despite its overt admonition, the story simultaneously emphasizes the pleasures of intellectual activity and the sense of purpose that might come from taking on roles beyond those of mother or caretaker. While she remains physically tied to her home, her interest in arithmetic allows her to interact with the male schoolteacher (who provides her these

problems) and the minister (who delivers them), giving her, if only temporarily, a means to participate in an intellectual discourse outside the home.

By the turn of the century, the practice of bookkeeping formed a bridge between home and workplace. On the one hand, it served the efforts of domestic science advocates to professionalize household tasks. In the home of Mrs. Trenor, Lily Bart's confidante in Wharton's *The House of Mirth* (1905), "the chaos of letters, bills and other domestic documents" gives her writing-table a "commercial touch," suggesting the conversion of her domestic space into a record-keeping office (34). On the other hand, bookkeeping was also becoming a professional option for women seeking work outside the home. In Sinclair Lewis's *The Job* (1917), the protagonist Una Golden lands her first job at an insurance firm based solely on her efforts "to balance Captain Golden's account-books, which were works of genius in so far as they were composed according to the inspirational method" (12). Her ability to untangle the chaos of figures convinces the manager to hire Una on the spot. As Lewis's novel suggests, the training that women received for their household bookkeeping eventually could translate into marketable professional skills; but for Lewis, the office is ultimately a new site where women can engage in romantic liaisons rather than, as Cather, Harper, Gilman, and Ferber envision, a place for women to establish a new mode of autonomy apart from their traditional roles as wives and mothers.

One of first office positions women occupied in the decades after the Civil War was as "calculator." Beginning in 1875, Edward Pickering, director of the Harvard Observatory, began hiring women as "computers" to process large volumes of numerical information. Similar positions soon emerged within the social and biological sciences, which were increasingly reliant on a flexible, affordable staff who could perform

statistical analysis.¹⁰ While their work as calculators was often perceived as unskilled labor, it eventually began to open doors for women to assume more prestigious and profitable positions in bookkeeping and financial analysis.¹¹ Census data corroborates these developments: although women made up only 5.7 percent of bookkeepers in 1880, they constituted 31 percent by 1910, and by 1930, 63 percent of all bookkeepers were women (Strom 18). But while the percentage of women bookkeepers rose, male bookkeepers continued to enter the field in increasing numbers; thus, unlike other office professions, bookkeeping did not enforce a strictly gendered division of labor—that is, it was not explicitly coded as a female domain until the 1950s (Strom 83).

Anxieties about women competing with men for positions manifested themselves in several significant ways. Because many male bookkeeping jobs were converted to accounting positions, which were often off-limits to women and required professional credentials, bookkeeping could now be considered lower within the office hierarchy and was often perceived as a more feminized and thus lesser trade, despite ongoing ambiguities about its limits.¹² There were some attempts to reestablish masculine superiority within the field of bookkeeping. A 1905 *New York Times* article, sarcastically entitled “St. Louis Lady Board Calls in Mere Man” and followed by several subheadings (“Never Asked Masculine Aid in Spending Money; But As To Bookkeeping! Well, There’s A Male Person Figuring on the Accounts and Fixing Up a Report for Congress”) details the accounting failures of the Board of Lady Managers of the World’s Fair, who were forced to call upon a male bookkeeper to rescue them from financial disaster.¹³ The article mocks the women’s attempts at self-sufficiency and their failure to recognize earlier their computational ineptitude and their need for heroic male intervention.

The introduction of computing machines to the office, while creating new opportunities for women workers, also undermined the skills necessary for traditional bookkeeping. A 1925 advertisement for the Monroe adding machine assures readers that its product demands no expertise: “Monroe simplicity and lightening speed keep her work moving rapidly, without mental or physical effort. Any girl in your office can be a Monroe girl if you provide a Monroe Adding Calculator” (qtd in Strom 75). The Monroe girl’s identity and skill set are not valued apart from the machine’s capabilities. Nonetheless, men feared replacement by women-operated machines, which could, as one merchant acknowledges, perform “the work of six men with great ease” (Page 7683). This fear becomes reality for the protagonist of Elmer Rice’s 1923 play *The Adding Machine*, which follows the decline of Mr. Zero, who is fired after twenty-five years as a bookkeeper in a department store. Though he took the job hoping to rise up the office ranks, his dreams of becoming the boss’s assistant (a more appropriately masculine title that would make him superior to his female coworker Daisy) is thwarted when the boss explains that his “efficiency experts have recommended the installation of adding machines” (28). In a gesture that renders women workers inferior to technology, the boss only later clarifies that these machines will be human-operated: “they can do the work in half the time and a high-school girl can operate them” (28). Rice’s play attests to male anxieties over the feminization of bookkeeping and also reinforces the perception that the position involves little more than a rote, mindless recording of figures.

In Willa Cather’s “Ardessa” (1918), the association of women with computing skills also serves as a disciplining tactic for maintaining proper gender roles. The story features three strong businesswomen working in a magazine office, including the

ambitious and numerically-savvy Becky Tietelbaum, who “never forgot dates or prices or initials or telephone numbers” (107). Becky is no match for her competitive colleague, Rena Kalski, who the male boss considers to be “as cold-blooded as an adding-machine” (115). Both the flattering representation of Becky and the dehumanizing comparison of Rena to an adding machine illustrate the ambiguous nature of women’s professional personas; on the one hand, women were praised and rewarded for their computational abilities and perceived proclivity for tedious clerical work, and at the same time, derided for adopting the “calculating,” aggressive demeanor typically associated with male professionals.¹⁴ This limited range of acceptable behavior for women calculators exemplifies the ongoing policing of gender boundaries within the accounting field.¹⁵

Cather’s story also reveals the policing of ethnic boundaries within the workplace. As Francesca Sawaya argues, “Cather indicts the current close relation between commercialism and journalism—a relation she charts out through the contest between the lady on the one side and the Jewish ‘girl’ on the other” (89). She associates the calculating persona with derogatory Jewish stereotypes, describing Rena Kalski as a “slender young Hebrew, handsome in an impudent” way and with a “rapacious mouth,” and Becky Tietelbaum as a “thin-tense faced Hebrew” who wears “cheap, gaudy clothes” (112, 110). In contrast, Cather’s portrait of the stenographer Ardessa seeks to retain a kind of unspoiled white femininity, invulnerable to the masculinizing pressures of the modern office that she instead transposes onto the Jewish women characters: “[Ardessa] shuddered at the cold candor of the new business woman, and was insinuatingly feminine” (105). To some extent Cather criticizes Ardessa’s inferior work ethic—her work was like “exercise without exertion. She read and embroidered...and

she liked to be seen at ladylike tasks and to feel herself a graceful contrast to the crude girls in the advertising and circulation departments across the hall (102). And yet, she also implies the indecorous nature of Becky and Rena's work, establishing a racialized hierarchy between the dignified, even if unproductive, work of the white stenographer and the tedious, menial labor of the Jewish bookkeepers. "Ardessa" reveals how the trope of the calculating woman could be simultaneously mobilized toward feminist and racist ends—that is, celebrated as a sign of female competency and empowerment and demeaned as an inferior from of labor, more suitably belonging to racial and ethnic minorities. While census records indicate that the majority of professional female bookkeepers between 1870 and 1930 were white and U.S. born, there is evidence that domestic bookkeeping was among the responsibilities given to black and immigrant servants before emerging as a platform for white women's professionalization.¹⁶

For example, the 1868 memoir of Elizabeth Keckley, a former slave turned seamstress and business liaison to Mary Todd Lincoln, details the financial troubles of Mrs. Lincoln that lead to Keckley's role as her personal secretary and behind-the-scenes bookkeeper. In debt and forced to sell off her dresses for money, Mrs. Lincoln asks Elizabeth to leave her self-established seamstress business so that the first lady might avoid the embarrassment of the "delicate business" of haggling for prices and settling up accounts. She thus transfers accountability to Elizabeth, who she relies on to "dispose of them quietly" (269). Keckley's choice to reproduce a numeric inventory of these items serves both as supporting evidence for her own account of past events and as a self-authorizing device, through which she establishes an objective valuation of her labor:

ARTICLES SOLD.

1 Diamond Ring

3 Small do.

1 Set furs

1 Camel hair shawl
1 Red do.
2 Dresses
1 Child's shawl.
1 Lace Chantilly Shawl. (328)

"The charges of the firm," she details, "amounted to eight hundred dollars. Mrs. Lincoln sent me a check for this amount. I handed this check to Mr. Keyes, and he gave me the following receipt" (328-9). If not for her detailed documentation in *Behind the Scenes*, Keckley's significant role as Mrs. Lincoln's account manager would likely remain invisibilized and unattributed. Moreover, Keckley's account serves as a crucial indicator of bookkeeping's gradual transition from white woman's burden to her specialized privilege.

Likewise, in Francis Harper's *Iola Leroy* (1892), a "tragic mulatto" story set during the Civil War, the eponymous heroine's uncle, Robert Johnson, describes how his slave master's wife taught him to "cast up accounts" because it "was handy for her to have some one who could figure up her accounts," or the work she finds beneath her (46). Once freed, Robert eventually capitalizes on these skills and opens his own hardware store in the North, where he is "doing a good business" (183). For Harper, keeping accounts encodes both racial as well as class significations. While for Robert bookkeeping skills offer the kind of class mobility and economic security that become markers of racial progress, Iola's job as an accountant in a predominately white department store simultaneously exposes the racial exclusivity of white working-class culture and at the same time represents an unbecoming, temporary means toward greater professional ends. Much like Ferber's Fanny, Iola aspires toward more socially activist work because "to be an expert accountant is not the best use to which I can put my life" (270). For Iola, accounting establishes her business know-how and strong work ethic,

but also, like Fanny, entails her isolation and disconnection from the black community with whom she seeks to reconnect.

Issues of gender, race, and class figure heavily in fictional representations of bookkeeping, motivating its depiction both as a thankless, behind-the-scenes position and as a rewarding and intellectually challenging one, demanding computational skills that often go unrecognized.¹⁷ In the trope of bookkeeping writers found a way to draw on the cultural and intellectual authority of mathematics to establish and regulate an individual or group's position within a social hierarchy. Especially for Gilman and Ferber, the calculating woman is not construed as pitiable, submissive, or corrupt, but as a necessary and alluring departure from traditional, limiting models of middle-class white femininity.

II.

What Diantha Did (1909–1910) has attracted little sustained critical attention to date, with most commentators emphasizing its parallels to Gilman's better-known fiction. The novel invokes the critique of marriage fundamental to "The Yellow Wall-paper" (1892) and *The Crux* (1911), and articulates a vision of matriarchal power similar to that of *Herland* (1915). But in reflecting Gilman's abiding interest in domestic reform and women's economic independence, *Diantha* shares more in common with her most well-known non-fictional book, *Women and Economics* (1898). More than any of her other fiction, *Diantha* echoes the primary agenda of this sociological treatise in its effort to challenge Victorian notions of men and women as inherently stable categories. In *Women and Economics*, Gilman highlights mathematics as a practice used to preserve distinctions between men and women's work, citing the work of Mary Somerville, a prominent nineteenth-century mathematician and astronomer, who "struggle[d] to

hide her work from even relatives, because mathematics was a ‘masculine’ pursuit” (53). Mathematics likewise functions in *Diantha* as a device for reimagining traditional gender characteristics. Rationality, for which mathematics serves as a primary model, is no longer the sole province of men, nor sentimentality the exclusive province of women.

In *Diantha*, Gilman uses mathematical notation not simply as a way of excising emotional responses but of subjecting emotions to rational analysis. This is a process Gilman put into practice in her own impersonal and quantitatively-oriented diaries, which reinforce her determination to control, contain, or redirect sentiment and emotion toward socially or economically productive ends.¹⁸ For Gilman, numerical description functions not only as a more incisive measure of the economic realities and underlying gender dynamics than ordinary language, but it is also a medium through which our emotional responses can be channeled into a more effective form of argumentation. Perhaps more than any of her fellow novelists, Gilman brings into relief the connection between numerical literacy and female empowerment. The novel testifies to the power of numbers to support rhetorical persuasion, to yield financial profit, and to reform social organization. This use of numbers as a means of establishing social order is, however, also deeply imbricated in Gilman’s xenophobia and her belief in eugenics as a way of preserving white superiority and legitimizing racial and ethnic “difference.” Indeed, in her 1908 essay “A Suggestion on the Negro Problem,” Gilman assumes the position of social scientist, drawing on pseudo-mathematical logic to prove quantitatively the different “rates” of evolution between white and blacks:

Given: in the same country, Race A, progressed in social evolution, say, to Status 10; and Race B, progressed in social evolution, say, to Status 4.
Given: That Race A outnumbers Race B as ten to one.

Given: That Race B was forcibly imported by Race A, and cannot be deported.

Given: That Race B, in its present condition, does not develop fast enough to suit Race A. (79)

In her analysis of this series of “facts,” Gilman considers that both “races have served each other in many ways,” but dismisses this thought as dangerously sentimental and unscientific: “These points may be laid aside. They arouse our feelings and do not clear our thoughts” (79). Gilman thus defers to mathematics as a neutral mediator for otherwise emotionally charged and “irrational” discussions of race.

It is perhaps not surprising that Gilman turns to quantitative data as a means of tempering emotions and rationalizing social hierarchies given her abiding admiration for the work of sociologists such as Herbert Spencer, Lester Ward, and Edward Ross, who relied heavily on mathematical and statistical data to buttress their claims for racial and ethnic taxonomies. Though *Diantha* appears to be the least overt example of Gilman’s eugenicist beliefs, they are subtly manifest in Diantha’s fiancé and eventual husband Ross Warden, whose name likely pays homage to both Edward Ross and Lester Ward. Lester Ward, often deemed the father of American sociology, wrote extensively about the application of mathematics to social phenomena in *Dynamic Sociology* (1883) and *Outlines of Sociology* (1898), recognizing math, even if at times ambivalently, as the “general gauge by which the position of every science is to be determined” (“Outlines” 7). Through Ward, Gilman met Edward Ross, with whom she developed a lifelong close friendship.¹⁹ Well known for his writings on “race suicide,” Ross called on statistics to formulate arguments about sustaining the white majority. In response to “the healthful slackening in the rate of growth” of African Americans (according to 1900 census data), Ross argues that “viewed in the light of actual statistics [the negro question] solves itself.”²⁰ Like Ross, Gilman also deploys quantitative data

as a way of deflecting accountability while still providing an “objective” referent for her views on racial hierarchies, population control, and social management.

This coming of age tale centers on Diantha Bell, a twenty-one year old schoolteacher who moves out of her parents’ home to pursue a career as a house servant. Though this line of work is considered improper for someone of Diantha’s middle-class stature, she is determined to increase her salary and earn enough money to start life with her fiancé Ross. Gilman stresses marriage as a fundamentally economic transaction by showing how Ross and Diantha must work to overcome the financial barriers that prevent them from marrying. Overburdened with providing for his widowed mother and two sisters and ineptly operating the family’s already mismanaged general store, Ross has neither sufficient savings nor prospects to marry Diantha. Rather than waiting for several years for Ross to make enough money to marry, Diantha strives for financial independence as a way to control her matrimonial fate. She achieves this success by faithfully relying on bookkeeping, by which she tracks and controls her finances and her eventual business ventures. It is also becomes for her an authoritative mode of self-expression, a way to account for her needs and desires.

Diantha first puts her accounting skills to use as a self-authorizing gesture when she tries to convince her father that she has “paid her dues” and should be permitted to leave the house to follow a career. When Mr. Bell protests (“How about what you owe to me—for all the care and pains and cost it’s been to bring you up?”), Diantha allows herself only a brief moment of emotional reflection—she “flushed. She had expected this, and yet it struck her like a blow”—before she redirects these emotions into a series of numerical reports on her household expenses and contributions (47):

‘I have considered that position, Father...So I’ve been at some pains to work it out—on a money basis. Here is an account—as full as I could make.’ She handed him a paper covered with neat figures. The totals read as follows:

Miss Diantha Bell,

To Mr. Henderson R. Bell, Dr.

To medical and dental expenses.....\$110.00

To school expenses.....76.00

To clothing, in full.....1,130.00

To board and lodging at \$3.00 a week.....2,184.00

To incidentals.....100.00

\$3, 600.00 (47)

That these tables are reproduced for the reader rather than simply alluded to reinforces the rhetorical power of numbers; not only does Diantha rely on these figures as an unequivocal record of her financial obligations, but the narrator also presents these calculations as solid proof of Diantha’s fiscal acumen. These numerical tables momentarily interrupt the narrative, acting as substantiating evidence for an otherwise incomplete account.²¹ In this way, the novel privileges numerical representation over language as a more precise and accurate account of Diantha’s experience: “This account was as clear and honest as the first and full of exasperating detail” (49). What Rebecca Connor writes about eighteenth-century female bookkeepers also applies to Gilman’s heroine; accounting offered women an alternative mode for recording experience as well as a means to establish their literal and figurative self-worth: “identity is configured through a template of numbers...Her identity depends on what she can count as hers” (108-9). But what Diantha counts as hers are not so much her material possessions,

which are modest at best, but rather the numeric value she places on her skilled labor or, in essence, on herself. In a sense, then, she “counts” because she counts. She positions herself as the sole “accountant” of her experiences and asserts her individuality and independence from her family through this numerical data. Her computational skills do not simply give her control over her own finances, but more importantly, they enable her to advocate persuasively on her own behalf.

Mr. Bell resists the idea of putting numerical values on familial obligations—to him “it looked strange to see cash value attached to that unfailing source of family comfort and advantage”(48)—but it is difficult for him to deny the numerical proof of Diantha’s hard work. Though represented much more sympathetically, Diantha’s efforts are reminiscent of Frank Norris’s Trina, who uses numeric data to convince McTeague to move to a cheaper apartment: “Trina had induced her husband to consent to such a move, bewildering him with a torrent of phrases and marvelous columns of figures by which she proved conclusively that they were in a condition but one remove from downright destitution” (170). Similarly, Diantha’s father cannot recall the past expenditures that these tables so precisely record, but he immediately trusts the accuracy of the figures. “He knew he had never spent \$1,130.00 on one girl’s clothes. But the items explained it”:

Materials, three years at an average of \$10 a year.....	\$30.00
Five years averaging \$20 each year.....	100.00
Five years averaging \$30 each year.....	150.00
Five years averaging \$50 each year.....	250.00
	\$530.00 (47-8)

While Diantha offers some commentary to justify her calculations, she relies primarily on the numbers rather than rhetoric to plead her case: “She laid before him the second sheet of figures and watched while he read, explaining hurriedly” her reasons for counting the work that “a servant would have done for \$5.00 a week” (49). She would rather the accounts speak for themselves:

Mr. Henderson R. Bell,

To Miss Diantha Bell, Dr.

For labor and services—

Two years, two hours a day at 10c. an hour.....\$146.00

Two years, three hours a day at 10c. an hour.....219.00

One year full wages at \$5.00 a week.....260.00

Six years and a half, three hours a day at 20c.....1423.50

\$2048.50

...Then came the deadly balance of the account between them:

Her labor.....\$2047.00

Her board.....936.00

Her ‘cash advanced’.....1,164.00

\$4, 147.00

His expense for her.....\$3,600.00

Due her from him.....\$547.00 (49-51)

Even the narrator, who presents the “deadly balance” sheet, relies on the numeric figures to make a more dramatic impact than traditional narration might offer. By subtracting her childhood expenses from the labor and services she has provided the family, Diantha makes the final argument that her father in fact owes her money, thus

relieving her of any financial or moral obligation. Rather than present an emotional plea to her father, Diantha relies solely on quantitative reasoning to impersonalize her decision to leave and thus to diffuse her father's emotional response. She understands that crying "would by no means strengthen her position" (59). For Diantha, the persuasive power of numbers lies in their power to transform emotional expression—in this case, familial love and support—into a rational, authoritative form.

Gilman broadens traditional gender roles by opposing Diantha's calm and collected demeanor against her father's emotional and impulsive behavior. Where Diantha relies on logic, her father turns to pathos: "You think it'll be good for your Mother's health to lose your assistance, do you?" (46). While she recalls her childhood in quantitative terms, he becomes nostalgic over forgotten memories: "Perhaps there was a tender feeling too, as he remembered that doctor's bill—the first he ever paid, with the other, when she had scarlet fever" (47). Or again, when he reflects: "it brought up evenings long passed by, the sewing wife, the studying children" (48). His emotions continue to build until he unleashes his final angry outburst at Diantha's unfeeling and detached calculations: "'This is the most shameful piece of calculation I ever saw in my life'... You go and count up in cold dollars the work that every decent girl does for her family and is glad to!... It's a shameful thing—and you are an unnatural daughter" (51). Again, Diantha keeps her emotions in check, responding "coldly" in the face of her father's unrestrained anger. His sense that she is "unnatural" suggests that her rational demeanor and emotional control—and implicitly her mathematical competence—appear to him as transgressions against her traditional role as a dutiful daughter.

This father-daughter relationship recalls Fleissner's attention to the recurring dynamic in naturalist narratives between the rational, "realist" woman and the

“sentimental,” nostalgic man, a dynamic reproduced in Diantha’s relationship to her fiancé.²² Although Diantha’s ambitions cause Ross some distress, this rational woman/sentimental man dialectic is not the result of a crisis of masculinity or the “feminization” of culture, as Fleissner suggests for the texts she spotlights, but rather part of Gilman’s effort to create more flexible gender identities and to relieve the heroine from driving the romantic storyline.²³ Ross’s emotional sensibilities are an essential counterpoint to Diantha’s logical, pragmatic disposition. He sustains the romantic narrative and tries to convince Diantha not to desert him in pursuit of her career, relying, like Mr. Bell, on an emotional appeal: “Let somebody else do the gold-mine, dear—you stay here and comfort your Mother as long as you can—and me. How can I get along without you?” (61). In their final exchange before she leaves, Ross “turned to her—was holding out his arms” and pleads, “You won’t go my darling!,” to which Diantha matter-of-factly responds: “I am going Wednesday, on the 7.10” (62). That Diantha embarks on a quest while Ross stays to tend to the home radically rewrites conventional gender roles. Indeed, Ross’s narrative resembles that of a typical naturalist heroine who finds herself “stuck in place.” Even after they are married and Diantha continues to expand her hotel business, he assumes the role of lonely housewife and she, the distant breadwinner: “When she rolled away in her little car in the bright, sweet mornings, a light went out of the day for him. He wanted her there, in the home....it was harder [for Ross] than for most men, because he was in the house a good deal” (182). Diantha, on the other hand, follows a narrative of upward mobility, moving from a contracted housekeeper for the wealthy Porne family, to managing a housekeeping service for beach cottages in Santa Ulrica, to lecturing and training groups of women in the fundamentals of domestic science, and finally establishing the

Union House, a cooperative business that provides for the middle and upper-class families of Orchardina. All of these achievements depend on her financial savvy and careful bookkeeping, or what are for Ross “the alien tasks of calculation” (127).

Despite the narrator’s insistence on rationality as an alternative to sentimentality, however, both the men and women characters register different affective responses to accounting. Ross “strove with it, toiled at it,” but “longed always to be free of the whole hated load of tradesmanship,” day-dreaming about “selling out the business and buying a ranch” (127). Mr. Porne, much like Mr. Bell, reacts with exasperation over Diantha’s calculated salary demands: “this amazing and arithmetical young woman makes us feel as if we were giving her wampum instead of money—mere primitive barter of ancient days in return for her twentieth-century services!” (82). While the male characters show an aversion to an economically disciplined lifestyle, the women find keeping accounts and performing calculations invigorating. Mrs. Bell, who “always loved arithmetic,” comes to help with the accounts for Diantha’s new housekeeping service. As the “months passed” and “the work steadily grew,” Mrs. Bell “became more and more cheerful...Her thin shoulders lifted a little as small dragging tasks were forgotten and a large growing business substituted” (147). Similarly, Mrs. Weatherstone, a rich resident of Orchardina, transforms herself from a depressed widow, a “pale, sad-eyed girl,” to an energetic, successful businesswoman by financing Diantha’s Union House business and establishing others like it around the country. Also inspired by Diantha, her younger sister Dora “amazed and displeased her family” by “going over to Diantha’s side and learning bookkeeping” (185). Rather than providing an escape or transcendence from feeling, these mathematical practices incite

strong emotional and affective responses that propel the characters toward or away from a disciplined lifestyle.

But while bookkeeping and financial investment improve the emotional and psychological lives of the middle and upper-class white women, brief references to the African-American cook Julianna, the Danish immigrant Mrs. Thorald, and to the unnamed group of servant “girls” who work under Diantha reflect the very power differential among working women that bookkeeping otherwise portends to overcome. As Charlotte Rich argues, “Diantha’s project is a profitable scheme based on others performing tasks that are unavoidably menial—a fact all the more discomfiting in an era in which hierarchies of “mental” versus “menial” labor coalesced” (22). Indeed, Diantha’s specialized mental labor not only places her at the top of this scheme, but also serves as a continual marker of her exceptional expertise. Moreover, Diantha exploits her role as keeper of the accounts to justify and more often elide the professional pecking order she creates. The narrator describes Julianna, for example, as “a person of color,” adding the derogatory caveat that she is “not the jovial and sloppy personage usually figuring in this character” (129). Diantha implies Julianna’s intellectual inferiority after Julianna is unable to recall her last name because of her numerous marriages, or as Diantha refers to them, “marital difficulties in bulk” (129). The narrator frequently contrasts Diantha’s “hard but exciting” work with that of the “simple” methods used by Diantha’s thirty employees, whom she refers to condescendingly as “girls” or “little helpers” (135). She also points to the varying skill levels of her employees and her own internalized ranking system for them: “among her thirty employees Diantha found four or five who were able and ambitious” (138). And yet she continues to tout her systematic training—“the speed, the accuracy, the

economy”—as way to reform the “old slipshod methods of the ordinary general servant” and believes that the more mathematically precise her business model, the more equal and fair are her working conditions (142). Diantha’s calculations offer solid proof of her seemingly egalitarian organization:

UNION HOUSE.

Food and Service.

General Housework by the week.....\$10.00

General Housework by the day.....2.00

Ten hours work a day, and furnish their own food....

Additional labor by the hour..... .20

Special service for entertainments, maids and waitresses

by the hour..... .25 (137)

While this carefully calculated system holds Diantha accountable to her employees and offers them financial stability, she relies primarily on her calculations to determine her business practices and to avoid direct engagement with the racial and ethnic inequalities that exist within her domestic labor force.

Though Gilman shows little sympathy for the underprivileged working ‘girl,’ she strategically draws on sentimental tropes to underscore the need for (white) women’s financial and professional independence. The novel’s dramatically emotional ending depends on two conciliatory gestures. Ross begins to pursue a career in genetic research (Gilman’s most obvious reference to eugenist ideas)—a move that places him in a more traditionally masculine role and allows him to accept the value of Diantha’s work. In a concluding letter to her, Ross acknowledges that he now understands “what brave, strong, valuable work you have been doing for the world. Doing it scientifically,

too. Your figures are quoted, your records studied, your example followed...As man to man I'm proud of you" (188). Ross's phrase "man to man" suggests that he has come to see her as his equal and embraces the masculine subject position that Diantha assumes throughout the narrative. Diantha reacts uncharacteristically by kissing the letter "hard, over and over" and giving "way to an overmastering burst of feeling," exclaiming "thank you!" between "long, deep sobbing sighs" (189). This final burst of emotion places her in a more traditionally feminine role; now that she has achieved success and gained the final approval of her husband, she allows herself to unleash the feelings she has heretofore needed to control. At the same time, this final scene reveals the powerful emotional desires that motivate Diantha's scientific endeavors. Rather than submitting the heroine to a traditional romantic conclusion, Gilman invokes sentimental conventions to validate Diantha's professional aspirations. Moreover, Diantha's sense of herself as a practitioner of science becomes crucial to this final moment of self-actualization.

III.

Like *Diantha*, Ferber's novel *Fanny Herself* (1917) is a narrative of triumph in which the heroine achieves both professional and romantic fulfillment after negotiating several identity conflicts. Gilman and Ferber's novels not only share similar narrative structures, they also feature heroines who rely on quantitative skills to achieve professional success, establish cooperative, intellectually nurturing bonds among women, and assume the role of the rational, "calculating" woman in contrast to the sentimental man. The quantitative skills of Ferber's protagonist Fanny are hardly unique among her female characters. Fanny shares many of the same characteristics as Miss Kelly, the number-juggling accountant in *Emma McChesney and Co.* and Mrs.

Carrie Payson in *The Girls* (1921), who “can add a double column in her head, just like her father” and even “does them by way of amusement” (4); and Jean Stoddard in the play *\$1200 A Year* (1920), who compares her role as homemaker and household accountant to that of an “expert mathematician,” working to “make the housekeeping money come out right at the end of the week” (28). Ferber’s portraits of bookkeeping women reinforce the view that these skills are typical rather than exceptional. But while Ferber identifies mathematics as an enfranchising tool for women to assert themselves in both the public and domestic spheres, she is equally interested in what women compromise in adopting these hard-nosed, methodical roles.

For Fanny, the number-crunching world of big business threatens to erase the particulars of her Jewish identity as a place where she feels compelled to hide her ethnicity. Through the trope of mathematics, Ferber illustrates the clash between the economic individualism of the ideology of the New Woman and the desire for ethnic identification and solidarity. Fanny struggles to reconcile these dual aspects of her identity: one, “generous, spontaneous, impulsive, warm-hearted,” the qualities she comes to associate with a distinctly Jewish identity; the other “cold, calculating, deliberate,” the characteristics she sees as necessary to excel in mainstream corporate America (108). While Fanny ultimately trades her corporate identity for a more philanthropic line of work after witnessing the hardships of immigrant women factory workers and embracing her Jewish heritage, Fanny’s desire for assimilation also carries with it a nativist attitude, and like Gilman, naturalizes a racial and ethnic taxonomy built on a model of mental versus menial labor, even as she attempts to highlight and critique such classifications. There is a tendency among Ferber’s critics to see her work as conciliatory, “catered to sentimental tastes” or committed to a “benevolent picture of a

multiethnic America.”²⁴ However, I see Ferber’s turn to the trope of mathematics as a way of engaging the question of who *counts* in a number-driven, corporate culture and what role sentiment plays in scientifically grounded, rational modes of representation.

Fanny Herself is a semi-autobiographical story that follows a young Jewish girl, Fanny Brandeis, from her youth in a small midwestern town to her rise in the Chicago business world. Like Ferber’s own father, Fanny’s father, who dies in the first chapter of the novel, is a struggling shopkeeper. Mrs. Brandeis, described reverentially as a “superpersonality” and a “very definite person,” heroically takes over her husband’s failing business while also caring for her children, serving as the primary role model and guiding force in Fanny’s development. In this respect, this narrative, like *Diantha*, is a story of matriarchal power, in which women by necessity are placed into the role of primary breadwinner, a situation that calls upon them to develop skills and a passion for their work that exceeds those of their male counterparts. Much like the male/female relationships in *Diantha*, Mr. Brandeis is clearly the sentimental counterpart to Mrs. Brandeis’ rational nature, just as Fanny’s pragmatism and analytical skills contrast to her brother Theodore’s idealism and the free-spirited nature of her future partner, Clarence. While Mrs. Brandeis could “add a double column of figures in her head as fast as her eye could travel” better than she could “set a table without forgetting the spoons,” Mr. Brandeis “had been a dreamer, and a potential poet, which is bad equipment for success in the business of general merchandise” (4). Mrs. Brandeis uses her bookkeeping skills—“a little figuring on paper”—to transform the business into a profitable venture (19). Fanny’s mother instills in her the importance of mathematical proficiency from an early age; though the adolescent Fanny “loathed arithmetic” and the “eight-grade horrors” of story problems, Mrs. Brandeis insists that she “crack her own

mathematical nuts,” because it is “good mental training, not to speak of the moral side of it” (65). A common tenet of late-nineteenth-century domestic science and conduct literature, this association of mathematics and morality plays out in Fanny’s disciplined and “calculatingly ambitious” nature (275).²⁵

After her mother passes away, a pivotal moment in the narrative when Fanny must find her own source of strength and motivation, she initially turns to her Jewish heritage as the moral imperative for her ambitions:

[S]he would be cold, calculating, deliberate, she told herself...Thousands of years of persecution behind her made her quick to appreciate suffering in others, and gave her an innate sense of fellowship with the downtrodden. She resolved to use that sense as a searchlight aiding her to see and overcome obstacles. She told herself that she was done with maudlin sentimentality. (108)

Fanny rejects “maudlin sentimentality” as a blinder to the realities of oppression and discrimination. In what appears to be a conscious rejection of sentimental models of femininity, she pledges to mold herself as “a hard, keen-eyed, resolute woman, whose godhead was to be success, and to whom success would mean money and position” (107). Ironically, however, Fanny’s determination to succeed compels her to hide the Jewish heritage that motivates her, believing it to be an impediment to her professional achievement. She vows to “admit no handicaps. Race, religion, training, natural impulses—she would discard them all if they stood in her way” (107). When Fenger, her new boss, asks her directly, “Jew?,” Fanny replies “no” without hesitation (136). Fenger acknowledges her cover-up with a demeaning response: “You’ve decided to lop off all the excrescences, eh? Well, I can’t say I blame you. A woman in business is

handicapped enough by the very fact of her sex” (136). His response confirms Fanny’s initial belief that her individual identity is a liability in the workplace.

As a newly employed sales associate at a large, Chicago-based clothing manufacturing company, Fanny quickly learns that numbers are the language of business and sentimentality a mere profitable marketing tool. Fenger calls Fanny’s suggestion to wrap the children’s clothing in pink and blue packages “sentimental slush” until she convinces him that they can use this to their financial advantage: “Sentimental, yes....but then, we’re running the only sentimental department in this business. And we ought to be doing it at this rate of a million and a quarter a year” (149). The narrator stresses the mathematization of corporate America, repeatedly describing Haynes-Cooper in numeric terms: “The firm began to talk in tens of millions...Lucky ones who had bought [stock]...with modest visions of four and a half per cent in their unimaginative minds, saw their dividends doubling, trebling, quadrupling” (139). Visitors to the manufacturing plant are awed by the tour guide’s casualness about the company’s sky-high profits: “How he juggles figures: how grandly they roll off his tongue. How glib he is with Nathan Hayne’s millions” (139). Fanny adapts well to this profit-driven environment and embraces the once dreaded exercise of mathematical calculations: “Fanny had statistics. Fanny had arguments. She had determination” (204). Like Diantha, Fanny builds a strong, self-confident identity by means of her mathematical skills. But while her ability to excel in the business world rests on her proficiency with numbers, Fanny feels pulled between her technical and artistic impulses, a tension that stands in for the larger conflict between her professional and ethnic identities.

Troubled as Fanny seems to be about workplace gender and ethnic discrimination, in several instances she exhibits her own anxieties about ethnic and foreign “others” and rationalizes a racialized professional order. Fanny represents her African-American servant Princess as “naturally” gifted at housekeeping and cooking, as someone who could “come out of the process with an unruffled temper and an immaculate kitchen” (178), and Princess’ husband is condescendingly described as “a very black and no-account husband,” a revealing association between his worthiness and his net worth (177). After Fanny’s brother Theodore returns from a long stay in Germany, his declaration—“I feel like an immigrant”—spurs Fanny’s sense of American superiority and exclusiveness, prompting her rejection of Theodore’s German wife (she’s “all that’s vile”) and her assurance that “you’re going to have your chance here [in America]” (274). In a brief encounter with Fenger’s Japanese janitor, Fanny again deploys racist rhetoric and an implicit defense of a professional pecking order: “She saw the little Jap dart suddenly back from a doorway, and she stamped her foot and said, ‘S-s-cat!’ as if he had been a rat” (302). As scholars such as Carol Bakter and Christopher Wilson argue, these unsympathetic, racist characterizations undercut Ferber’s other attempts to render sympathetic portraits of Jewish immigrant workers, such as the “over-read, under-fed, emotional, dreamy little Russian garment worker” who Fanny observes marching in a suffrage parade and who moves her to tears (251).²⁶ These characterizations not only reveal Fanny’s struggle between her Jewish and American identities, but also point to Ferber’s strategic appropriation and disavowal of sentimentality as a tool for representing gender, race, and class dynamics.

Clarence emerges in the narrative to “rescue” Fanny from her materialist pursuits and reconnect her with her Jewish heritage. He locates the origin of Fanny’s

success in her religious identity and believes that a renewed connection to her religion will prevent her from selling her soul to serve capitalist interests:

I don't object to this driving ambition in you. I don't say that you're wrong in wanting to make a place for yourself in the world. But don't expect me to stand by and let you trample over your immortal soul to get there...I tell you, Fanny, we Jews have got a money-grubbing, loud-talking, diamond-studded, get-there-at-any-price reputation, and perhaps we deserve it. But every now and then, out of the mass of us, one lifts his head and stands erect, and the great white light is in his face...You're suppressing the thing that is you. You're cutting yourself off from your own people—a dramatic, impulsive, emotional people. (189-90)

Clarence associates a calculating business persona with the most negative of Jewish stereotypes and instead identifies artistic and creative skills as morally rewarding and essentialized Jewish characteristics, a notion he further supports by citing famous Jewish artists: “You see it all the way from Lew Fields to Sarah Bernhardt; from Mendelssohn to Irving Berlin; from Mischa Elman to Charlie Chaplin” (190). Though Clarence appeals to Fanny’s growing sense of identification with her Jewishness—as evidenced by her tearful proclamation “These are my people! These are my people!” after she identifies with the Jewish garment worker—she still sees the allure of financial security.²⁷ She initially resents his advice and defends her desire for money: “I’m getting the things I starved for all those years. Why, I’ll never get over being thrilled at the idea of being able to go to the theater, or to a concert, whenever I like” (238). But, as the narrative develops, Fanny finds the corporate environment increasingly stifling, even as she glamorizes the high-rolling world of business and maintains a sense of pride about rising in its ranks.

She locates this frustration in her disinterested practice of calculation. Feeling disillusioned by her work, “her voice grew dry and lifeless as she went into the figures” (220). The narrator explains Fanny’s situation by returning to the idea of a divided self; she is “working with her head, not her heart,” not the “hollow muscular structure,” but “the secondary definition” which “has to do with such words as emotion, sympathy, tenderness, courage, conviction” (228). The narrator presents mathematics as the source of Fanny’s dispassionate attitude toward her work and is at times quick to critique her objectives—“Big business seems to dwarf the finer things in her”—but at the same time attests to Fanny’s continued attraction to this line of work (151): “Self-confidence was there, and physical vigor, and diplomacy. But above all there was that sheer love of the game; the dramatic sense that enabled her to see herself in the part” (243). Working with figures might leave her “dry and lifeless,” but there is also something seductive and stimulating for her about “talking in six-figure terms” and becoming a master of “the game.” Unwilling as she may be to reduce Fanny’s qualities to the realm of sentiment, the narrator tentatively embraces Fanny’s mathematical inclinations.

In a conclusion that appears to trade the narrative of professional development for the romantic plotline, Fanny leaves her job and heads to Clarence’s Colorado cabin to reconnect with him and to contemplate her professional future. Fanny’s journey, like Diantha’s move to a fictional California town, reinterprets the familiar naturalist narrative of man’s westward adventure and “return to nature” as a woman’s passage to self-discovery. However, her “progress” is marked, also like Diantha’s, by the shedding of her calculating persona and subsequent display of emotional vulnerability: “Her lower lip trembled. She caught it between her teeth in a last sharp effort at self-control...in a

panic, her two hands came up in a vain effort to hide her tears. She sank down...and the proud head came down to her arms" (320). Though she is finally able to reveal her affection for Clarence, she quickly interrupts this emotional scene to discuss her desire to return to the city and to work. Her plans to pursue a new career as a newspaper illustrator suggest her continued professional ambitions, even if they represent a clear shift to a more creative and humanitarian line of work than computing "lifeless" figures.

This career change also marks Fanny's return to her Jewish faith, as suggested by the subject of her first published illustration: the young Russian Jewish marcher. But even within this new profession Fanny values a dispassionate approach: "[She] had done her with that economy of line, and absence of sentimentality which is the test separating the artist from the draughtsman" (258)—again exemplifying Ferber's insistence on distinctions of expertise and her skepticism toward purely sentimental representation. While Ferber appears intent on opposing rationality and sentiment, calculation and creativity, these dual impulses inform Fanny's actions throughout the novel and act not simply as antagonists but as foils for one another. The ambiguous ending suggests the difficulty for Ferber in either embracing or rejecting a model of womanhood based primarily on rationality, discipline, and professionalism. It is tempting to interpret this ambiguity as Ferber's attempt to appease a broad audience by creating a "calculatingly ambitious" yet emotionally sensitive heroine, a sentimental heroine caught in a realist paradigm. However, we might also see Fanny's divided selves as a critique of the either/or logic that imposes on women a limited range of acceptable roles, desires, and behaviors from which they must choose. Her novel underscores the difficulty of constructing a new model of femininity in which a woman can be calculatingly ambitious—and also mathematically adept—without the risk of

being labeled masculine or feeling pressure to revert to traditional feminine roles. Ferber's repeated description of Fanny as "paradoxical" is significant; a paradox, of course, is a seemingly self-contradictory statement that is nevertheless true. Her novel, in other words, expresses the possibility for these dual aspects of Fanny's identity to coexist without contradiction.

The novel's ambiguous ending also corresponds to Ferber's dialectical representation of bookkeeping and quantitative reasoning as practices that both construct and constrain modern conceptions of selfhood. Ferber's novel, along with the other texts considered here, offer a potential alternative to dominant interpretations of mathematical imagery in fiction of the late nineteenth and early twentieth centuries. Rather than simply a symbolic means of reinforcing the qualities of rationality, abstraction, objectivity, and detachment, these mathematical tropes offer writers a new lexicon for defining, interpreting, and delimiting subjective experience, indicating a more complex, co-constructive relationship between science and subjectivity than scholars of these traditions tend to suggest. The trope of the female keeper of accounts is an important indicator of how the same technoscientific developments and the emergent "calculating spirit" that Max Weber famously claimed as the sources of modern disenchantment and objectification are also integral to how modern subjects—and women in particular—think about and negotiate their relationships to a changing social and economic environment. This perspective might thus open up further avenues for thinking not just about how literature borrows from or communicates with science, but also how literature functions as crucial interpreter of the cultural dimensions of science.

¹ Challenging traditional notions of naturalism as a male-centric genre involving deterministic narratives that end either in decline or triumph, Fleissner not only repositions women as central to naturalist narratives, but also shows how the modern woman's story resists conventional closure. Ending neither in complete failure or success, naturalist women find themselves in a kind of perpetual stasis, or a "stuckness in place" (9). Fleissner replaces "the notion of naturalist determinism with the more nuanced concept of *compulsion*," to account for the "repetitively compulsive everyday actions" on which so many fin-de-siècle heroines fixate (9). I build on Fleissner's analysis by arguing that the quantitative impulse serves as a transformative act that turns narratives of stuckness into narratives of success.

² For a discussion of the correlation of masculinity and scientific reasoning, see, for example, Susan Bordo's *The Flight to Objectivity: Essays on Cartesianism and Culture*. Buffalo: SUNY Press, 1987. Public discourse on suffrage entailed a policing of affect. Opposers aligned women with excessive emotionality, decrying the suffragettes as "shrieking" and "hysterical." A 1907 article focuses on the differences between men and women's affective responses at an anti-suffrage society meeting: the women were "combative" while the "quiet, unassuming men" were "'attacked' by the 'infuriated' suffragettes." See "To Keep Women in Her Place." *New York Times*, 26 May 1907, 13. Conversely, advocates for suffrage turned this argument against the opposition, using the term "sentimental" to describe efforts to preserve traditional gender roles. In a letter to the editor, one Massachusetts suffragette declares: "There is no reason except a sentimental one why women should not vote." See "They Do Not All Belong to Organizations that Meddle." *New York Times*, 2 Oct 1905, 8. The word "sentimental" thus became a term of opprobrium in late-nineteenth- and early-twentieth-century public discourse, shifting from a notion of emotional intelligence to one of emotional indulgence. Prominent literary figures of this period similarly criticized the "excesses" of sentimental fiction and celebrated the "economy" of realist fiction. For a detailed account of how realist writers disparaged (while still drawing on) sentimental writing, see, for example, Hildegard Hoeller's *Edith Wharton's Dialogue with Realist and Sentimental Fiction*. Gainesville: Univ. of Florida Press, 2000.

³ Miranda Hickman's study of the geometric inclinations of modernist writers argues, for example, that "geometric gestures were enlisted in a phobic project of countering the 'effeminacy' that had come to be linked in the public mind with Aestheticism" (xviii). *The Geometry of Modernism: The Vorticist Idiom in Lewis, Pound, H.D., and Yeats*. (University of Texas, 2005). Ann Ardis similarly points to the modernist appropriation of scientific rhetoric as a means of establishing objectivity and expunging emotion and sympathy in *Modernism and Cultural Conflict, 1880-1922* (Cambridge, 2002). Both Hickman and Ardis consider how modernist writers themselves insisted on such interpretations in their own non-fiction writings, urging associations between their work and the "impersonal," unsentimental aesthetics of science. Kathleen Woodward's recent book, *Statistical Panic: Cultural Politics and Poetics of the Emotions* (Duke, 2009) invites the question of how statistics can produce or offset powerful emotional responses (albeit mostly negative ones) and thus opens up ways in which we might begin to think about science and sentiment as more closely intertwined.

⁴ As stated in my Introduction, I do not intend to demonize mathematics here, but quite oppositely to urge the awareness of mathematics as a culturally embedded set of

practices and ourselves as agents and practitioners of the field, responsible for its ethical and just applications. For a more detailed account of the rising social dimensions of mathematics during the late-19th and- early-20th centuries, see Theodore Porter's *The Rise of Statistical Thinking, 1820-1900*. Princeton: Princeton University Press, 1988, and *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton: Princeton University Press, 1996. For a more specific account of the quantitative underpinnings of eugenics and craniometry, see Stephen Jay Gould's *The Mismeasure of Man*. New York: W.W. Norton & Co., 1996.

⁵ Louise Newman elucidates Gilman's preoccupation with the idea of "civilized" society and the racist logic Gilman deploys to distinguish "white civilization" from those at less "advanced stages of evolution," or those perceived as "primitive" others. See Newman, *White Women's Rights*, 132-157.

⁶ Sawaya, *Modern Women, Modern Work*, 3. In her study of modern professionalism, Sawaya argues that professionals' claim to egalitarianism underhandedly "enforced social exclusivity": "The ideology of meritocracy—the notion that everyone has an equal chance to succeed through education and training—ostensibly promoted equal opportunity, but through its prohibitive forms of accreditation and refusal to acknowledge the power of institutions, it functioned to rationalize white, male, middle-class authority" (3).

⁷ Mary Beth Norton, "Eighteenth-Century American Women in Peace and War: The Case of the Loyalists," in *William and Mary Quarterly* 3 (1976): 286-409.

⁸ In an 1824 letter to the editor of the *Philadelphia Portfolio*, one man responds to the news that women have begun to study geometry: "The proper object of geometry is the development of the abstract properties and relations of space. In this science it cannot be expected that females will make much proficiency. Nor ought geometrical knowledge to be considered as a necessary object of their pursuit." Quoted in Patricia Cohen, *A Calculating People: The Spread of Numeracy in Early America*. Chicago: University of Chicago Press, 1982, 143.

⁹ Tolley points out that this new emphasis on vocational courses and the practical uses of education led many schools to convert upper-level science and mathematics courses into electives, particularly for girls, and that these domestic science program precipitated the decline of women's enrollment in science and especially mathematics courses in the early 1900s (169).

¹⁰ See David Alan Grier, *When Humans Were Computers*. Princeton: Princeton University Press, 2005.

¹¹ Sharon Hartman Strom points to several additional factors that contributed to the increasing demand for women calculators and bookkeepers in the early twentieth century: the rise of large corporations dependent on record keeping, data management and large bodies of "cheap" clerical labor, including life insurance companies, saving and loan companies, public utilities and government agencies such as the Internal Revenue Service; the introduction of new technologies such as the typewriter, the adding machine, the Arithometer, and the Comptometer that increased efficiency, productivity, and information trafficking; and finally, but significantly, labor shortages as a result of WWI. See Strom, "Machines Instead of Clerks': Technology and the Feminization of Bookkeeping, 1910-1950." *Computer Chips and Paper Clips: Technology and Women's Employment*. Washington D.C.: National Academy Press, 1987, 64-5. See also Charles

W. Wootton and Barbara E. Kemmerer, "The Changing Genderization of Bookkeeping the United States, 1870-1930," *The Business History Review*, 70.4 (1996), 541-586.

¹² Wootton and Kemmerer offer a detailed analysis of the difference between bookkeeping and accounting, a distinction that began to emerge by the end of the nineteenth century. Generally speaking, bookkeeping was understood as a practice of recording and describing financial data, while accounting involved interpretive and predictive skills (543-544). However, Strom points to the difficulty of establishing universal standards for clerical positions since some stenographers performed the work of bookkeepers and vice versa and some women employed as bookkeepers were actually performing the work of an accountant, in some cases, successfully passing CPA exams without accounting degrees (82-93).

¹³ *New York Times*. 1905. "St. Louis Lady Board Calls in Mere Man." June 16.

¹⁴ Men often feared replacement by women-operated machines, which could, as one merchant acknowledges, perform "the work of six men with great ease" (Page 7683). This fear becomes reality for the protagonist of Elmer Rice's 1923 play *The Adding Machine*, which follows the decline of Mr. Zero, who is fired after twenty-five years as a bookkeeper in a department store. Though he took the job hoping to rise up the office ranks, his dreams of becoming the boss's assistant (a more appropriately masculine title that would make him superior to his female coworker Daisy) is thwarted when the boss explains that his "efficiency experts have recommended the installation of adding machines" (28). In a gesture that renders women workers inferior to technology, the boss only later clarifies that these machines will be human-operated: "they can do the work in half the time and a high-school girl can operate them" (28). Rice's play attests to male anxieties over the feminization of bookkeeping and also reinforces the perception that the position involves little more than a rote, mindless recording of figures.

¹⁵ One of first office positions women occupied in the decades after the Civil War was as "calculator." Beginning in 1875, Edward Pickering, director of the Harvard Observatory, began hiring women as "computers" to process large volumes of numerical information. Similar positions soon emerged within the social and biological sciences, which were increasingly reliant on a flexible, affordable staff who could perform statistical analysis (Grier 81-88). While their work as calculators was often perceived as unskilled labor, it eventually began to open doors for women to assume more prestigious and profitable positions in bookkeeping and financial analysis. Census data corroborates these developments: although women made up only 5.7 percent of bookkeepers in 1880, they constituted 31 percent by 1910, and by 1930, 63 percent of all bookkeepers were women (Strom 18). But while the percentage of women bookkeepers rose, male bookkeepers continued to enter the field in increasing numbers; thus, unlike other office professions, bookkeeping did not enforce a strictly gendered division of labor—that is, it was not explicitly coded as a female domain until the 1950s (Strom 83). For more detailed accounts of specific factors that contributed to the increasing demand for women calculators and bookkeepers in the early twentieth century, see Sharon Hartman Strom, "Machines Instead of Clerks': Technology and the Feminization of Bookkeeping, 1910-1950." *Computer Chips and Paper Clips: Technology and Women's Employment*. Washington D.C.: National Academy Press, 1987, 64-5, and Charles W. Wootton and Barbara E. Kemmerer, "The Changing Genderization of Bookkeeping the

United States, 1870-1930," *The Business History Review*, Vol. 70, No. 4 (Winter, 1996), pp. 541-586.

¹⁶ Wootton and Kemmerer provide further demographics about these women workers: 99.7 percent were white, mostly single; approximately 49 percent were U.S. born with U.S.-born parents, and 42 percent were born to parents who were born outside the U.S. (568-9).

¹⁷ Bookkeeping, and clerical work more generally, underwent similar transformations in Britain during this period. George Bernard Shaw's 1894 play *Mrs. Warren's Profession*, features Vivian, the central character and daughter of Mrs. Warren, who happily works as an actuary, performing "calculations for engineers, electricians, insurance companies, and so on" (18). She is described favorably in the stage notes as "prompt, strong, confident, self-possessed" (16). When her mother's friend Praed wonders about the sacrifices of her personal life to her work, asking "Are you to have no romance, no beauty in your life?," Vivian explains that she doesn't "care for either" and that she not only "likes working and getting paid for it," but that she has "never enjoyed myself more in my life" (19). Vivian's profession allows her an independent and cosmopolitan lifestyle, full of Beethoven and Wagner concerts, trips to the National Gallery, and long stays in London, and she thus considers herself a "perfectly splendid modern young lady."

¹⁸ See *The Abridged Diaries of Charlotte Perkins Gilman*. Ed. Denise D. Knight. Charlottesville: University of Virginia Press, 1998. After 1903, Gilman suspended her diary writing, which was already quite reserved and straightforward, to record instead only financial accounts, appointments, shopping lists. In these records, earnings, dates and times—that is, numerical information—take precedence over prose.

¹⁹ Louise Newman writes about their relationship of mutual respect and their frequent exchange of letters. Gilman also relied on Ross for advice on "Standard Authors on Scientific Subjects" that she might use to rectify the "unscientific method of [her] work" (144).

²⁰ "America On the Eve of A Great Moral Revival: Prof. Ross, Analyzing Growth of National Conscience, Favors Restriction of Birth Rate." *New York Times*. 2 January 1910. Ross details his views on racism and "race suicide" in his article, "The Causes of Racial Superiority." *Annals of the Academy of Political and Social Science* 18 (July 1901): 67-89.

²¹ The literary use of quantitative charts as both persuasive, concrete evidence and as a means toward one's self-realization warrants broader consideration than this essay permits and could include, for example, the revealing of Gatsby's childhood daily schedule and "GENERAL RESOLVES" that "prove" Gatsby's earnest and self-disciplined beginnings, or Dick's cost sheet in Horatio Alger's *Ragged Dick* that underscores how his life hangs in financial balance.

²² Fleissner observes this gender role reversal in earlier naturalist novels such as *Sister Carrie* and *McTeague*, in which the woman is "cold, pragmatic, rational; the man, pitiful and hopeless" (162). In both these novels, the women characters become financially independent while the male protagonists are forced to beg their partners for money in order to scrape by. Within this "selfish woman and the begging man" dynamic, the naturalist woman could be seen as "a 'realist' character, while he—steeped in a passive nostalgia, pleading only for an ounce of sympathy from both her and us—could be called a 'sentimental' one" (163). As she summarizes in her Introduction, "the deepest

repositories of sentimental, therapeutic, indeed nostalgic culture in the 1890s may have belonged to the era's manly men" (17).

²³ In *Women and Economics*, Gilman argues that gender boundaries are more fluid than our cultural narratives about them suggest: "The most normal girl is the 'tom-boy'... The most normal boy has calmness and gentleness as well as vigor and courage." *Women in Economics: The Economic Factor Between Men and Women as a Factor in Social Evolution*. New York: Harper & Row, 1966, 56.

²⁴ Though attentive to Ferber's implicit critique of capitalism, Joyce Antler overlooks some of the tensions in Ferber's fiction, instead emphasizing her "benevolent picture of multiethnic America" and the way that she "seamlessly joined her American, female, and Jewish identities in a romantic vision of possibility" (160,166). Antler, *The Journey Home: Jewish Women and the American Century*. New York: The Free Press, 1997. Donna Campbell notes the misrepresentation of Ferber's fiction in the decades following her critical acclaim in the 1920s in "Written with a Hard and Ruthless Purpose: Rose Wilder Lane, Edna Ferber, and Middlebrow Regional Fiction" in *Middlebrow Moderns: Popular American Women Writers of the 1920s*. Eds. Lisa Botshon and Meredith Goldsmith. Boston: Northeastern University Press, 2003, and even more recently Lauren Berlant elucidates the complexity of Ferber's racial politics in her novel *Show Boat* in *The Female Complaint: The Unfinished Business of Sentimentality in American Culture*. Durham: Duke University Press, 2008.

²⁵ Where an earlier generation of conduct manuals defined femininity according to proper behavioral and emotional practices—promoting the idea that good conduct alone could elevate one's social status—nineteenth and early-twentieth-century domestic science literature fused moral and behavioral guidance with scientific rhetoric, making emotional, psychological, and spiritual fulfillment a product of systematic, rational, and economic practices. As one writer declares, "Let your expenditures be regulated, not merely by a regard to your ability, but to your accountability as a steward of the divine bounty. Regard economy as a virtue, and never be unwilling to be seen in the practice of it." See, *The Lady's Own Book: An Intellectual, Moral, and Physical Monitor*. Glasgow: Dunn & Wright, 1859, 55.

²⁶ See Carol J. Bakker, *Reforming Fiction: Native, African, and Jewish American Women's Literature and Journalism in the Progressive Era*. New York: Columbia University Press, 2000, and Christopher P. Wilson, *White Collar Fictions: Class and Social Representation in American Literature, 1885-1925*. Athens: Georgia, 1992.

²⁷ For a more detailed analysis of the link between Fanny's Judiasm and feminism, see Eileen H. Watts, "Edna Ferber, Jewish American Writer: Who Knew?" *Modern Jewish Women Writers in American*. Ed. Evelyn Avery. New York: Palgrave Macmillan, 2007, 41-61.

Chapter 2:
Mathematical Modalities in Modernist Fiction:
Frances Newman, Mina Loy, and H.D.

This chapter establishes a crucial link between what we might call the “middlebrow moderns” of the previous chapter and the conventionally modernist poetics of H.D., Mina Loy, and Frances Newman by exploring how these latter writers draw similarly on mathematical imagery as a mode of self-definition and as a means of disassociating themselves from sentimentalism.¹ Though H.D., Loy, and Newman’s interest in geometric imagery (in addition to metaphors of arithmetic and calculation) might seem to reinforce the qualities of abstraction, non-referentiality, and elitism thought to distinguish high from middle- and low-brow literatures, a closer examination of these geometric tropes reveals less of a formal or aesthetic rift between “rival” groups of women writers and instead an extension or intensification of the use of mathematical tropes as an expressive and empowering mode of self-representation. More specifically, for writers such as H.D., Loy, and Newman, math becomes a vehicle not so much for talking about professional identity or social positioning, as is the case for Gilman and Ferber, but rather for talking about sexual identity, sexual pleasure, embodiment, and emotional and psychological states of being. This new emphasis on sexuality, intimacy, and psyche can be understood in the context of the burgeoning and increasingly popularized sciences of sexology and psychology as well as within what Dale Bauer describes as the literary historical move from “sentimentality to sexuality,” that is, the shift from “self-expression—with the self understood as an autonomous and private being” to “a focus on intimacy and sexuality as the primary modes of personal expression” (3). Women authors, according to Bauer, “helped fashion a dominant idiom of sexual expression (with intimacy as the necessary condition for inter-relational

equality) to replace self-expression as the primary goal of the modern self" (3). Within this new lexicon of sex expression, I explore how modernist women writers like H.D., Loy, and Newman push the limits of this emergent sex discourse by merging it with the language of arithmetic and especially geometry. I show how these women writers use math both to critique repressive, heteronormative, and masculinist models of sexuality and to consider the liberatory potential of new sexual arrangements.

The language of mathematics offers these writers more than simply a new vocabulary for distancing themselves from sentimental fiction and legitimizing sex as a worthy object of study. The women writers on whom I focus capitalize on the principles of mathematical abstraction—by eliminating characteristics or attributes of the particular in favor of the general or universal case—to bring a new perspective to existing social and sexual norms. For example, Newman, Loy, and H.D. all invoke metaphors of calculation and arithmetic as a way of linking personal constructions of identity to broader social constructs, or to the cultural calculus that regulates our behaviors and attitudes. In this way, these women writers anticipate central aspects of Lauren Berlant's analysis of "the female complaint" in that they, like Berlant, recognize the lure of conventionality, but also turn a critical eye toward these normative, recursive practices that position women as the purveyors of love and feeling while also rendering them politically and intellectually passive. For Loy and H.D. in particular, depictions of persons and bodies as abstract geometric objects—including, for example, parallelograms, cylinders, and concentric circles—also function to deemphasize the particularities of gender in relation to or as a determining factor of sexual preference. When Loy depicts a sexual encounter as the "lucid rush-together" of "human cylinders," or H.D. as "rings on rings that made a geometric circle," they depict sex as mutually

desiring and non-hierarchical, and thus resist masculinist notions of sex as male directed and dominated and also, paradoxically, the objectification of the female body as a mere physical object.

Perhaps even more profoundly, these gender-neutral, generic geometric figures shift focus away from sex identity to sexual activity or pleasure. Rather than stable, fixed entities prior to their sexual encounter, their bodies co-create these geometric formations through their interactivity with one another. In some sense, then, the implications of these geometric bodies anticipate Judith Butler's sense that sex and gender are illusory and performative rather than simply corporeally determined: "'sex' is an ideal construct which is forcibly materialized through time. It is not a simple fact or static condition of a body, but a process whereby regulatory norms materialize 'sex' and achieve this materialization through a forcible reiteration of those norms" (1-2). While I do not want to overstate the incipient post-structural, queer theoretical aspects of Newman, Loy, and H.D.'s work, a closer investigation of the expressive nature of these geometric tropes reveals the extent to which these women writers understood sex and sexuality as central components of feminist political and literary agency.

By examining how these modernist women writers repurpose the "masculine" subject of mathematics toward developing a more equivalent, reciprocal, and gender-independent model of sex, I also offer a new way of approaching the "abstract" mathematics of modernism, one that moves beyond the notion of math imagery as a sign of degenerate, elitist, or masculinist modernism and toward an understanding of how such imagery engages questions of modern subjectivity and literary representation. Beginning with Newman and moving to Loy and H.D.'s work, I trace the use of mathematical terms and themes toward the development of a politically motivated

critique of existing literary and cultural traditions, moving from the subject of sexual awakening in Frances Newman's *The Hard-Boiled Virgin* (1926), to marital sexuality in Mina Loy's "Parturition" (1914), "Virgin Plus Curtains Minus Dots" (1915), "The Effectual Marriage or The Insipid Narrative of Gina and Miovanni" (1917), and "Human Cylinders" (1917), and finally to sexual liberation in H.D.'s *HERmione* (1927) and *Nights* (1935). Through close readings of these texts, I aim to explore the seemingly unlikely connections between mathematical rhetoric and modernist gender politics.

I. From Object to Subject: Francis Newman's *The Hard-Boiled Virgin*

"She would rather be the subject of any verb than its passive object"—Francis Newman

Though still somewhat on the margins of the modernist canon, Francis Newman's provocative writing captured public attention during her tragically short lived career. In between her work as a librarian at Florida State College and Georgia Institute of Technology, Newman wrote numerous book reviews, or what one critic describes as "corrosive and sparkling essays in literary criticism" (Baugh *v*). She soon turned to writing fiction, completing *The Gold-Fish Bowl* (written in 1921 but unpublished until 1985), the O. Henry Prize winning short story "Rachel and Her Children" (1924), the bestselling *The Hard-Boiled Virgin* (1926), and *Dead Lovers Are Faithful Lovers* (1928) before suffering a fatal cerebral hemorrhage in 1928.² By far Newman's most successful work, *The Hard-Boiled Virgin* became an instant bestseller and provoked the admiration—and in some cases scorn—of her fellow writers and critics. Author James Branch Cabell, Newman's longtime friend and mentor, wrote enthusiastically about the novel: "I can think of no book ever written by any woman which I like better. This

appears to be the most brilliant, the most candid, the most civilized, and...the most profound book yet written by any American woman" (*Letters* 213). Others were shocked by Newman's relatively frank discussion of female sexuality and sexual development, and like fellow writer Rebecca West, felt the need to criticize the novel publicly for the way it "hurls the sexual facts of life around like custard pies" (West 327). The novel was banned in Boston for "obscene, indecent, impure language," and Newman herself—in her typical tongue-in-cheek fashion—commented that Atlanta was "shocked almost into convulsions over it" (Blake 308; *Letters* 226). In an irony Newman likely would have enjoyed, the Southern culture she criticizes in her novel for its repressive and restrictive attitudes toward women proved to be just that in many of the harsh attacks on the "vulgarity" of the novel.³

Indeed, critics struggled to fit Newman into an existing literary mold because of her ambivalent relationship to Southern culture; though she wrote mostly from and about the South, her satirical perspective and stylistic experimentation appeared to some as more in line with the European modernist tradition and compared her to Virginia Woolf and Marcel Proust rather than her fellow Southern writers such as Ellen Glasgow and Mary Johnson. Early critics considered Newman's innovative merging of Southern and modernist perspectives as paradoxical: "a strange mixture of a very modern woman, intellectually emancipated from conventionality and a Southern girl who has been carefully reared to remember all the proprieties" (qtd. in Wade 2). Newman herself indicated her fraught relationship to the South in numerous interviews and letters. After fleeing Atlanta for New York in 1926, Newman wrote about feeling "homesick" until she sees "a copy of the Atlanta paper" and remembers "that I can never stand it again," while later admitting to her inability to "write at all in New York"

(*Letters* 187; 295). In *The Hard-Boiled Virgin* (hereafter *HBV*), loosely based on Newman's own life, this ambivalence toward the South is manifest in the protagonist Katherine Faraday's frustrated participation in the traditional Southern female rituals of chaste courtship, *débutante* balls, and finishing school. The story follows Katherine from her early childhood at the turn of the century through her early adult years just following WWI, unfolding in a series of episodes in which she learns about the pressures and expectations of womanhood. While she concedes to perform publicly an image of virginal femininity in an effort to secure a husband, the narrator offers glimpses of Katherine's private, internal struggle to define her sexuality on her own terms, discover and explore her own body, nurture her intellect, and express herself as a writer.

One of the most distinctive features of this female *bildungsroman* is the persistent use of quantitative and geometric figures as a narrative device for describing Katherine's calculated world. As one critic writes, "Newman's prose itself is remarkably, almost pathologically, saturated with repeated numerical references: dates, ages, and quantities are repeated so compulsively that they cease to be informational details and become instead an obtrusive rhetorical strategy" (Benson 641-2). These numerical references generally emphasize the rigidly structured way of life that Katherine must navigate. She determines her actions according to "probability" and counts even the smallest gestures, taking "three sips of water" or adding "six cloves and two candied cherries" to her tea (110, 66). Events are coordinated according to strict measures of time—"the first hour of five nights" or "during the fifteen hours of five days"—and clothing must be worn to mathematical perfection—hats are worn at the "correct angle," skirts placed "four fashionable inches above her waist" complete only with "a pair of sixteen button

black glacé gloves” (106, 25, 88). On a deeper level, Newman is particularly interested in exploring the effects of this calculating ethos on the female psyche—how it becomes internalized and transformed into a tool for self-scrutiny. Katherine repeatedly subjects herself to self-measurement in order to assess her sexual desirability, as when she “remembered with mortification that her own chest and her own waist and her own hips had almost exactly the same circumference” (39). Katherine’s hyper-rationalized world makes impossible any authentic expressions of sexuality and sensuality, as each move becomes a highly orchestrated effort to achieve “the right quantity and volume of laughter” in order to prove herself worthy of marriage (138).

Though Katherine subjects herself to strict numerical analysis, her interest in practicing mathematics, or undertaking the “easy triumphs of mental arithmetic,” serves paradoxically as a refuge from all the external pressures imposed on her—a rare opportunity for introspective thought as opposed to superficial interactions. Her voracious and early interest in reading mathematical and scientific textbooks pulled from her father’s library indicate her keen academic abilities and desire for intellectual stimulation. Katherine’s mother, however, perceives these talents as a liability and encourages her daughter instead to take up lessons in domestic science, or what Katherine sees as little more than “broiling chops and folding napkins” (168). But Katherine realizes early on that her intellectual abilities are not valued above her ability to attract the opposite sex; she finds that both boys and men are “not usually taken with romantic attachments for little girls who can spell words of five syllables and who can find the eighteenth terms of an arithmetical progression” (46). Both her entrapment within and transcendence through mathematical reasoning reinforce the double bind she finds herself in: she feels pressure to abandon her intellectual pursuits in favor of honing

her sexual attractiveness and wifely potential, at the same time that the expectation of chastity and sex within marriage lead her to believe that scholarly discipline is her only means of self-realization, lest she fall prey to “deviant” sexual temptations. Indeed, the fundamental irony of the novel is that Katherine’s quest to attract a suitor with whom she can finally explore her budding sexuality actually precipitates her fear of sexual contact and makes her more vigilant about resisting temptations. Forced into rationalistic overdrive by a strict set of social and sexual codes, Katherine struggles to relinquish these codes and allow herself to experience real pleasure. When she does finally lose her virginity at the end of the novel, she so fears getting pregnant out of wedlock that she renounces marriage and sexual companionship to pursue instead her career as a writer. Though she ultimately breaks away from the conventions of Southern belledom, she does so at the expense of suppressing her own sexuality. Katherine’s compulsion to quantify herself and her social world thus serves as a way for Newman to highlight the systemic constraints placed on sexual practices within a society that privileges rationalism, analysis, and classification.

And yet, on a narrative level, this recourse to mathematical description also enables Newman to represent sexuality outside of a sentimental framework—not as a symbolic, abstract concept but as a natural, biological phenomenon that can be scientifically validated. As a Southern belle reared on traditional Victorian values, Katherine has no language for describing her own anatomy except to observe the geometric qualities of her body; through the “convex reflections” of her bathtub faucets, she hopes that time will “enlarge” and “curve” her “thin and very straight” legs, and she observes “between her flat chest and thin legs...a line she never noticed before—a delicate line which was slightly browner than the area she thought was her stomach”

(35). This use of the “line” metaphor throughout the novel to refer to her genitalia reinforces Katherine’s sheltered upbringing while also allowing Newman to acknowledge a subject rarely discussed in such a candid way. Katherine’s self-exploration marks a significant step away from the romanticized and “purified” representations of sexuality and embodiment that she finds in the Victorian conduct manuals and sentimental novels that make up her early “education” and instead moves her toward an unfiltered and frank acknowledgement of her own anatomy. This discovery also leads her to a “sudden revelation” about one of the functions of her anatomy: giving birth. She conjures a dramatic scene of future childbirth, relying on Greek mythology as her only point of reference:

She had a sudden revelation that...the part of herself which she thought was her stomach would burst along the delicate brown line, and that she would naturally shriek and that her daughter would dart into the world like Pallas Athena darting from the brain of Zeus, and that a doctor would give her ether and sew her up. (36)

Despite this description’s childlike naiveté, she recounts this revelation in a relatively frank and unreserved way and indicates her incipient interest in the physiological and medical aspects of giving birth rather than the symbolic nature of childbirth and motherhood.

One contemporary critic saw this frankness as *HBV*’s downfall, arguing that the novel “hovers between the unseen and the obscene” for the way that it is “scientifically frank in frequent references to certain biologic facts of feminine anatomy and physiology” (qtd in Wade 156-7). But it is precisely this matter-of-fact approach that Newman self-consciously undertakes. She viewed developments in the behavioral and

biological sciences as an opportunity rather than a constraint on sexual expression. In an 1928 interview Newman credited modern psychology for recognizing sex as “one of the fundamental instincts of life” and therefore making it the rightful province of any literature “which deals with human beings.” While still “not considered polite to mention it or be conscious of such a force existing,” Newman believed “it is far better to tell the truth about life from the beginning and thereby avoid disillusionment” (qtd in Wade 157). Rather than opposing scientific interpretations of sexuality, Newman’s heroine draws on the authority of science to legitimize her revelations about sexuality. In fact, this overlap of science and sexuality would hardly seem surprising or unexpected to Newman given the mathematical nature of late nineteenth- and early twentieth-century sexology and psychology, as I discuss in my Introduction.

Indeed, it is only through medical and scientific texts that Katherine finds reliable and direct information about sex, especially in comparison to reading novels such as J.M. Barrie’s *Sentimental Tommy* (1896), through which Katherine learns only moral codes based on deeply subtextual references to sexuality.⁴ She first learns about male anatomy from Gray’s *Anatomy of the Human Body* (64); mating and reproduction from Darwin’s *Origin of the Species* (84); and venereal disease from Nelson’s *Encyclopedia* (171). These resources offer her a culturally acceptable means of learning about her own body and a foundation for her later observations. When Katherine begins to communicate her findings about men and women’s sexual behaviors and desires, she assumes the role of social scientist, observing and analyzing her subjects from a cool-headed distance and even comparing her findings to scientific discoveries. She feels “all the satisfaction of a scientific discovery” when “she realized how much her future life might be influenced by the knowledge that if a girl sits down and smiles up at a man

who is looking down at her, he will certainly kiss her if he takes either an honorable or dishonorable interest in her (186). When she draws a similar conclusion about the seemingly unabashed sexual advances of men and the burden placed on women to resist them, she again feels “all the satisfaction of a scientific discovery, because she realized how much her future life might be influenced by the knowledge that if a woman tells a man she is hopelessly virginal, he will almost immediately try to prove that she is mistaken” (253). With characteristic wit, Newman traces her heroine’s efforts to uncover fundamental truths about the relations between men and women—truths that seem to carry the weight of scientific fact. Despite their humorous tone, these recurring “discoveries” also convey the importance Newman places on sexual education as an empowering and protective measure; Katherine understands the value of having access to “knowledge” that might “influence” her “future life.”

Melanie Benson interprets these scientific and mathematical references as an “obtrusive rhetorical strategy” implemented to reinforce “the repressive devices of narcissism and arithmetic [that] circumscribe Katherine faithfully and increase exponentially until the end” (641). While Newman draws on mathematical description to emphasize and critique the rigidly gendered and constraining social codes of Southern belledom, this appeal to mathematics is descriptive as well as prescriptive; her numerically saturated prose enacts a new way of representing sexuality that trades the rhetoric of sentiment for that of science. It is also the novel’s sharp and extended critique of sentimentalism that has often been overlooked by critics, who tend to focus primarily on her satire of Southern culture. From the very title of the novel, the term “hard-boiled” suggests to readers that the heroine will prove to be more tough and world-wise than the female characters who populate sentimental fiction, and Newman

likely shocked if not offended her public with the use of “virgin” as a proud moniker, particularly for her readers in the South, where, according to Newman, “no lady was supposed to know she was a virgin until she had ceased to be one” (175). But it is Newman’s substitution of emotional content for mathematical description that most evidently establishes her anti-sentimental perspective. From the novel’s first sentence, the narrator declares Katherine as the “sixth pledge of [her parent’s] love,” and caps off this opening chapter with Katherine’s first step toward disillusionment: the realization that “the holy bond of matrimony sometimes follow the horrors of connubial fury” and thus to the conclusion that her mother and father “are not only one flesh, but two” (9, 11). The narrator describes their relationship numerically to indicate Katherine’s naïve formulation of the realities of her parents’ sexual lives. Numerical description functions as a key device through which the narrator communicates—while also distancing herself—from sensitive or taboo subjects. This mathematical rhetoric provides just enough abstraction to open up a candid discussion of sexuality while also offering the narrator a critical, “objective” distance from such subjects.

Katherine’s emerging writing career follows her move away from sentimental tropes and toward more realistic, deeply introspective subject matter. Her style is not one drawn from inspiration as much as it is the result a carefully honed method and diligent practice. In the evenings after reading the popular romance novel *The Rosary* (1909) by Florence Louisa Barclay, Katherine attempts to write her own romance, imagining herself as the heroine: “[The Rosary] sent her to bed early every evening so that she could plan carefully punctuated stories about Katherine Faraday and a husband as handsome and as romantically broken in the hunting field as young Mr. Dugdale” (71). It is only in the fictional world that Katherine can live out her romantic fantasies,

and yet in these early attempts at writing she feels compelled to conform to the conventions of nineteenth-century romantic fiction, leading her to construct storylines that contrast sharply with her reality. After reading the meticulously detailed *The History of England* by Lord Macaulay (1864) and Walter Tyndale's *Below the Cataracts* (1907), she likewise sketches her own precisely orchestrated romantic adventures, "plan[ing] carefully punctuated little stories about the evening, a correct year away, when Robert Carter would return to her..."(75). But Katherine's stories hardly capture the moments of sexual awakening that preoccupy her and which form the fundamental plot of Newman's novel. For Katherine, reading is an erotic experience, often accompanied by a "hot bath at night" and giving way to intimate moments of self-exploration. Writing, however, particularly as she initially conceives it, seems to require the sublimation of any erotic feeling. Just after she plots out this rather chaste love story involving Robert Carter, the narrator offers a glimpse of the highly charged feelings Katherine cannot represent in her fiction: "And sometimes she did not read anything or plan anything, and a fountain rose and fell and dropped its electric spray through her thin brown body" (75). Though somewhat disguised in metaphor, this rare reference to masturbation offers no illusion about the sexual desires of women that so often are elided in the Victorian literature Katherine diligently tries to imitate. On the one hand, Katherine's methodical, "calculating" approach to writing implicitly critiques the formulaic nature of romantic fiction—a genre that Newman suggests can be mastered simply through practice and repetition; on the other hand, her approach also mirrors the perspective of many contemporary modernist writers such as Eliot and Pound, who sought to distinguish themselves from their literary predecessors by stressing

disciplined writing practices and establishing what they argued were certain “objective” standards of composition and literary evaluation.

But despite Katherine’s prudent, sometimes even compulsive, efforts at writing romantic fiction—in which she spends “hours planning letters,” “carefully calculat[ing] every sentence,” occupying “four years with writing and rewriting letters” that she hopes will be “sufficiently ardent”—she never quite masters the genre, just as her own life fails to conform to the model she finds in the sentimental fiction she reads (233–4, 236). It is only when she determines to write a more personal, “hard-boiled” story that she finds her voice and begins to garner critical success. Her play, wittily titled “No Sheets,” depicts “a girl who could not face the idea of marriage or even seduction” (257), and marks Katherine’s first attempt to capture her true feelings in her fiction as well as her decision to eschew the pressures of courtship and marriage. However, it is ironic that in doing so she fulfills the model of chastity that initially restrains her. Katherine draws much satisfaction and self-confidence from her play’s success—which “had been admired by all the dramatic critics”—and begins to “feel at last that a peg has at least as much right to be square as a hole has to be round” (281). Her revision to this familiar expression suggests that she embraces her nonconformity and relishes her new, even if frowned upon, career. Through Katherine’s success as an author of a definitively modern, unconventional drama, Newman cleverly embeds a defense of her own style. Ultimately the novel’s numerically saturated prose seems less a device to ensnare or limit her heroine and instead one that frees both author and protagonist from the limitations they find in sentimental representations of femininity.

In significant ways, Newman’s novel anticipates aspects of Lauren Berlant’s analysis of the sentimental; Newman, like Berlant, is attentive to the ways in which

sentimentality links women through narratives of common experience and suffering—hence Katherine’s anxious anticipation of the pains of childbirth, the shame of premarital pregnancy, and the triumph of marriage gleaned from the sentimental novels she reads. As importantly, both Newman and Berlant are also critical of sentimentality’s ability to obscure the systematic inequalities and limitations imposed on women through its focus on empathetic identification over social activism and political reform.⁵ Through her hard-boiled heroine, Newman actively resists emotional identification and evocation in favor of illustrating her protagonist’s enculturation in a larger system of hierarchical authority. The language of mathematics serves as an essential tool in Newman’s effort to not only to disassociate her writing from sentimentalism, but also to signify the deeper structural logic that shapes gendered power relations. Newman finds in the non-subjective, impersonal language of math a way to articulate not just Katherine’s personal trials and tribulations, but her entanglement in the patriarchal regulation of women’s sexual and artistic expression. That Katherine internalizes this quantitative perspective further emphasizes the indivisibility of her private (sexual) world from the public (patriarchal) sphere. Her attempts at self-calculation indicate a breakdown between the subjective and objective; she is no longer able to distinguish between her own desires and those imposed on her through social conditioning.

Within the tradition of modern American women’s writing (in so far as a coherent tradition exists), Newman’s novel serves as an important marker of how sexual expression came to be seen as the locus of women’s artistic and cultural liberation. *HBV* stages the struggle to transition, as Dale Bauer observes in her recent study, “from sentimentality to intimacy” or from “a praxis of self-expression to a praxis of *sexual* expression” (4). While Katherine struggles to move beyond self-expression to vocalize

her sexual desires, the narrator revels in sexual expressivity, refusing to be guarded and self-censored like her protagonist, unlocking the sexual and bodily realities that Katherine cannot comfortably articulate and which therefore inhibit her full self-realization as both a sexual being and an unguarded writer. Newman's novel thus offers a useful lens through which to read the work of Mina Loy and H.D. for the way it contextualizes their continued investment in sexual expression as an emancipatory discourse connected to other forms of power. What Newman, Loy and H.D. all have in common is their use of mathematical tropes to create a more politically charged, "objectively" grounded rhetoric that approaches sexuality not simply through an individualist framework but instead as a signifier of a culturally and structurally embedded logic. For these writers, mathematics serves as a means both to critique existing paradigms and to create new forms of representation.

II. Plus/Minus Identities: Selected poems by Mina Loy

Though now recognized primarily for her poetry, Mina Loy jump-started her writing career with a couplet of manifestos in 1914, titled "Aphorisms on Futurism" and "Feminist Manifesto." In a reverse move to many of her American writerly colleagues, Loy expatriated from Europe to America, settling in Greenwich Village in the 1920s and making New York and eventually Colorado her permanent home after 1936.⁶ Despite her strong connection to the American writing scene, Loy's creative influences were artistically and geographically varied. Like H.D.'s association with the Anglo-American, male-driven movements of Imagism and Vorticism, Loy was closely linked to Italian Futurism and its founder and her one-time lover F.T. Marinetti. Loy and H.D.'s ambivalent relationships to these movements and their founders would become the source of much critical debate then and still now.⁷ What critics seem to find most

difficult is the problem of interpreting Loy and H.D.'s use of scientific and mathematical tropes—or what many interpret as unambiguous indicators of their aesthetic allegiance to these movements—in light of their otherwise fraught relationship to Vorticist and Futurist values. This tendency to correlate mathematics and masculine aesthetics, however, ignores or misreads the feminist ends to which Loy, like Newman and H.D., deploys mathematical imagery. To even greater political ends than Newman, I show how Loy draws on mathematical tropes to expose the patriarchal control of women's romantic, sexual, and reproductive lives and also to envision a more companionate form of intimacy.

In her "Feminist Manifesto," Loy introduces readers to some of the major concerns—marriage, sexuality, and the relationships among men and women—that animate her poetry. Here, as in her poem "Virgins Plus Curtains Minus Dots" (1915), Loy seeks to expose the cold calculus of patriarchal marriage, in which women become a negative value:

The woman who adapts herself to a theoretical valuation of her sex as a *relative impersonality* is not yet feminine. Leave off looking to men to find out what you are *not*. Seek within yourself to find out what you *are*. As conditions are at present constituted you have the choice between Parasitism, Prostitution, or Negation. (269)

She laments women's economic codependence, which leaves them little choice but to marry (parasitism), lest they turn to prostitution or destitution (negation). Within the "economics" of marriage, she argues, "the value of woman depends entirely on chance," or whether she can attain the "advantageous bargain" of marriage and thus "obtain a concrete value" (270). She urges women to resist defining themselves in relation to men

or within a system that privileges and normalizes male experience. While Loy argues that men and women's sexual interests are pitted against one another, her work stays firmly within the boundaries of heterosexual coupling and even suggests that the act of sex (albeit disassociated from marriage) might bring men and women together: "The only point at which the interests of the sexes merge is the sexual embrace" (269). She advocates for women's sexual and reproductive rights, including the right to reproduction outside marriage, and for the removal of the stigma against sex.

At the same time, her feminist values are underpinned by a troubling eugenic logic, through which she advocates for an "adequate proportion" of "women of superior intelligence" to "unfit or degenerate members of her sex" (270). Ironically, she deploys the same logic of calculation to express her eugenic ideas as she does to critique the economic realities of marriage. Like the writers on whom I focus in Chapter 1, these competing applications of quantitative description indicate its ongoing use as means to both construct and constrain particular qualities of personhood (an empowered femininity and a resolute ideal of whiteness). Though the writers on whom I focus in this chapter engage less explicitly with issues of race and ethnicity than those I discuss in Chapter 1, Loy's manifesto, along with the relative silence of H.D. and Newman on the subject of race, in effect normalizes white women's experience and exemplifies first-wave feminism's exclusionary politics, or, as Dana Seitler observes, "early-twentieth-century feminism's campaign to free white women from masculine hegemony through a commitment to popular science, specifically 'eugenic discipline'" (64). Loy, H.D, and Newman are certainly also much more attuned to the gendered history of science and mathematical praxis than to the ways their methods have been used to rationalize racial discrimination and categorization.

Like her “Feminist Manifesto,” the title of Loy’s poem “Virgin Plus Curtains Minus Dots” (1915) similarly points to the economic equation of marriage by which virginal brides must give up their dots (shorthand for dowries) to become captives of their homes. The poem elaborates on the results of this equation: while men “are going somewhere/ And they may look everywhere,” houses “hold virgins,” who “without dots/ Stare beyond probability” (36). Loy stresses the unlikelihood of a woman’s mobility without a husband or financial resources by deeming it a statistical improbability. Women buy into the fantasy of love while the underlying economic motivations of marriage are obscured:

We have been taught
 Love is a god
 White with soft wings
 Nobody shouts
VIRGINS FOR SALE
 Yet where are our coins
 For buying a purchaser

 Love is a god
 Marriage expensive

 A secret well kept. (37)

The poem addresses women as a collective body in its use of “we” and “our” to emphasize these sexual and marital conventions as widespread, systematic, and recursive. Women “have been taught” that love is an intangible, priceless quality, while “the secret well kept” is the literal and figurative price that one pays to be worthy of purchase, having no “coins” of her own “For buying a purchaser.” If this poem focuses on the initial “transaction” that leads to women’s physical, social, and emotional confinement, “The Effectual Marriage or The Insipid Narrative of Gina and Miovanni” (1917) (commonly interpreted as a reference to Loy’s own relationship to Giovanni Papini, an Italian journalist and writer), points to her eventual complacency toward

domestic entrapment. In their house, they are physically separated according to traditional gender roles—he in his library, she in the kitchen:

In the evening they look out their two windows
Mioivanni out of his library window
Gina from the kitchen window
From among his pots and pans
Where he so kindly kept her
Where she so wisely busied herself. (31)

Loy satirically suggests that Gina might feel herself “immaterial” if it were not for her important role as a “correlative” to her husband, an “instigation of the reaction of man” (31). Her critique of the idea that a woman’s significance is defined in relation to male needs and desires recalls her manifesto’s demand for women to be more than a “relative impersonality.” As the instigator of “the reaction of man,” or the “mollescent irritant of his fantasy,” Loy also critiques the subordination of women’s sexual pleasure to that of men (31). In its place, Gina busies herself with frivolous domestic activities, or the “pet simplicities of her Universe,” and convinces herself that she lives in a perfect world, “where circles were only round/Having no vices” (35). Like a circle, her daily routine has no clear start or finish and every day, as with every given point on a circle, is identical to every other. These two concluding lines of the poem suggest that Gina is tragically and unknowingly trapped in the geometry of her domestic surroundings, unaware, as one critic observes, of what keeps her within “circumscribed gender limits.”⁸

While Loy relies on mathematical imagery to reinforce marriage as a zero-sum game (“Virgin Plus”) or as a cyclical repetition of domestic tasks (“Effectual Marriage”), she also frames childbearing in mathematical terms, as an act that might lead women from a negative to a positive self-image. “Parturition” (1914) begins with a woman in the throes of giving birth—a still-taboo subject, rarely if ever before represented in such vivid detail.⁹ The woman initially experiences the breakdown of her external and

internal selves: “I am the centre/Of a circle of pain/Exceeding its boundaries in every direction” (67). During labor, she sees herself as little more than the bearer of intense pain, or the “infinitely prolonged nerve vibrations,” a mere vessel for the birth of her child: “I am the false quantity/In the harmony of physiological potentiality” (67). As delirium sets in, she again senses the “Negation of myself as a unit,” but when she feels the “Stir of incipient life/Precipitating into me,” she begins to recognize her own value and strength:

Mother I am
Identical
With infinite Maternity
Indivisible
Acutely
I am absorbed
Into
The was-is-ever-shall-be
Of cosmic reproductivity. (70)

She identifies herself assertively as a mother and feels an instant, unbreakable bond with all other mothers, to whom she now feels cosmically linked. This gives her a sense of positive definition, a feeling of revelation and release (infinitude) and wholeness rather than negation (indivisibility). As she senses herself “unfolding” and becoming a “woman-of-the-people,” she revels in the multiplicity of her identity and her inclusion in a larger collective subjectivity (70-1). Here, the mathematical language reinforces the breakdown of the internal/external, the subjective/objective, wherein her individual experience is expressed within a collective discourse.

While these mathematical modifiers might seem little more than playful projections of a Futurist aesthetic of abstraction and aggression, as many critics have suggested, Loy’s use of math registers a much deeper and dynamic feminist agenda. Loy, like Newman and H.D., draws on math to envision a model of companionate love

that displaces gender as a determining factor and instead focuses on the social frameworks from which sexual identity is constructed. Loy and H.D. in particular draw important links among patriarchal authority, scientific determinism, and gender and sexual essentialism. For Loy, these links are best demonstrated in her poem “Human Cylinders” (1917), in which she laments the “scientification” of sex—and with it the universalization of male sexuality—while also imagining a more sensual, reciprocal form of sex. She begins with a critique of mechanical and detached sexual interactions: “The human cylinders/Revolving in the enervating dusk/” fail to reach “the mystery of singularity” by simply going through the motions, “Having eaten without tasting/Talked without communion” (12). In “the lucid rush-together of automatons,” the lack of meaningful connection prevents these lovers from finding out if they “Could form one opulent wellbeing” (12). This subordination of erotic love to robotic coupling recalls a similar critique of a mechanistic male libido and the subsequent deferment of female pleasure in her “Love Songs to Joannes” (1915-17): “Something the shape of a man.../More of a clock-work mechanism/Running down against time/To which I am not paced” (92). In the second stanza of “Cylinders,” Loy connects these “clock-work” sexual relations to a broader cultural privileging of logic and intellect over intuition and sensuality. Through the “[s]implifications of men,” or the “frenzied reaching out of intellect to intellect,” sex becomes an intellectual rather than a bodily experience, a suppression of the physical or somatic aspects of intimacy:

Concordance of respiration
Shames
Absence of corresponding between the verbal sensory
And reciprocity
Of conception
And expression
Where each exudes beyond the tangible
One thin pale trail of speculation (12)

In a results-oriented, rationalistic modern culture, Loy suggests, we become disembodied beings seeking to reason our way toward some kind of transcendence or move “beyond the tangible,” bringing us closer to that “one last tentacle of intuition” left “[t]o quiver among the stars” (13). But intellectual discourse, or the “verbal sensory,” she urges, can hardly be a substitute for the physical connection that arises from the “concordance of respiration” and brings us no closer to transcendent truth, but only to a “thin pail trail of speculation.”

The third and final stanza moves toward greater generalization by linking sexual and scientific determinism. In our desire for concrete answers and definitive subject positions, we reach for “the impartiality of the absolute,” which collapses or “routs the polemic,” reducing our unique qualities and perspectives to a destructive sameness. Loy contends that our compulsion toward the absolute is what brings us dangerously close to our own undoing:

Or which of us
Would not
Receiving the holy-ghost
Catch it and caging
Lose it
Or in the problematic
Destroy the Universe
With a solution (13)

In recognizing our ability to “destroy the Universe/ With a solution”—a plausible reality during an ongoing world war—Loy warns against the technoscientific domination of human nature. She posits a kind of proto-ecofeminist argument by showing that the same logic that seeks to constrain women’s sexual and emotional lives also propels the desire to dominate the human and natural world. As a whole, the poem draws analogies between the battle of the sexes and large-scale warfare and establishes

a causal link between sexual and bodily disconnection and the potential for human destruction.

And yet, despite the poem's critique of a mathematized and mechanized culture, Loy's version of the geometric body, the human cylinder, also envisions the potential for intimate interactions that transcend prescriptive gender roles. As equal forces, these two bodies hold the possibility that they might "wrap each closer," engage in nonverbal and sensory communication, and realize their potential to "form one opulent wellbeing" rather than succumb to an isolating self-absorption. Loy laments a shared intimacy never fully realized with frequent references to cooperative terms—"communion," "leaning brow to brow," "communicative," "concordance," "corresponding," and "reciprocity"—qualities integral to her vision of an ideal partnership. For Loy, such a partnership is not a call for absolute sameness and stability, but instead for a relationship that is "revolving" or ever changing and does not try to "rout the polemic" or eradicate difference. Though Loy's use of the geometric body is not as sustained or as self-consciously deployed as H.D., it nonetheless reflects Loy's frequent turn to mathematical imagery as a mode of feminist critique and inspiration. Her "repurposing" of mathematics to describe and interpret a female worldview complicates traditional interpretations of her math aesthetic as an extension of a masculinist, Futurist agenda. Her work also offers a broader perspective on what modernist writers find so compelling about mathematics; it is not simply a rote tool of calculation or a symbol of absolute certainty but rather a vehicle through which we might alter or reshape our perceptions and patterns of living.

III. Concentric Configurations: H.D.'s *HERmione* and *Nights*

H.D.'s semi-autobiographical novel *HERmione* (1927) sketches the interior world of its protagonist Hermione "Her" Gart as she navigates familial expectations and romantic relationships. The novel is sprinkled with first person declarations—"I am Hermione Gart"—but is predominately told by a third person omniscient narrator who occasionally undercuts Hermione's self-revelations—"She was not Gart, she was not Hermione" (4). The novel is at once an intensely personal and introspective character study and also a detached analysis of a woman trapped in a world shaped by those around her. As Susan Friedman writes, the novel "demonstrates a self-conscious play with splitting, then doubling, the self into analyst and analysand" and documents "the endless process of 'working through' the tangled forest of female subjectivity within a culture and language that perpetually positioned her as an object" (81-3). Hermione oscillates between subject and object status throughout the novel. The nickname Her—as both proper name and object pronoun—"intensifies the split between the narrating 'I' and its object, the narrated 'Her'" (Friedman 83). This deliberate blurring of boundaries between subjectivity and objectivity is part of H.D.'s larger effort to challenge the division of art and science. Particularly through the trope of mathematics, *HER* explores the capacity for science to construct, constrain, and express subjectivity, and conversely, the artist's ability to analyze, objectify, and experiment with her subject.

For H.D., reconciling the hierarchical divisions between science and art, objectivity and subjectivity, certainty and creativity was a deeply personal issue. She comes from a long line of distinguished scientists, including her maternal grandfather, Francis Wolle, a well-known botanist; her father, Charles Doolittle, an accomplished professor of astronomy and mathematics at Lehigh University and first director of the

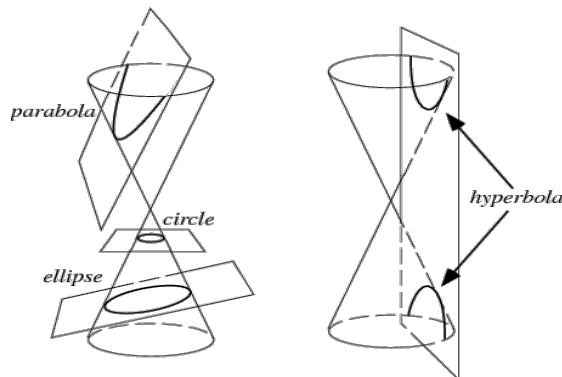
Flower Astronomical Observatory at the University of Pennsylvania; and her older brother Eric, who succeeded his father as a professor of astronomy at Penn. H.D. felt the weight of her father's expectations from an early age: he "wanted eventually (he even said so) to make a higher mathematician of me or research worker or scientist like (he even said) Madame Curie. He did make a research worker of me but in another dimension" (qtd in *Psyche Reborn* 200). H.D. suggests that her writing methods and techniques owe something to her father's profession, though she claims to "derive my imaginative faculties through my musician-artist mother" (*TF*, 121). As the only child in the Doolittle family not to graduate from college, H.D. felt like a failure, especially to her father; she wrote about this struggle to define herself in relation to her parents: "she was a disappointment to her father, an odd duckling to her mother, an importunate overgrown unincarnated entity that had no place here" (qtd in Guest 22). H.D. often refers to the pull she felt between her scientist father and artistic mother and her continual search for her place on the spectrum between them. As she writes in *Tribute to Freud*, "I am on the fringes or in the penumbra of the light of my father's science and my mother's art" (145). She later sought to reconcile these forces—her father's science and her mother's art, mathematics and myth, intellect and imagination—in her analysis of a particularly vivid dream in which she leads her father to meet "the Queen, the mother":

They and the dream reconcile my father's purely formal, rational, scientific mathematics + astronomy with the inner mystery of the letter and numbers + the astrology + star lore + 'myth' of the *Kabballe*....Mathematical Astronomy + 'mystical' religious or esoteric Astrology are reconciled. Or reality + fantasy...or intellect + imagination...or science + art...+ so on. (qtd in *Psyche Reborn* 188)

The plot of *HER* involves a similar path toward self-discovery that depends on Hermione's ability to reconcile these seemingly oppositional forces—to make science a vehicle for art and art an interpreter of science.

The novel opens with an emotionally distraught and confused Hermione, who has left college after failing a geometry course, much like H.D.'s early withdrawal from Bryn Mawr. Uncertain about her direction in life, Hermione “went round in circles,” feeling “nebulous” and considering herself “a failure” (3-4). She identifies her “failure to conform to expectations” as her inability to pass a mathematics course, specifically conic sections, or the study of curves formed by the intersection of a plane with a cone:

[C]onic sections was the final test she failed in. Conic sections would whirl forever round her for she had grappled with the biological definition, transferred to mathematics, found the whole thing untenable. She found the theorem tenable until she came to conic section and then Dr. Barton-Furness had failed her, failed her...they had all failed her. Science, as Bertram Gart knew it, failed her...and she was good for nothing. (5-6)



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While Hermione assumes some of the blame for this failure, she suggests that her male professor and her scientist brother Bertram (modeled on her brother Eric)—and masculinist science more generally—are also to blame for her ultimate exclusion from

the realm of science. Interestingly, H.D. takes some creative liberties with her biography in this respect: although she was doing poorly in her other classes at Bryn Mawr, it was a literature and not a mathematics course in which she received her only failing grade.¹⁰ Her protagonist's failure in mathematics, however, points to the powerful effect that H.D.'s father had on her sense of "valuable" work. Hermione laments her lack of success in the sciences because, as for H.D., it would have given her the validation and acceptance from her father she craved: "Her mathematics and her biology hadn't given her what she dreamed of. Only now she knew that failing at the end meant fresh barriers, fresh chains, a mesh here. The degree almost gained would have been redemption" (12). Throughout the novel, mathematics functions dialectically as a field that excludes and alienates Hermione, but one to which she is also continually attracted and through which she expresses and validates her emotional, sexual, and bodily desires. She finds mathematics both disabling and enabling; on the one hand, the subject triggers a crippling self-doubt about the value and significance of her work and acts as a symbolic specter of domestic entrapment and heteronormative expectations, while, on the other hand, it provides her an unbiased vocabulary to talk about her innermost fears and desires.

No longer in school and uncertain about her future, Hermione is thrown back into the tedium and tensions of family life in her parent's Pennsylvania home, which the narrator describes through a series of arithmetic metaphors. Her brother Gart and his new wife Minnie, also take up residence in Gart Grange, disrupting the family dynamics and leaving Hermione to recalculate her position within the household. Minnie, in her neediness and attention-seeking behavior, seems to Hermione "like some fraction to which everything had to be reduced" (15). Minnie's introduction to the family makes

Hermione feel like the odd person out; at the dinner table she looks on as “Gart and Gart sat facing Gart and Gart,” their even pairing further naturalizing the heterosexual coupling that so far eludes Hermione (35). Minnie’s conventional femininity makes Hermione feel inadequate, eliciting anxious memories of grade school arithmetic:

Minnie made her feel eight, nine with a page of those fractions which all have to be resolved to something different because one of them is of a different common.... something. Denominator. Even the least thought of add, subtract made Her feel blurred, she could never again casually deal with fractions in composite values. Minnie however was, she knew it, the one fraction that reduced them all, as family, to that level. (17)

Minnie provokes Hermione’s regression to childhood feelings of jealousy, competitiveness, and inadequacy. This scene of the traumatic math class returns again and again in Hermione’s most emotionally vulnerable moments, a referent for the feelings of inadequacy she has difficulty expressing. The overbearing and controlling nature of her on-and-off again lover and one-time fiancé George Lowndes (a nod to H.D.’s affair with Ezra Pound) draws out Hermione’s insecurities as both a writer and lover; he “brought back hunched shoulders, little desk...and the heated scrape of slate pencil across slate surface. Numbers jogged and danced and long division made a stop in her brain...” (66). When she later breaks her engagement with George, having fallen deeply in love with Fayne Rabb (likely a stand-in for H.D.’s lesbian affair with Frances Gregg), the nervous responses from her family again prompt her math anxiety: “[S]he dreamt she was waiting for examinations and had forgotten logarithm. Logarithms. Something binomial and something conic that was a section” (196). Hermione correlates all her subsequent “failures,” particularly her failure to conform to

heterosexual norms, with her failure to become a successful scientist like her father and brother—that is, her failure to follow the “Gart formula.” H.D. uses this math imagery both as a symbol of the emotional barriers she constructs for herself and as a mode of expression for her feelings of anxiety and “failure” to conform to external expectations.

The narrator also uses arithmetic and geometric terms to emphasize Hermione’s feelings of social and spatial confinement. Hermione is critical of the women in her social circle, who seemed to her “flamingly parasitic,” desperately striving to model themselves on European bourgeois culture, collecting things that “could hardly have been distinguished from that of Chelsea or certain sectors of the Rive Gauche” (48). Hermione finds this careful, calculated self-fashioning daunting and even distorting: “A convex Victorian mirror above the head of the girl opposite showed Nellie and Hermione tilted sidewise....careful lines of the oblong pattern where the folded cloth had been carefully unfolded, making two careful lines bisecting teacups” (52). It occurs to Hermione that she “was not made for any of these groups” because she is unable to conform like the others, who “were assorted, out of different boxes, yet all holding to some pattern, they had the trademark of nonentity” (55). Though George has little money, he offers Hermione the potential for escape from this rigidly structured life, but she cannot ignore her attraction to Fayne, leaving her feeling “broken like a nut between two rocks” and unable to break from the house that confines her (81):

We are set like a problem on a blackboard. The house is a columns of figures, double column and the path at right angles to the porch steps is the line beneath numbers and the lawn step is the tentative beginning of a number and the little toolshed and the springhouse at the far corner of the opposite side is bits of

jotted-down calculations that will be rubbed out presently...Suffocating...it's suffocating. It's like breathing in a crowded schoolroom. (83)

Metaphors of calculation and accounting reinforce Hermione's financial conundrum: George cannot offer her stability, but neither can she establish an independent life with Fayne without the monetary support of her father. When Hermione asks her mother to join her in breaking from the "Uncle Sam, Carl-Bertrand-Gart God" that "shuts us up in a box," her mother responds, "your father and his work are more important" (96).

Hermione pleads further: "Why don't you see—don't you see? There are numbers fencing us in. We are being fenced in with numbers, one I love, two I love, three I love" (96-7). Numbers function as metonymies for the patriarchal, heteronormative practices that lead her mother to sacrifice her own desires to support her husband's career and keep Hermione under her father's control, discouraging her self-sufficiency and denying her the possibility of a life with Fayne. And yet, by "fencing her in," these numbers also work to define Hermione's sense of self; the numbers function as an "external" mode of order that paradoxically constitutes her and those she loves as subjects.

What appears to save Hermione from the depths of despair is her discovery of writing as a means of escape from her calculated, regulated lifestyle: "some scheme of biological mathematical definition left Her dizzy. It had not occurred to Her to try and put the thing in writing" (71). Though she earlier associates mathematical imagery with her feelings of inadequacy and her entrapment within a carefully orchestrated, homogenized social environment, she begins to claim writing as scientific research "in another dimension." While Bertrand "later turned to mathematics. Hermione, in the same spirit, later turned to Bertrand's bookshelves" (18). She comes to see writing as a companionate if not superior tool for understanding the world around her:

Now I will reveal myself in words, words may now supercede a scheme of mathematical-biological definition. Words may be my heritage and with words I will prove conic sections a falsity....mythopoeic mind (mine) will disprove science and biological-mathematical definition. (76)

Finally able to assume the first-person perspective, Hermione recognizes her authorial power to create a particular reality and to develop her own sense of truth just as a scientist seeks to establish a “mathematical-biological definition.” Moreover, as Adelaide Morris argues, Hermione’s declaration reflects H.D.’s overarching critique of “the foundations of the Order of Gart,” or some of the basic premises of Newtonian-Cartesian science, “among them the distinction between subjectivity and objectivity, the notion of absolute space and absolute time, and the feasibility of precise linear statements” (161). Rather than “imitating, complementing, or assimilating science,” Morris argues persuasively that H.D. overturns the foundations of classical science “by following intuitions that share their matrix with the insights that generated relativity, quantum mechanics, and chaos theory,” or the so-called post-classical sciences that embrace relativism, contingency, and indeterminacy (176). In this sense, she does something quite different from her contemporaries Pound and Eliot; she does not seek to model her fiction on science, but instead to use fiction as a vehicle for interpreting and interrogating our assumptions and beliefs about science and mathematics as well to explore their creative and aesthetic dimensions.

In some instances H.D. appears to privilege fiction writing over scientific communication; words, as Hermione suggests, supercede mathematical expressions in their ability to elicit emotional responses and assume multiple meanings. When her mother Eugenia divulges the poignant details of Hermione’s birth, every word is

weighted with meaning: “Words of Eugenia had more power than textbooks, than geometry, than all of Carl Gart and brilliant ‘Bertie Gart’” (89). And yet, while H.D. celebrates the creative, expressive, intuitive power of writing, it is also the deeply personal, almost confessional nature of writing that often drives her to take refuge in the less emotionally charged, value-neutral language of mathematics. Particularly in her attempts to represent the morally laden, socially contentious subjects of female sexuality and lesbian desire, H.D.’s narrator frequently relies on geometric imagery. She reappropriates the subject of geometry from a practice that alienates her (her failure to pass conic sections) to a mode of expression for her most intimate desires. These mathematical metaphors succeed in couching controversial subjects behind the authoritative, impartial discourse of science and also reinforce the inadequacy of ordinary language to convey the complexities of human experience, especially with regard to sexuality: “There were things she would never get into words, mixed up with mathematics” (17). Rather than functioning as empty signifiers, however, these geometric figures are crucial to H.D.’s effort to defamiliarize conventional representations of sexuality as biologically fixed and gender-based and at the same time to naturalize and normalize new, more fluid and multi-dimensional models of sexuality.

Hermione is introduced to Fayne at the same tea party she initially describes as overly calculated and confining; however, seeing Fayne actually changes the geometry of the room, opening up the space to new possibilities:

A face drew out of people grouped like teacups and people bisected by long lines of blue curtain...Across the table, with its back to the little slightly convex mirror, facing Her Gart and Jessie, was this thing that made the floor sink beneath her feet and the wall rise to infinity above her head. The wall and the

floor were held together by long dramatic lines of curtain falling in straight pleated parallels. (52)

Hermione cannot yet name this “thing,” this magnetic attraction to a “girl who *was* seeing Her” and whose stare seem to encode their mutual desire (52). In their entrancement with one another, they are suspended in time and space, liberated from the bisecting lines that once divided the room but now appear as straight parallels stretching to infinity. The room’s infinite expansion suggests the possibility of breaking from conventional relationship patterns and creating new social arrangements. While Fayne provokes Hermione to imagine new spatial (and sexual) orientations, George can only divide her from herself, offering no alternative to or transcendence from the existing structure of her life. Though she does have feelings for him, he cannot fully satisfy her desires: “She wanted George with some uncorrelated sector of Her Gart, she wanted George to correlate for her, life here, there. She wanted George to define and make definable a mirage, a reflection of some lost incarnation” (63). Up until this chance meeting with Fayne, Hermione looked to Gart to satisfy her unfulfilled desire, the “lost incarnation,” that had yet to materialize or to take shape. As in other instances, the narrator abstracts Hermione’s physical and emotional desires into a vaguely spatial image, and here this serves to emphasize that the part of her—the “sector”—that loved and desired George was only a fraction of her whole self. At least initially George seems to hold the promise of a “correlated” or “normal” life, but Hermione cannot suppress her intense attraction for Fayne, an attraction she communicates through the language of geometry.

When she kisses George, she does not feel transformed into another dimension as she does with Fayne: George’s kisses “smudged out circles and concentric

circle...The kisses of George smudged out her clear geometric thought but his words had given her something" (73). George interrupts her "clear geometric thought"—her visions of synchronized, concentric bodies—with his linear efforts to make love to her. Though George does inspire her to take up writing, Hermione describes their physical interactions as overly courteous and somewhat contrived: "the recurring, rather chivalrous really, kiss of George...doesn't affect the back of my head" (74). Even as she shares this intimate moment with George in the forest, her mind wanders back to the moment she and Fayne first met. Recharged with erotic tension, Hermione recalls that Fayne, "had made walls heave and walls fall and straight lines run to infinity in the polished surface left between groups of people talking" (74). Whereas arithmetic computations evoke anxiety, failure, and entrapment for Hermione, she begins to associate geometric figures with clarity, openness, and erotic energy. The narrator relies primarily on geometric terms to describe the intimate, bodily interactions between Hermione and Fayne during their only fully realized sexual encounter of the novel:

Her Gart saw rings and circles, the rings and circles that were the eyes of Fayne Rabb. Rings and circles made concentric curve toward a ceiling that was, as it were, the bottom of a deep pool. Her and Fayne Rabb were flung into a concentric intimacy, rings on rings that made a geometric circle toward a ceiling, that curved over them like ripples on a pond surface. (164)

For H.D. geometry is thus not only, as Hickman argues, "linked with erotic intensity," but rather *enables* the expression of "deviant" sexuality, safeguarding her sexual desires in a universally accepted, culturally authoritative idiom. As Susan Friedman writes, "desire—forbidden desire—cannot speak itself directly, in public," however, "fiction can

disguise forbidden desire so that it can escape the censor to find some sort of screened expression” (24). In *HER*, geometric figures encode the explicit details of Hermione’s sexual encounters while still offering readers veiled access to these intimate, private moments.

Although this novel went unpublished during H.D.’s lifetime (a fact that might suggest her effort to suppress her bisexual identity), her gesture toward geometry appears less an act of concealment than an attempt to naturalize homosexual desire and to frame it in unbiased, gender-neutral terms.¹¹ Just like the concentric circles that occur in nature—“on a pond surface,” for example—Her and Fayne are drawn into, “flung into,” a mutually supportive, symmetrical relationship. Unlike the divisive, phallic imagery she associates with George—“static, upright, parallel, the static upright tree shafts held parallel crossbeams of polished oak wood” (92)—the circular imagery she associates with same-sex coupling represents the appealing qualities of wholeness, equality, and dynamism. Though the language of geometry offers a degree of protective abstraction, H.D. hardly shies away from exploring lesbian desire as an alluring alternative to heterosexual monotony.

Suspended in time and space, H.D.’s geometric bodies are not only free from the typical constraints of societal expectation and judgment, but also more specifically from traditional demarcations of gender. Though modernist scholars insist on the correlation of mathematical imagery and masculinist aesthetics, what is so compelling about H.D.’s use of math, as well as that of the other women writers on whom I focus, is their insistence on math as a means of critiquing heterosexual and sexist culture as well as unsettling and denaturalizing conventional gender roles and relationships. Math is instead a contested discourse through which male writers often seek affiliation and

resolution and through which women writers such as H.D. envision escape from the burdens of gender. Indeed, *HER* renders problematic any easy equation of sex, gender and desire; concentric circles signify love, intimacy, and togetherness irrespective of any gender inflections.

This transcendence of the gendered body through geometry is taken to new heights in H.D.'s *Nights* (1935), in which the protagonist, Natalia, longs to be "embodied in long parallelograms and in square and cube and rectangle" to escape the pressures of heterosexual coupling and maternal expectation. As a semi-autobiographical novella about a woman's journey toward sexual self-discovery, *Nights* is strikingly similar to *HER*, though in many ways a more tragic depiction of a journey toward self-realization. Like Hermione, Natalia struggles with the burden of sexual choice. Unable to salvage her marriage to her unfaithful husband Neil, who has run off to Italy to rendezvous with a group of young male companions, she begins an intense, twelve-day affair with the much younger David in the hopes that he will assuage her despair, all the while struggling with her attractions to her sister-in-law's friend Una, who "with her damned homosexuality, had kept that other light burning in a secret crypt" (69). Natalia struggles to make sense of Neil's infidelity, speculating that she might have driven him away by her resistance to having children: "Was her fervour [for David], after all, an illicit escape, an inhuman intolerance of the casual, tiresome things of this life? Should she have Neil's children?" (53). Renne, her sister-in-law and confidante, tries to dissuade her from thinking about children as a solution to her marital problems: "I've told you a thousand times, that would spoil everything. If you have his child then *you* are woman, *he* is man, that's smashed" (46). Though Renne believes that Natalia and Neil simply need a "spot of good analysis," Renne also understands Natalia's desire to

resist conventional marital roles and recognizes her deep ambivalence about bearing children.

Natalia turns to David with the expectation that she can escape the “tiresome things in life” through a series of intense, but non-committal sexual encounters carried out over a string of nights. But she soon learns the self-sacrifice she must undergo in her lovemaking sessions with David: “she would hold her muscles tense, herself only a sexless wire that was one wire for the fulfillment” (51). Their non-reciprocal and even suffocating sexual encounters (“her breath was taken into his body, then she stopped breathing”) lead Natalia to pleasure herself once David has left (“after you left....then I excited myself more”) (63-4). In the description of her ninth evening with David, geometric imagery functions to restructure her relationship to David and to herself; she dreams of transforming herself via geometric reconfiguration—a transformation that suggests her desire for self-pleasure over self-erasure:

She must get away, must lie alone, must let lines and patterns and the two interlocked triangles of light and shadow, like the drawing-book illustration of light and shadow, draw her out. She wanted to watch triangles of light and shadow, on her ceiling. She wanted to lie, parallel with a ceiling and she wanted to be a parallel, running to infinity and never touching that twin other line. She wanted David there. But she must be free. (90)

Natalia longs to be transported to another reality and to be free, like a parallel line that never converges with the other. She longs, like Loy’s female subjects, for a sexual identity that exists apart from and is not defined by men. Her re-embodiment in “square and cube and rectangle” promises an escape from the physical constraints of femininity, and more specifically, as Hickman argues, from “childbearing and its

entailments” (167). The geometric simplicity and sleekness of her house offers her a model of ideal bodily form that bears none of the usual markers of identity:

The house was her spirit—she had never so loved any house. It was parallel and modern and ran level with lines of mountain, it was squares to be bisected and parallelograms and rhomboids. In the sparse and geometric contour of the house, there was all wisdom... She would be so embodied in long parallelograms and in square and cube and rectangle. She wanted those things. (90)

Rather than a tragic “erasure of the feminine,” this desire for geometric embodiment imagines a self-contained, self-fulfilled, and independent subjectivity (Friedman 270). Natalia’s desire for bodily transcendence and ultimately her death by suicide—both figured through geometric metaphors—are as much a comment on the physical and sexual restrictions imposed on women by a patriarchal culture as they are about what might be gained through denaturalizing and reconfiguring traditional gender and sexual roles.

In both *HER* and *Nights*, the fantasy of geometric embodiment is a radical solution to the problem of phallogentric power structures, though neither protagonist ultimately succeeds in overcoming the social pressures that characterize her existence. In *Nights*, for example, Natalia’s personal, introspective account of her affair, which makes up Part 2 of the novella, is filtered through the lens of a male writer, John Helsing, an acquaintance of Natalia’s who is asked to introduce her story (making up Part 1) and who provides the pseudonym for the novel’s initial publication.¹² John’s “scientific training” and his work as a publisher of “semi-popular scientific brochures” make him the rational, controlled counterpart capable of making Natalia’s “erratic” behavior and her “fervid stream-of-consciousness” prose more accessible to her

readership. John assumes the role of authoritative interpreter of Natalia's "mathematically simple" suicide, in which she skates "two straight lines, on a flat surface on an Alpine lake, running to infinity," or until the lines "met in a dark gash of the luminous ice-surface" (5, 10). The only way for Natalia to solve the "problem" of heterosexual coupling—the problem of how to make parallel lines meet—is through her symbolically charged suicide. John corroborates her motivation: "for all her erotic experiments, she could not make an equation that answered, only that last one, *two parallel lines meet*," but the "dark gash" in the ice "had demonstrated perfectly" (4-5). In her death, Natalia essentially chooses not to chose, refusing to constrain her fluid sexual identity and, at the same time, she surrenders control over her own self-representation, leaving behind a narrative which can now only be realized through masculine intervention.

Likewise in the conclusion of *HER*, metaphors of calculation reemerge and replace the dream of geometric transcendence. Also unable to resist the pressures of heterosexual norms, Fayne betrays Hermione by engaging in a brief affair with George. Hermione's response to Fayne's confession is one of cold calculation: "One I love, two I love. I am in love with...*nothing*" (219). An earlier, tender moment shared between them now appears to foreshadow this betrayal; reading aloud from Swinburne's "Itylus," Hermione pauses on the line, "*O sister my sister O singing swallow, the world's division divideth us*" (179). The "world's division" serves as a metonymy for the larger patriarchal culture that divides and creates competition among women, turning the affection Fayne and Hermione once had for one another into rivalry for the same male figure. To escape her romantic woes, Hermione schemes a plan to expatriate to Europe, which she imagines to be a "place for grown-up people" in contrast to America, which

still conjures anxious images of “desks with stooping shoulders” (232). She sees Europe as the antidote to American conformity and homogenization and characterizes the U.S. as one large scientific laboratory: “There was nothing in America for them but rows of desks and stabilization and exact formalization (Uncle Sam pressing things down in test tubes), there was nothing but standardization or dancing at a carnival...In between there were no nuances” (233). This characterization of America also implicitly refers to the regulation of gender and sexual practices: the rituals of heterosexual bonding—such as dances at carnivals—leave little room for “nuances” and demand “the exact fitting to one type” (233). Though a much more hopeful ending than *Nights*, Hermione’s plans for a new life in Europe are rendered ambiguous when she returns home to find Fayne “alone upstairs in [her] little workroom,” a potential threat to Hermione’s newfound resolve to be “at one with herself” and “with the world,” as she finds herself once again trapped by Fayne’s fickle affections (234). In some sense, then, Hermione moves from one convention (heterosexual marriage) to another (monogamous coupling), unable to escape the imposition of heterosexual patterns onto her romantic and sexual desires. As a whole, H.D.’s arithmetic and geometric imagery work in tandem to reveal the tensions between phallogentric and “concentric” modes of sexual discourse—that is, the tension between normative, determinate conceptions of sexual identity and more fluid, multi-dimensional formations.

Like many of her female contemporaries, as Mary Galvin suggests, H.D. understood that “modernism’s break with the structure of tradition could only be realized if sexual politics were understood to be among the major undergirdings of that structure,” and that “the continued privileging of masculinity would undo any modernist attempts to restructure our modes of perception” (63). Both *HER* and *Nights* identify

mathematical determinism, gender essentialism, and heteronormativity as part of the same phallogentric logic—a logic that leads Hermione to deem herself “a failure” and Natalie to plot her suicide. What H.D. does ingeniously is highlight the role of mathematics in the privileging of masculine authority and reasoning while at the same time repurposing the subject toward feminist, liberatory ends and, more specifically, toward envisioning new sexual and aesthetic paradigms. This entanglement of mathematics and sexual politics is where H.D.’s “geometrics” diverges from the approaches of her male contemporaries Pound and Lewis, and thus where my reading of H.D. differs from that of Miranda Hickman. Though Hickman acknowledges that H.D.’s geometric body “encodes a wish for sexual ecstasy” that can be seen as “liberatory and empowering” insofar as it “has nothing to do with maternal nurture,” she focuses on showing how this body encodes the Vorticist qualities of “severity, intensity, strength, and austerity” so forcefully advocated by Pound and Lewis (184, 248). Hickman further aligns H.D. with the masculine posturing of Vorticism:

[H.D.’s] geometric body seems to suggest a fantasy of imperviousness and detachment that compensates for a fear of fragility and pain. If the qualities of Vorticism are aimed to counter effeminacy, H.D.’s imagination here, celebrating Vorticist qualities through the construction of the geometric body, may analogously counter weakness and vulnerability. (184)

But it is precisely masculinist science—“Gart and the formula and Uncle Sam”—that H.D. critiques and against which she launches her feminist counter-aesthetic. Her geometric images emphasize openness and fluidity more than severity or stasis; they enable her artistic experimentation, her desire to “become the thing that is really irreconcilable, a sort of scientific lyricist” (*Nights* 24). For H.D., geometry is not a means

for detachment, indifference, or impersonality, deployed to fend off emotional vulnerability, but instead conveys a powerful desire to break from conventional sexual and aesthetic codes. Moreover, she reveals a desire not to be disembodied but embodied differently in relation to gender and sexual norms.

And yet, despite these powerful invocations for self-transformation and social change, it is hard to dismiss the ill-fated conclusions of both novels, and in particular, the protagonists' apparently inevitable return to convention, even in spite of their keen awareness of the constraining practices and rituals of heteronormative culture. What Lauren Berlant calls women's "love affair with conventionality"—their continual return to the performance of "normative, generic-but-unique femininity" in the hopes of feeling a sense of belonging through a shared struggle over "love's complexities"—provides a useful perspective for making sense of the attraction/repulsion dynamic that afflicts the protagonists of H.D.'s fiction as well as the female subjects of Newman and Loy's work (2, 6). Though Berlant's analysis of this phenomena focuses primarily on middlebrow fiction and film, the work of these characteristically modernist women writers illustrates a similar desire to form an "intimate public" in which women are "emotionally literate in each other's experience of power, intimacy, desire, and discontent, with all that entails: varieties of suffering and fantasies of transcendence; longing for reciprocity with other humans and the world; irrational and rational attachments to the way things are" (5). Though Loy and especially H.D.'s geometric imagery encodes a desire for escape from convention, these repeated tropes simultaneously work to construct some kind of external order that validates and normalizes desires that are perceived as deviations from the norm. Though modernist writing is often perceived as hostile to conventionality, these texts indicate a desire for belonging, solidarity, and normativity,

even if transposed onto new social configurations. This tension between “making it new” and establishing new aesthetic and social norms deserves further consideration, particularly if we are to build on our understanding of modernist writing a set of competing and often contradictory interests.

¹ Studies of “middlebrow” literature and culture have begun to emerge over the last twenty years, namely Joan Shelley Rubin’s *The Making of Middlebrow Culture* (Chapel Hill: University of North Carolina Press, 1992), and more recently, the essay collection *Middlebrow Moderns: Popular American Women Writers of the 1920s*, edited by Meredith Goldsmith and Lisa Botshon (Boston: Northeastern University Press, 2003), and from whom I draw the above characterization.

² Though Newman’s cause of death was initially reported as a cerebral hemorrhage onset by advanced pneumonia, later reports surfaced that she had died by accidental—and some even claimed intentional—overdose of a barbiturate called Veronal. Some newspapers exploited this rumor, calling her suicide attempt an unsurprising result of her spinsterhood and salacious imagination. In one writer’s sexist summation, Newman “had succumbed to futility, heightened with spinsterish complications,” or, as another wrote maliciously: “Like the types she wrote about—those deliberate sensualists, for example—she was above the vulgarity of reason. She simply wanted to die” (qtd. in Wade 18). Several of Newman’s close friends sought to defend her honor by putting together a report that documented her consultation with doctors just prior to her death. According to their typescript and Newman’s own personal letters, doctors had diagnosed her with inflammation of the optic nerve days before she passed away—a condition that likely lead to her cerebral hemorrhage, the ultimate cause of her death. That so much controversy surrounded her death suggests that Newman had made quite a polarizing impression on her audiences in her short-lived career.

³ Among the most scathing reviews was that of Elmer Davis, who considered the novel a blasphemy against the South: “Only a Southerner can appreciate it fully,” later adding that “every line of this is grounds for lynching, unless Georgia and the South have lost their pristine vigor” and that she has “committed treason against her fatherland” as well as “against her sex” (449). The Baptist Convention of Georgia echoes this criticism, though in much less sensational terms, calling the novel “blasphemous stuff which reeks with vulgarity and with unmentionable implications” (qtd in Blake 308).

⁴ From *Sentimental Tommy* she learns only that “Tommy ran away with Grizel because Grizel would have ceased to be respectable if she had run away alone,” and it is this relatively benign revelation about the sanctity of marital sexuality that leads almost immediately—and quite contrastingly—to her disillusionment about her “delicate line” and its connection to reproduction (Newman 35).

⁵ See Lauren Berlant’s *The Female Complaint: The Unfinished Business of Sentimentality in American Culture*. Durham: Duke University Press, 2008.

⁶ Critics often align Loy with the American modernist movement. Virginia Kouidis, for example, claims: “Although British by birth, Mina Loy has been considered an American modernist poet since her arrival in New York in 1916” (167). According to Kouidis, Loy’s innovative work found a more sympathetic audience in America and a home in several American little magazines (167). Virginia Kouidis. “Rediscovering Our Sources: The Poetry of Mina Loy.” *boundary 2*, 8.3 (1980): 167-188.

⁷ See, for example, Miranda Hickman’s *The Geometry of Modernism*, Sheri Benstock’s *Women of the Left Bank, Paris 1900-1940*. Austin: University of Texas Press, 1987, and Julie Schmid’s “Mina Loy’s Futurist Theatre.” *PAJ: A Journal of Performance and Art*, 18.1 (1996) 1-7.

⁸ Suzanne W. Churchill. *The Little Magazine Others and the Renovation of Modern American Poetry*. Hampshire: Ashgate Publishing Ltd, 2006, 205-6.

⁹ See Linda A. Kinnahan. *Poetics of the Feminine: Authority and Literary Tradition in William Carlos Williams, Mina Loy, Denise Levertov, and Kathleen Fraser*. Cambridge: Cambridge University Press, 1994, 50.

¹⁰ Barbara Guest, *Herself Defined*, 5.

¹¹ Rachel DuPlessis and Susan Friedman speculate that H.D. might have chosen not to publish this novel because she did not want to compromise or disguise her open “celebrations of lesbian eroticism,” which were likely to be censored by publishers and which might alienate her readers, as it had for her contemporary Radclyffe Hall (103). See Susan Friedman, *Penelope’s Web: Gender, Modernity, H.D.’s Fiction* (Cambridge: Cambridge University Press, 1990), 102-104.

¹² According to Susan Friedman, “H.D. privately printed 100 copies of *Nights* in 1935 under the name John Helsforth, a screen which particularly delighted her, even though it surely couldn’t have deceived the friends to whom she sent copies of the book” (270).

Chapter 3:
“Numbers Have Such Pretty Names”:
Gertrude Stein’s Mathematical Poetics

In this chapter, I argue that the now familiar descriptions of Stein’s writing as modeled on science—accounts of how her work draws on neuroscience or psychology, for example—tend to overlook the extent to which her work illustrates congruencies among different fields, particularly between mathematics and writing. It is not so much that she borrows from or models her writing after the methods and idioms of mathematics, but that her work is *about* the convergence or points of intersection between these two realms, at a time when both literature and mathematics are seeking a more robust disciplinary foundation.¹ Mathematics functions in Stein’s work neither simply as an analogy for writing methods nor as a mere aesthetic tactic; instead, she deploys mathematical concepts and methods to explore the structural, syntactical, and semantic possibilities of linguistic expression, and, as importantly, to reinforce the feminist perspectives that underpin her fiction and poetry and to consider fundamental aspects of subjectivity and perception.

I thus share with scholars such as Steven Meyer, Maria Farland, and Jennifer Ashton an interest in exploring Stein’s writing as conversant with contemporaneous scientific and mathematical developments; however, my goals differ in two significant ways. The first is that my focus is less on tracking “the circulation of intact ideas” between disciplines and more on how Stein’s work reinforces literature and mathematics as what Gillian Beers calls “open fields”—fields whose parameters are continuously under revision and subject to transformation through their interactivity.² What connects Stein to her mathematical contemporaries—namely Bertrand Russell, Alfred North Whitehead, Georg Cantor, Gottlob Frege, and theoretical physicist Niels Bohr—

more than a common search for order, exactitude, and determinacy, is a struggle over the representational limits of language and an awareness of the interdependency of ordinary language and mathematics. In other words, they are connected more by logical ambiguities and linguistic paradoxes than by any of the conclusions of their work. This perspective might thus help to resolve some of the ongoing critical debates about how to categorize Stein's work. Critics have tended to position her fiction as either committed to "the determinacy of meaning" (Jennifer Ashton) or to a "poetics of indeterminacy" (Marjorie Perloff), and accordingly label her either a modernist or proto-postmodernist. However, placing her work alongside these contemporaneous mathematicians offers a way to understand this determinacy/indeterminacy dialectic as a defining characteristic of both modern literary and mathematical inquiry rather than as a divisive wedge separating rival literary or mathematical paradigms.

My analysis also diverges from approaches that focus primarily on explicating the formal qualities and methods of Stein's work. Though I am likewise interested in exploring Stein's formal techniques, I also show how her engagement with mathematics also leads us to reconsider the content or the referential aspects of her writing. More specifically, I explore how she draws on concepts in set theory, logic, and arithmetic to critique patriarchal literary standards, to explore the dynamic between individual perception and external reality, and to consider the ontological status of subjects and objects, individuals and things.³ For Stein, mathematical thought and expression are crucial to how we perceive ourselves as individuals in relations to others and to how we make sense of external reality.

I begin by tracing Stein's own assessment of the relationship between her writing and mathematical thought as well as some of the more recent criticism on her

scientific impulses, using both to contextualize my understanding of her critical responses to various fields of mathematics as they arise in works such as *Q.E.D.* (1903), *Tender Buttons* (1914), “Patriarchal Poetry” (1927), “Four Saints in Three Acts” (1932), and *The Geographical History of America* (1936). I show how the shift in her fiction from more realistic modes of representation (e.g. *Q.E.D.*) toward greater and greater abstraction (e.g. *Tender Buttons*) coincides with her move away from a realist conception of mathematics and toward a non-Platonist, material-discursive view of the discipline.⁴ Paradoxically, her move toward abstractionism leads her to engage more fully with questions of subjectivity, materiality, embodiment, and cognition—experiential phenomena that are for Stein indivisible from the subject of mathematics.

I.

Stein’s critical assessment of her own work, to which she devoted much attention throughout her career, stresses the connection between her writing and mathematics. As she notes in *The Autobiography of Alice B. Toklas* (1933), “In Gertrude Stein, the necessity was intellectual, a pure passion for exactitude. It is because of this that her work has often been compared to that of mathematicians” (A 198-9). But this is a comparison that Stein observed more readily than her readers, considering that a number of her contemporary critics often deemed her work meaningless or senseless rather than noting its exactitude, precision, or formality.⁵ Despite perceptions that her writing is primarily an exercise in disrupting conventional modes of grammar, syntax, and narrative construction, Stein and other more sympathetic critics have argued persuasively that there is a carefully conceived method to her presumed literary madness, even if the effect of this method can indeed sometimes be maddening. In her

1935 essay “How Writing is Written,” Stein explains her overarching effort to achieve the kind of semiotic precision attributed to mathematics:

While I was writing I didn’t want, when I used one word, to make it carry with too many associations. I wanted as far as possible to make it exact, as exact as mathematics; that is to say, for example, if one and one make two, I wanted to get words to have as much exactness as that...I made a great many discoveries, but the thing that I was always trying to do was this thing. (H 157)

She not only suggests an effort to achieve a close correspondence between word and referent—so that each word does not “carry with too many associations”—but also offers a basic formula for sentence construction to emphasize the idea that each unique word (each “1”), when put together in a particular sequence, can add up to different meanings (as in $1+1=2$). It is not just the individual word that counts, but also that its associations with other words combine to create different meanings and effects.

Those familiar with Stein’s writing know well that she trades metaphoric richness and referential transparency for calculated repetition and syntactical rearrangement. She approaches each word as an individual unit that can be combined with other units to form a sequence, even if that sequence does not add up to a cohesive idea: “I took individual words and thought about them until I got their weight and volume complete and put them next to another word” (TI 15). This metaphor is significant to understanding the mathematical nature of Stein’s methodology: meaning and connotation—what she calls weight and volume—are literally translated into a mathematical procedure. Stein understood this method as a distinctive feature of her writing; her critical essays repeatedly emphasize this highly self-conscious effort to explore the structural similarities between mathematical and linguistic expression.

Her admission of mathematics' role in her literary experimentation has no doubt fueled scholarly attention to its various manifestations in her writing, as has Stein's background in science and her continuing relationships to psychologist William James (under whom she studied) and mathematician Alfred North Whitehead (whom she befriended and stayed with for an extended time after England declared war on Germany in WWI). Scholars such as Steven Meyer and Maria Farland argue for the importance of considering her stylistic conventions and devices in light of her earlier career as a medical student and researcher and in the context of contemporaneous developments in medical and neuropsychological science. Meyer argues that her writing was not just informed by science, but "turns out to be a form of experimental science itself" (xxi). For Meyer, Stein's work, like that of William James in psychology and Alfred North Whitehead in mathematical philosophy, should be seen as part of a larger tradition of "poetic science" or scientific experimentalism, which sought to radicalize nineteenth-century empirical science and to consider the role of experience as integral to the construction of knowledge rather than simply as a medium through which knowledge is obtained or transmitted. While Meyer acknowledges that Stein's "fundamental intuition' remained scientific," he ultimately aims to show that her background in neuropsychology provided the foundation for her later attempts to challenge traditional scientific conventions (4).

Robert Chodat has taken issue with approaches like Meyer's that privilege science as the primary context through which to understand Stein's work; in contrast, he justifies her "enigmatic writings without dubious appeals to 'exactitude' and mathematics" (582). Chodat challenges claims that her work is "scientific," asking whether her texts "could actually be used in the formation of general predictive

hypotheses” or if we could “even *repeat* it to see if we could achieve the same outcome” (592). He concedes that “[n]o literature is ‘scientific’ in the sense I have just described,” because it lacks the nomological function that “makes science ‘scientific,’” adding that “[w]e should not expect portraits of persons to be as sharply predictive as scientific accounts of other phenomena, nor be disappointed when they fail to live up to such demands” (592). According to Chodat, Meyer’s “impoverished” understanding of scientific inquiry as primarily a descriptive enterprise ignores one of its most important functions: to predict or “anticipate future phenomena” (591). But Chodat’s own limited conception of scientific inquiry focuses more on the applications and the accuracy of scientific results than on the processes and practices through which scientific knowledge is constructed and communicated. He also dismisses a long tradition of interdisciplinary investigation, particularly within science studies, that illustrates the reciprocal conceptual and methodological influences of art and science. While considering Stein’s writings *as science* is problematic for some of the reasons Chodat identifies, his reading disregards Meyer’s effort to show how questions of knowledge, experience, and observation cut across seemingly distinct domains, belonging no more to science than to literature, and thus necessitating the placement of Stein’s work in the context of these competing and overlapping modernist discourses. Stein scholars need not “appeal” to science in order to explicate her work, but they need to recognize the interplay of literary and scientific impulses already present in her writing.

Whereas Meyer and Farland highlight the link between Stein’s experimental fiction and her early scientific training, Jennifer Ashton shifts from a biographically centered analysis to a more historicist and formalist approach that considers Stein’s work as contiguous with certain aspects of modern mathematics. One of the few

scholars to consider Stein's engagement with mathematical ideas in any kind of sustained way, Ashton focuses on Stein's persistent interest in the idea of wholeness, which shifts among literary, philosophical, and mathematical contexts. For Stein, she argues, "these categories were not distinct; the grammatical question of what counts as a completed sentence is as central to defining the conditions of wholeness as the mathematical question of what it means to count" (288). Stein herself explains this interest in wholeness in "How Writing Is Written":

You see, I had this new conception: I had this conception of the whole paragraph, and in *The Making of Americans* I had this idea of a whole thing. But if you think of contemporary English writers, it doesn't work like that at all. They conceived of it as pieces put together to make a whole, and I conceived it as a whole made up of its parts. (H 153)

She reinforces this effort to treat each word as a unique entity or integer that plays a distinct part in the sum of the paragraph. In *The Making of Americans*, Stein attempts to capture a "history of every one" by accumulating and repeating particular descriptions that make up a whole person. As Ashton observes, "the projected history of everyone becomes a projected list of kinds of persons," as every *one* in Stein's words is "a part of some kind," and thus part of "a universal grouping" (298). Though not explicitly stated in Ashton's article, the mathematical ideas she considers central to Stein's work are strikingly similar to the basic premises of set theory, which were introduced primarily by Georg Cantor in the 1880s.⁶

Before returning to the subject to Stein criticism, I want to first offer a brief overview of the basic premises of set theory as well as examples from Stein's writing that share these characteristics, both to illuminate the structural impetus behind much

of her experimental writing and also to demonstrate her sustained interest in the connections between mathematics and grammar. In an 1874 paper, Cantor made the important discovery that not all infinite sets are the same. For example, he showed that the set of all real numbers has a higher *power* or *cardinality* (or is, in a sense, larger) than the set of rational fractions.⁷ In order to describe the cardinality of sets, Cantor introduced the concept of *countability*, whereby a set is *countable* only if it has the same number of elements as the set of all positive integers.⁸ His early work on infinities led him to this general conclusion, offered in an 1883 lecture: “every set of distinct things can be regarded as a unitary thing in which the things first mentioned are constitutive elements” (Johnson 36). This relation of a part to its whole within set theory is called *membership*; for example, the set of all British novelists is a member of the set of all novelists. A set is defined by its elements, and the number of elements determines the power or cardinality of the set. This basic notion—the idea that mathematical objects can be grouped according to sets—gave rise to a distinct branch of mathematics devoted to the formalization of all mathematical concepts and inspired questions about the foundation of mathematics that were taken up by logicians such as Russell, Whitehead, and Gottlob Frege. For these mathematicians, set theory offered a means to establish elemental principles that would provide validity for the whole of mathematics. Comparably, Stein experiments with the most basic ingredients of composition—the interplay of words, phrases, syntax, and punctuation—as a means of determining the semantic permutations of a particular phrase or sentence.

Her specific interest in sets and their constitutive elements arises not only in *The Making of Americans* but also in her 1923 poem “Are There Arithmetics,” an early exercise in considering the relations of smaller to larger sets of linguistic elements—

smaller to larger groups of syllables, words to sentences, sentences to lines or sections—all of which are part of the whole piece. An excerpt of the poem reads:

Are there arithmetics. In part are there
arithmetics. There are in part, there
are arithmetics in parts.
Are there arithmetics.
In part
Another example.
Are there arithmetics. In parts.
As a part.
Under.
As apart.
Under.
This makes.
Irresistible.
Resisted.
This makes irresistible resisted. Resisted. (AR 198)

Lines 2-5 are all “parts of” the first and longest line. While lines 1-5 become progressively shorter, relying on fewer words in each line, each set of words connects to the previous line by way of its relation to the first. The syntactical reordering allows each word to serve different roles within the structure of the sentence so that no hierarchy is created among the words and no regular or fixed pattern dictates their position as the poem “progresses.” In line 6, Stein offers “another example” of the “arithmetics” of linguistic expression. “As a part” and “as apart” use the same letters of the alphabet and contain the same number of elements but yield different meanings, demonstrating the possibility of multiple answers to the same grammatical equation (and perhaps why Stein pluralizes the word ‘arithmetic’). Judy Grahn points out Stein’s demonstration of the “correspondence between small numbers being a part of larger numbers, and small groups of syllables being a part of larger groups of syllables” in lines 13-15, as “the ‘resist’ is part of ‘resisted’ is part of ‘irresistible’—and then irresistible itself is a part of the larger language structure” (255). For Stein, each part is

critical to the whole; the repetition and re-ordering of words typical of her writing insures that her readers pay attention to the particular construction of each part rather than the collective meaning or the sum total of the piece.

Considering her work in relation to basic set theoretic ideas also provides a context for understanding some of her lesser known books such as *To Do: A Book of Alphabets and Birthdays* (1940) and her libretto *Four Saints in Three Acts* (1932). In *To Do*, a children's book, Stein moves through each letter of the alphabet, under which she associates four proper names—"B is for Bertha and Bertie and Ben and Brave and a birthday for each one" (AB 5). Names and birthdays are common denominators of identity, and this is what unifies all the individuals described in the text: "And so each one had to have one one birthday...even their mother Bertha had to have one" (5). Stein moves from the largest set (all those with names and birthdays) to subsets (all those whose names begin with a particular letter from the set {A, B, C...X, Y, Z}). Each individual is then further distinguished from another by a set of particular characteristics: "Orlando liked to lick stamps but he did not like to keep them, Olga hated stamps, Only liked stamps but he could not read" (36). Stein thus calls attention to various modes of identity categorization and the common impulse both to classify and individuate. As I later show in works such as *Q.E.D.* and *The Geographical History of America*, this interest in mathematical concepts is as much a formal exercise as it is her way of reflecting on questions of subjectivity and self-perception:

There were two brothers and two sisters James, Jonas, Jewel and Jenny, they used to quarrel about which was the biggest, they used to quarrel about which was the oldest they used to quarrel about which was the tallest they used to

quarrel about which was the smallest and when they quarreled they used to say that they would take away each other's birthday. (20-1)

These siblings are grouped not only by their relation to one another but by the first initial of their names, though they attempt to differentiate themselves from one another according to size and age, only to threaten each other with the removal of their unique birth dates. Even in the most playful of texts like *To Do*, the underlying structure bears close resemblance to a fundamental problem of set theory: determining whether a set can be characterized based on the properties of its members.⁹ The key difference, however, is that Stein focuses on *distinguishing* elements (i.e. persons) of a set (groups or populations), while mathematicians are generally more concerned with establishing the *properties* of sets rather than the objects that make up a set.

In *Four Saints in Three Acts*, Stein focuses principally on two saints, St. Therese and St. Ignatius, references thirty-some saints, both real and fictional, and includes four acts. While the title might thus seem to be a misnomer, it highlights the opera's preoccupation with the division and quantification of characters and acts, as reflected by recurring questions such as, "How many acts are there in it," or "How many saints in all." More specifically, the title refers to subsets of elements—saints and acts—contained within the whole text. According to Katherine Kelly's account of the opera's production history, "Virgin Thomson commissioned Stein to write the libretto for the opera. The two collaborators eventually settled on the subject of saints, Stein selecting her two favorites—Teresa of Avila and Ignatius of Loyola" (363-5). Stein's libretto dramatizes this same constructive process of identifying a broad category—the subject of saints—selecting a specific number of saints from all possible saints, and then putting the subjects into a narrative. As the opera opens:

In narrative prepare for saints.
Prepare for saints.
Two saints.
Four saints. (S 41)

Similarly, the final lines of the last act alternate between specific quantitative descriptions of saints and generic, indefinite descriptors:

All Saints.
 To saints.
Four Saints.
 And saints.
Five Saints.
 To saints.
Lact Act.
Which is a fact. (S 86)

‘All,’ ‘four’ and ‘five’ are quantitative values that are opposed—both figuratively and spatially—to the ambiguous preposition ‘to’ and the conjunction ‘and,’ exemplifying her continual exploration of the relation of parts and wholes, and specifically the relation of individual to group identity.

Stein also calls attention to the division of dramas into sections by using a non-systematic, non-sequential ordering of scene numbers. Act 1 concludes with a directive to “Repeat First Act” and multiple instantiations of acts and scenes arise throughout the text. For example, in the second version of Act 2, there are nine instantiations of Scene 5, suggesting that all of the content under each section is a part of Scene 5:

Scene 5

There are many saints.

Scene 5

They can be left to many saints

Scene 5

Many saints.

Scene 5

Many many saints can be left to many many saints scene five left to many many saints

(S 59)

As is common in Stein's self-referential experimentalism, the scene number or the ordering of scenes often become part of the content of that particular scene, as shown above in the last line, "scene five left to many many saints," or later in Scene 7, which begins, "One two three four five six seven scene seven. Saint Therese scene seven" (S 61). Here Stein refers to traditional modes of dramatic presentation in which scenes build on one another in sequential order—the typical modes of narrative and character development she resists—so that the content of this scene, as with many others, entails the process of constructing its form. As with many of her works, the process of its construction makes up much of the text's content.¹⁰

In *Four Saints in Three Acts*, numbers are pivotal to the form as well as the content, functioning structurally to "order" the play and also thematically as descriptors of the saints. These numeric descriptions function as much to individuate the saints as to organize them according to groups, as indicated at the beginning of the opera:

Four saints are never three.
Three saints are never four.
Four saints are never altogether.
Three saints are never idle.
Four saints are leave it to me.
Three saints when you see.
Begin three saints.
Begin four saints.
Two and two saints.
One and three saints. (S 43)

Stein delights in the definitude of numbers as descriptors of her subjects, stressing that four is not identical to three and vice versa, or that two and two saints adds up to four, just as one and three saints does as well. The saints do not perform actions in the opera

so much as they determine their relations to one another through various quantitative and spatial qualities, including position (“Saint Therese seated and not surrounded”), distance (“One two three. There is a distance in between”), time (“St. Therese. In a minute.”), and number (“St. Ignatius and one of two.”). These qualities are strikingly similar to Aristotle’s ten categories of being, among which are such categories as quantity, relation, time, position, and place, and about which many subsequent philosophers (Kant, Heidegger, Husserl, to name only a few) have ruminated and revised.¹¹ Stein intervenes in this ongoing philosophical dialogue by similarly considering how language—whether ordinary or mathematical—mediates and even constructs these categories of being. The “nature” of being, she suggests, cannot be understood outside of a representational system. She is also interested in how individuals define themselves in relation to one another and to the world—relations that for her assume physical, material, and spatial forms and can thus be observed, measured, and quantified.

As a whole, the opera highlights both the fundamentally quantitative “ingredients” of narrative form—time, space, structure, and sequence—and the quantitative aspects of the self in relation to other. The prologue establishes for the reader that the opera as a whole comprises a narrative: “In narrative prepare for saints,” and further down the page, “What happened to-day, a narrative,” and several pages later, “A narrative to plan an opera” (S 41, 45). The opera playfully enacts the definitional qualities of narrative, defined by the *Oxford English Dictionary* (*OED*) as “an account of a series of events, facts, etc., given in order and with the establishing of connections between them.”¹² The enumeration of saints throughout the text quite literally offers an *account* of the saints that unfolds in a *series* of grouped statements that

establish the relations among them. As the saints all gather together at the opera's conclusion, Saint Therese recognizes the importance of quantitative analysis to the structure and organization of individuals in a group: "The sisters and saints assembling and reenacting why they went away to stay. One at a time regularly regularly by the time that they are in and in one at a time...Saint Therese. It is very necessary to have arithmetic inestimably" (S 84). As Saint Therese observes, assembling the saints according to space ("they are in"), time ("by the time"), sequence and number ("one at a time") requires quantitative description. Here, Stein stresses arithmetic or quantification as a *mode* of expression rather than as a determination. Her numbers ultimately never add up to anything, just as the narrative never "progresses" in the traditional sense.

It with this interest in exploring Stein's developing sense of the open-endedness of mathematical thought and expression that I return to Jennifer Ashton's critical perspective. For Ashton, the correspondence between Stein's literary project and the mathematical philosophies of her contemporaries situates her writing firmly in the context of modernism, complicating recent criticism that claim her as a postmodernist *avant la lettre* or as a pioneer of linguistic indeterminacy. Ashton argues that poststructuralist readings of Stein disregard her commitment to a poetics of determinacy—one that she claims Stein reinforces through her appeal to mathematics. She understands Stein's expressed effort to make her writing "as exact as mathematics" as what Stein "thinks of as its absolute determinacy" ("Writing" 4). I argue, however, that Stein, especially in her later fiction, uses numbers as descriptive tools in a way that parallels a contemporaneous shift in mathematical philosophy: away from an object-oriented focus—the study of mathematical things and their properties—towards a more

complex linguistic foundation—studying the effects of the ambiguous nature of language on mathematics. In other words, Stein reinforces the convergence of mathematics and language made apparent through the logicist program of mathematicians such as Frege, Russell, and Whitehead. Moreover, exploring what Stein writes *about* mathematics rather than how she employs some of its concepts suggests that she comes to understand mathematics less as a paradigm of determinacy and more as a descriptive tool integral to how we make sense of the natural and social world. Stein admittedly never solves the “problem of approximation” nor locates some absolute measure of determinacy; instead, her quest for exactitude leads her again and again to the representational paradoxes and limits that both mathematics and writing encounter. While she might aim for an exactitude of reference analogous to a mathematical equation—so that “one and one make two”—her systematic use of self-referential language is in direct tension to the linguistic exactness she seeks.

Consider, for example, her famous line, “a rose is a rose is a rose,” which is more than just a simple repetition of phrases.¹³ While Stein considers this sentence as an attempt to link firmly the quality of ‘rose-ness’ to the word ‘rose,’—or to establish what Pound called “the thing-ness of the thing”—the sentence elicits a certain ambiguity with regard to how we read it: either as ‘a rose is a rose’ *is* a rose, or, a rose *is* ‘a rose is a rose.’ Because the phrase circles back on itself, it is unclear to the reader which part of the phrase is being described as having a rose-like quality. Countless other self-referential statements and passages, including in particular those discussed above in *Four Saints and Three Acts*, create ambiguities that undermine her efforts toward precision and exactitude. Though Ashton acknowledges that Stein’s writing generates “indeterminate effects,” she maintains that these are counter to Stein’s intentions and thus challenges

the “prevailing critical view of [Stein’s] work, which sees her interest in the ‘liveliness’ of words as a commitment to “the poetics of indeterminacy” (“From Modernism” 28). She instead aligns Stein’s goals with those of Russell and Whitehead, who likewise sought a determinate logical grammar: “her commitment to the autonomous text is directly bound up with an account of language that insists that, like symbols in Whitehead and Russell’s vision of a logically perfect language in *Principia Mathematica*, words and their meanings stand in a relation of one-to-one correspondence” (28). But this “vision” only represents part of their scientific realizations; what connects Stein to her scientific contemporaries has as much to do with their goals as their failures.

The logicians of Stein’s era also come up against the limits of linguistic determinacy in their attempts to create an unambiguous mathematical language. While the problem of assigning truth values to self-referential statements is classical, it became a fundamental concern for mathematicians such as Russell and Frege, who sought to axiomatize set theory. Statements referring to themselves, such as “this statement is false,” are logically problematic because their truth value is indeterminate; to claim the statement is false is to admit its truth, and to say the statement is true is to admit it is false. Ultimately, these mathematicians realized the inevitability of such ambiguous statements, and while these discoveries did not interrupt the everyday practice of “doing mathematics,” they had a profound effect on the philosophy of mathematics, which now required a much more careful treatment of language, particularly in dealing with self-referential statements. Comparably, Stein’s literary experiments appear to yield different results from those she perhaps intended because her commitment to exactitude paradoxically produces a surplus of linguistic meaning. She is, like these scientists, attentive to the slipperiness of language—to referential excess—*because of*, but not in

contradiction to, her efforts toward precision and exactitude. The very nature of the efforts of these mathematicians to achieve a logically perfect language forces them to confront the semantic imperfections that stand in their way. The dual impulses that critics have observed and debated about in Stein's writing—the tension between linguistic exactitude and ambiguity—are not problems in need of resolution but rather characteristic tendencies of modern scientific inquiry.

Recent criticism on Stein has invested in a critical tug-of-war over which literary movement she best fits—modernism or postmodernism—according to the extent her fiction commits to a poetics of determinacy or indeterminacy. While I agree with scholars such as Ashton and Nicola Pitchford that we significantly limit our understanding of Stein by removing her from the context in which she wrote, fitting her writing into either paradigm tends to undermine the changes *within* Stein's writing—her moves from realist modes to non-mimetic ones—imposing a coherency on her writing that suits the agreed upon tenets of that particular literary movement more than it does her actual body of work. Three crucial aspects complicate the classification of Stein's writing according to such broad categories: her writing draws from and later rejects nineteenth-century notions of literary representation; it comes to define a “modern” aesthetic while also remaining on the periphery of the modernist movement; and it anticipates fundamental aspects of postmodern writing, even if it does not consistently embrace what Marjorie Perloff has called her “poetics of indeterminacy.” Stein's engagement with mathematical philosophies reveals her investment in ideas that transcend literary boundaries. Indeed, her numerous non-fiction essays are less concerned with defining a modernist aesthetic than they are with defining universal qualities of writing and meaning-making. More specifically, as I show, the shift in her

writing from realism to abstraction corresponds to a shift in her representations of mathematics from a Platonist perspective to a less determinate, non-realist conception of the subject. Mathematics figures centrally in the development of her abstract writing at the same time that it provides her with the rhetorical and conceptual tools for exploring social, material, and subjective experience.

II.

While Stein is known mostly for her radical experimentalism, her earliest attempts at fiction, such as *Q.E.D* and *Fernhurst*, draw significantly from the traditions of American realism and naturalism. Written in 1903, *Q.E.D.* is considered Stein's first novel, though it remained unpublished until 1950 (four years after Stein's death) due, scholars speculate, to its "overt, realistic, autobiographical lesbian content" (Dekoven, "Preface" *xi*). The original title *Q.E.D.*, later changed to *Things As They Are*, refers to the Latin abbreviation of the phrase, "which was to be demonstrated," formerly used at the end of mathematical proofs to indicate that something has been proved definitively. The title, along with the third person, past tense narration, gives the reader the sense that the characters have little control over their fates and that the story's conclusion is inevitable, as is typical in naturalist novels. The story is divided into three sections, each following one of three women—Adele, Mabel and Helen—who develop intimate friendships after traveling together on a steamship to Europe. Further drawing on the naturalist tendency to create characters whose lives are genetically and socioeconomically predetermined, the personalities of Stein's characters are physiognomically determined, or linked to their physical characteristics. The narrator introduces readers to Mabel through a detailed description of her face:

It was pale yellow brown in complexion and thin in the temples and forehead; heavy about the mouth, not with the weight of flesh but with the drag of unidealised passion, continually sated and continually craving. The long formless chin accentuated the lack of moral significance. If the contour has been a little firmer the face would have been baleful...It would never now express completely a nature that could hate subtly and poison deftly. (Q 179)

All three women struggle with the expression of their emotions and with keeping their instincts and passions in check. Stein describes Helen as “a woman of passions but not of emotions, capable of long sustained action, incapable of regrets” (Q 179). The main character, Adele, who some argue is a stand-in for Stein, struggles to suppress her irrational impulses and to maintain, when she explains to Helen, “the middle-class ideal which demands that people be affectionate, respectable, honest and content, that they avoid excitements and cultivate serenity” (181). As Adele also asserts, “The whole duty of man consists in being reasonable and just” (180). Her passions and instincts take over, however, as Adele develops intense feelings for Helen and burning resentment toward Mabel, who maintains a closer connection to Helen.

Q.E.D., however, becomes more than simply an ironic title referring to the *irresolvable* love triangle at the center of the story because it comes to represent the deterministic worldview—figured as a mathematical proof—that Adele adopts by the novel’s end. This perspective emerges early in the story when Helen kisses Adele and Adele considers the kiss a result of outside forces rather than inner desires:

‘Oh’ began Adele slowly ‘I was just thinking.’ ‘Havent you ever stopped thinking long enough to feel?’ Helen questioned gravely. Adele shook her head in slow negation. ‘Why I suppose if one can’t think at the same time I will never

accomplish the feat of feeling. I always think. I don't see how one can stop it... 'Well' Adele put it tentatively 'I suppose it's simply inertia.' (186)

As Adele wonders if it is 'inertia' that brought them together, she "stopped thinking" and experiences a kind of epiphany, realizing her inability to control her irrational or emotional impulses. For Adele, fate draws two people together just as a mathematical equation works itself out: "Why...it's like a bit of mathematics. Suddenly it does itself and you begin to see" (186). Like a mathematical solution, Adele's relationship with Helen appears laid out before her, predetermined. Mathematics is thus represented as a complete and self-generative system—something that "does itself" without or prior to human interference. Mathematics serves in this novel as proof of a constant and transcendent reality—an external world whose force is greater than individual will. Adele reinforces this notion in the novel's conclusion when she responds to Helen's last letter: "Hasn't she learned that things do happen and she isn't big enough to stave them off...Can't she see things as they are and not as she would make them if she were strong enough as she plainly isn't" (227). Adele now sees the "dead-lock" between these three women as inevitable, as that "which was to demonstrated." That *Q.E.D.* draws on a deterministic model of mathematics as the primary means for understanding its fatalism is crucial to understanding how Stein's attitude towards mathematics plays a role in shaping her narratives.

In *Tender Buttons* (1914), one of her early and most recognized experimental works, Stein moves away from the notion of a fixed, determinate reality "behind" language to the notion of a reality defined through language. As Christopher Knight argues, *Tender Buttons* marks her transition from the classical to the modern episteme.¹⁴ According to Knight, this text is "constructed upon some rather classical premises of

perception,” reinforced by its emphasis on “color, difference, space, time, measure, meaning, substance, use, necessity, etc.,” or those qualities “most identifiable with the classic episteme” (36). He also points to Stein’s expressed goal of “really knowing what a thing was” and defining that object through the “seemingly more material and spatial qualities of number, measure, weight and difference” as evidence of the text’s foundation in classical epistemology (37). In “Colored Hats,” for example, one can see this attention to quantitative description: “Colored hats are necessary to show that curls are worn by the addition of blank spaces, this makes the difference between single lines and broad stomachs, the least thing is lightening” (TB 473). And yet, Stein shows little interest in using these qualities to conjure an accurate picture or a realistic representation of reality; there is hardly a direct correspondence between the objects and their descriptions. While the descriptions emphasize material, physical, and sensory qualities, they read more like passing observations than a list of the object’s determinate properties. Consider, for example, the opening sentence of “Milk”: “A white egg and a colored pan and a cabbage showing settlement, a constant increase” (TB 487). As her use of the present tense emphasizes, she is primarily interested in capturing phenomena rather than the inherent attributes of a particular thing.

Knight likewise concedes that Stein does not “do what she set out to do: to make the word be the thing. That she is, though she is hesitant to admit it, much more engaged in the making of metaphors, of substitutions, than she is in the making of nonlinguistic things” (43). For Knight, *Tender Buttons* both represents “the culmination of the classical episteme” and marks a crucial shift in her conception of language: “Stein is beginning to conceive of language in a different way, not the way of correspondence within which the plane of language stands parallel to that of things; rather, more in the

way of language as an enveloping net faithfully contouring the ever various lumpish matter of ‘reality’” (35, 42). What Knight understates, however, is the degree to which Stein self-consciously challenges, rather than draws on, classical notions of number, measure, color, and difference as stable, objective qualities independent of language and observation. She identifies these classical modes of observation for the readers, referring to the acts of counting, measuring, and differentiating rather than specific instances of these practices, as she does in the following sentences: “A measure is that which put up so that it shows the length has a steel construction”; “Why is there a difference between one window and another, why is there a difference, because the curtain is shorter,” and “Suspect a single buttered flower, suspect it certainly, suspect it and then glide, does that not alter a counting” (502-3, 484). More than simply defining an object according to its unique quantitative qualities, Stein is interested in *how* something is described—that is, the *methods* of measurement and how these function semantically and grammatically to shape our perceptions of the objects observed. As she writes in *Lectures in America* (1935), “I began to discover the names of things, that is not discover the names but discover the things the things to see the things to look at” (LA 331). Rather than simply call a thing by its name, Stein focuses on the “things to see the things to look at” or the descriptive words that conjure the things “without naming them.”

Indeed, while critics emphasize Stein’s focus on the thing-in-itself in *Tender Buttons*, the book as a whole is far less concerned with objecthood than it is with the act of describing. The descriptions refer less to the given object than to their own grammatical and syntactical construction. In “Roastbeef,” Stein engages in a metadiscourse that playfully explores the function of different parts of speech: “In the

inside there is sleeping, in the outside there is reddening, in the morning there is meaning, in the evening there is feeling” (TB 475). The preposition ‘in’ begins each clause and modifies nouns (“inside,” “outside,” “morning” and “evening”) that reinforce the preposition’s basic function: to express spatial and temporal relationships. A similar sentence arises later in this section that uses prepositions, nouns, and verbs that express size, position, space, and movement: “Around the size that is small, inside the stern that is the middle, besides the remains that are praying, inside the between that is turning, all the region is measuring and melting is exaggerating” (479). These examples show Stein’s interest in exploring the fundamental aspects of grammatical construction. She also experiments with the way words can act as multiple parts of speech (by shifting the same word from adjective to noun or from noun to verb) and considers how different modifiers shape our understanding of a noun: “A transfer, a large transfer, a little transfer, some transfer, clouds and tracks do transfer, a transfer is not neglected” (481). While Stein may have set out to define the characteristics of a particular thing, her metadiscourse demonstrates that the object’s identity or “thingness” is inseparable from the language that describes it—that is, objects do not have inherent attributes independent from the language that describes them. This shift in perspective has important implications for her representation of mathematics as a paradigm of determinacy.

In order to demonstrate how her later fiction contributes to rather than resists available models of indeterminacy, I trace key similarities between Stein’s perspective in *Tender Buttons* and the philosophical insights of physicist Niels Bohr (1885-1962). While somewhat overshadowed by his protégé, Werner Heisenberg, Bohr was deeply invested in exploring the larger implications of his discoveries beyond the realm of

physics, which continues to attract the attention of scholars such as Karen Barad, a physicist and theorist who finds Bohr's "philosophy-physics" critically relevant if not essential to current debates about material-discursive relations.¹⁵ As Barad argues in detail, one of Bohr's most important contributions to physics, his complementarity principle, qualifies Heisenberg's more oft-cited uncertainty principle:

Heisenberg's uncertainty principle is an epistemic principle: it favors the notion that measurements disturb existing values, thereby placing a limit on our knowledge of the situation. By contrast, Bohr's indeterminacy principle...is an ontic principle: the point is not that measurements disturb preexisting values of inherent properties but that properties are only determinate given the existence of particular material arrangements that give definition to the corresponding concept in question. (261)

In other words, Bohr challenges the long-standing notion that the physical world abides by the laws of Newtonian physics by claiming that objects do not have inherently determinate, observation-independent properties. According to Bohr, there can be no clear distinction "between a phenomenon and the agency by which it is observed...an independent reality in the ordinary physical sense can neither be ascribed to the phenomena nor to the agencies of observation" (54). For Bohr, phenomena describe the dynamic between object and measuring apparatus, or, as Barad glosses, "the primary ontological unit is not independent objects with inherent boundaries and properties but rather *phenomena*...Phenomena are constitutive of reality. Reality is composed not of things-in-themselves or things-behind-phenomena but of things-in-phenomena" (139-40). Bohr's own analyses of the epistemological and ontological implications of his findings in quantum theory have not only made his work more accessible to non-

specialists but also underline the importance he places on the interpretive aspects of physics. What makes his work particularly useful for cultural and literary theorists is not that it offers a scientific analogy for linguistic indeterminacy, but rather he shows that physical and linguistic indeterminacy are interrelated problems. Bohr not only finds that “things do not have inherently determinate boundaries or properties,” but also that “words do not have inherently determinate meanings” (Barad 138).

While neither Bohr nor Stein is evidently aware of each other’s writings, they share some notable similarities both in their perspectives on language, including the semiotics of mathematics and the challenges they pose to classical notions of reality as stable and independent. In his claim against the idea that language is secondary, Bohr famously wrote, “We are suspended in language in such a way that we cannot say which is up and which is down. The word ‘reality’ is also a word, a word which we must learn to use correctly” (qtd. in Peterson 302). Like Bohr, Stein begins to embrace the idea that language comprehends reality rather than lies behind it. Reflecting on her work in *Lectures in America*, Stein offers a comparable statement:

Language as a real thing is not imitation either of sounds or colors or emotions it is an intellectual recreation...And so for me the problem of poetry was and it began with *Tender Buttons* to constantly realize the thing anything so that I could recreate that thing. I struggled I struggled desperately with the recreation and the avoidance of nouns. (331)

According to Stein, language does not serve a mimetic or mediating function, but rather a creative one; meaning does not inhere in words or things, but is created over and again through different linguistic arrangements. This helps to explain why certain objects in *Tender Buttons* receive multiple sets of unique descriptions. In “Food,” for

example, there are multiple sections for items such as “potatoes,” “orange,” “chicken,” and even “salad dressing and an artichoke.” The first two of four different sections on “chicken” reads:

CHICKEN

Pheasant and chicken, chicken is a peculiar bird.

CHICKEN

Alas a dirty word, alas a dirty third alas a dirty third, alas a dirty bird. (492-3)

Each description alters the reader’s impression of the object; the first sentence recalls the chicken as a kind of fowl, the second refers to connotations of the word “chicken.” Thus, for Stein, as for Bohr, description does not uncover an object’s inherent properties but “recreates” qualities observed under specific conditions. In “Rooms,” Stein indicates that objects change under different conditions: “Suppose they are put together, suppose that there is an interruption, supposing that beginning again they are not changed as to position, suppose all this and suppose that any five two of whom are not separating suppose that the five are not consumed...There was no certainty” (501). An object’s qualities are not certain, according to Stein, but are shaped by a number of outside factors, including position, movement, time, and quantity. For Stein, language serves as the “agency of observation” or the measuring apparatus that cannot be disentangled from the object under observation.

However distant or neutral the narrator of *Tender Buttons* might seem—given that the words appear detached from a perceiving, embodied subject—the text does not represent a world of static objects with observation-independent qualities, but rather a world of things in flux, phenomena to which an observer must be witness. The narrator’s presence manifests in observations such as the following: “The shadow is not

shining in the way there is a black line. The truth has come. There is a disturbance,” and in the self-reflexive comment, “The author of all that is in there behind the door and that is entering the morning. Explaining darkening and expecting relating is all of a piece. The stove is bigger” (498-9). The author “behind the door” recognizes her inseparability from the phenomena described. Indeed, Stein’s interest is in experiential phenomena, that is, in capturing material, tactile, and sensory experiences. Like *Four Saints in Three Acts* or *Alphabets and Birthdays*, what might appear at first as a purely formal exercise turns out to be a reflection on the fundamental aspects of subjective experience. The concluding paragraph of “Roastbeef” insistently distinguishes the experiential and material from the abstract:

There is coagulation in cold and there is none in prudence. Something is preserved and the evening is long and the colder spring has sudden shadows in a sun. All the stain is tender and lilacs really lilacs are disturbed...The result the pure result is juice and size and baking and exhibition and nonchalance and sacrifice and volume and a section in division...This is a result. There is no superposition and circumstance, there is hardness and a reason and the rest and remainder. There is no delight and no mathematics. (482)

Stein adopts an anti-Platonist perspective that rejects the notion of the physical world as a shadowy reflection of a transcendent, ideal realm. This passage suggests that there is nothing “behind phenomena” but only “things in phenomena.” More specifically, her claim that there is “no mathematics” suggests that there is no mathematics as it has been traditionally conceived—as something that exists outside of physical reality or apart from human conceptual frameworks. After all, she does not reject the existence of mathematical values altogether since she refers to “size,” “volume,” “a section in

division” and a “remainder” as a concrete “result.” Bohr’s quantum theory holds similar implications for mathematics; his indeterminacy principle overturns the Newtonian view that objects have inherently determinate values that need only be revealed mathematically. He challenges realist conceptions of mathematics as a pre-formed semiotics that functions outside and beyond phenomena.

Tender Buttons marks a significant shift in Stein’s perception of mathematical objects compared to the view represented in *Q.E.D.*—that is, a shift away from the idea that mathematical entities are fixed and preexistent objects to the idea that they function semiotically. Numbers operate in *Tender Buttons* in a descriptive capacity, as they do in a more sustained way in her later plays and operas. For example, in the first section titled “Objects” and within the subsection called “A Box,” Stein uses numbers as a descriptive substitute for naming the box as such:

A custom which is necessary when a box is used and taken is that a large part of the time there are three which have different connections. The one is on the table. The two are on the table. The three are on the table. The one, one is the same length as is shown by the cover being longer. The other is different there is more cover that shows it. The other is different and that makes the corners have the same shade the eight are in singular arrangement to make four necessary.

(465)

Rather than simply a rote tool for calculating and measuring, mathematics serves as an expressive means for describing and explaining phenomena. For Stein, mathematics is no longer simply a metaphor for a transcendent reality, but rather a system bound up with the conventions of language, a descriptive tool for representing objects as well as subjects.

Another crucial similarity that links Bohr and Stein to their scientific contemporaries such as Russell and Gödel is that they all encounter the limits of representation, whether linguistic or mathematical, despite their efforts to achieve determinate results, or, to attain an exactitude of reference (Stein), to maintain scientific objectivity (Bohr), to establish a robust foundation for mathematics (Russell), and to uphold the belief in an objective mathematical reality (Gödel). Though their work offers some of the most prominent models of indeterminacy, these scholars were also invested in resolving the representational problems they encountered. These efforts are neither contradictory nor ironic, but rather the outcome of investigating what can be definitively known. In different ways, they sought as much to preserve a certain determinacy of meaning as to account for impediments to it. Thus, in placing Stein in the context of these scientists, these competing goals can be understood as a defining characteristic of modernist scientific inquiry rather than as an inconsistency in need of resolution or as a literary methodological problem.

Stein's self-analysis reflects this dialectic: while she aspires to make her writing "as exact as mathematics" and to know definitively "what a thing was," she also questions whether these goals can be realized and admits to arriving at unexpected results. She confesses in *Lectures in America* (1935) to being "bothered about something and it had to do as my bother always has had to do with a thing being contained within itself" (305). She also "began to wonder at at about this time just what one saw when one looked at anything really looked at something...did it make itself by description by a word that meant it or did it make itself by a word in itself" (LA 303). She begins, in other words, to question whether meaning inheres in the word or is instead created through its relation to other words. She continues to explain that what "excited [her]

so very much” was that the descriptions that conjured a specific object, or the “words that make what I looked at be itself,” were never a precise or transparent referent for that object, often having “nothing whatever to do with what any words would do that described that thing” (LA 303). She recognizes the unwieldiness of language, the “difficulty,” to use her own term, of pinning language down to an exact science. No longer bound by a classical, deterministic view of mathematics, Stein increasingly approaches mathematical terms and concepts as creative, constructive resources for critiquing gendered power relations and asking questions about “human nature” and “the human mind.”

III.

In “Patriarchal Poetry” (1927), Stein continues to use mathematics as a means for theoretical as well as literary intervention. What is different about this poem, however, is that she explores mathematics not simply as a symbol for an abstract reality (*Q.E.D.*) or as a descriptive device (*Tender Buttons*), but rather as a cultural phenomenon, bound to the system of patriarchal order and authority. For Stein, the traditional literary canon is similar to other male-dominated institutions that value order, method, reason, and tradition: “Patriarchal poetry reasonably/Patriarchal poetry administratedly/Patriarchal poetry with them too/Patriarchal poetry as to mind/Patriarchal poetry reserved/Patriarchal poetry in regular places” (P 123). Patriarchal poetry, according to Stein, is a masculinist institution (“Patriarchal poetry *their* origin and *their* history”) whose standards are militantly upheld (“Patriarchal poetry left left left right left”), resulting in a homogenous body of literature (“Patriarchal poetry is the same”). While critics such as Marianne DeKoven question whether the poem provides an “*interpretable* feminist thematic content,” it is hard to

overlook Stein's overwhelmingly critical representation of patriarchal poetry as a male-dominated, exclusionary system ("A Different Language" 129). The mock sonnet she places in the middle of this prose poem offers a sample of what she considers patriarchal poetry:

A SONNET

To the wife of my bosom
All happiness from everything
And her husband.
May he be good and considerate
Gay and cheerful and restful.
And make her the best wife
In the world
The happiest and the most content
With reason.
To the wife of my bosom
Whose transcendent virtues
Are those to be most admired
Loved and adored and indeed
Her virtues are all inclusive
Her virtues are beauty and her beauties
Her charms her qualities her joyous nature
All of it makes of her husband
A proud and happy man. (P 124)

While the poem is ostensibly a man's declaration of love for his wife, he actually celebrates the woman's pliancy to her wifely duties—his ability to "make her the best wife in the world." That her own happiness and contentment are contingent on his satisfaction recalls the critiques of heterosexual dynamics that arise in Newman, Loy, and H.D.'s work, as discussed in the previous chapter. He praises her as an object of male desire ("Whose transcendent virtues are those to be most admired and loved and adored") and touts her virtues as reflections of his own status and desirability: "All of it makes her husband a proud and happy man." While this poem playfully parodies the marginalization of women and the rote mechanics of the Western literary tradition—

suggested by the sonnet's adherence to conventional form in the repetition of "To the wife of my bosom"—other passages convey a more serious critique of the canon's privileging of male experience, such as her insistent, two-page-long section involving various combinations of the following phrases: "Let her try. Just let her try. Let her try. Never to be what he said. Never to be what he said" (P 121).

Directly following "A Sonnet," she continues to associate "patriarchy" with a parodied view of science, technology, and mathematics. She associates the word "patriarchal" with the kind of authoritative language typical of scientific or technical writing: "Patriarchal in investigation and renewing of an intermediate rectification of the initial boundary between cows and fishes. Both are admittedly not inferior in which case they may be obtained as the result of organization industry concentration assistance and matter of fact" (P 110-11). She sees the literary canon as a business-like institution, one that develops according to a generalized economic principle in which value is determined by comparison to an ideal standard: "Patriarchal poetry makes no mistake makes no mistake in estimating the value to be placed upon the best and most arranged of considerations" (124). Such rigid standards mean that the canon must "include cautiously," proceeding "one at a time." This systematic, quantitative method of inclusion/exclusion—"putting three together all the time two together all the time...five together three together all the time"—masks the continual reproduction of traditional literary conventions such that we "never...think of Patriarchal Poetry at one time." As her frequent use of numerical expressions to define patriarchal poetry suggest, Stein mocks the reliance on mathematics as an ideal standard for masculine epistemology and its attendant qualities: order, method, reason, tradition, and precision. She not only identifies mathematics as a paradigm of rationality and objectivity ("There

never was a mistake in addition”), but also offers a crucial observation about the appropriation of mathematics to preserve hegemonic structures (“Patriarchal poetry makes no mistake”) (106, 115). Exploring her use of mathematical expressions in this poem is thus critical to understanding not only the complexity and pointedness of her feminist agenda, perhaps best exemplified in this poem, but also the growing complexity of her critical engagement with mathematics.

In “Patriarchal Poetry,” numbers function metonymically for the ordered, regulated nature of mathematics that Stein associates with the literary canon:

Patriarchal poetry makes it as usual.
Patriarchal poetry one two three.
Patriarchal poetry accountably.
Patriarchal poetry as much.
Patriarchal poetry reasonably
Patriarchal poetry which is what they did.
One Patriarchal Poetry.
Two Patriarchal Poetry
Three Patriarchal Poetry.
One two three.
One two three. (126)

The sequence of numbers “one two three” are synonymous with regulation (“makes it as usual”), rationalization (“accountably”), standardization (“as much”), and reason (“reasonably”). More broadly, she compares patriarchal poetry to the whole number system:

Patriarchal Poetry shall be as much as if it was counted from one to one
hundred.
From one to one hundred.
From one to one hundred.
From one to one hundred.
Counted from one to one hundred. (125)

Like any number system—defined as a “set of symbols used to express quantities as the basis for counting, determining order, comparing amounts, performing calculations, and representing value”¹⁶—patriarchal poetry is a set of literary conventions that serve as

the basis for determining hierarchies, comparing elements among literary works, and conferring value on these works. Each text is a discrete entity that belongs to a larger series that can be added to and summed up to determine its total value: “Patriarchal poetry added to added to to once to be once in two Patriarchal poetry to be added to once to add to to add to patriarchal poetry to add to to be to be to add to to add to to add to patriarchal poetry to add to” (128). For Stein, patriarchal poetry develops methodically and laterally, evolving one integer at a time to form an ordered series such as that of the scale from one to one hundred: “Patriarchal poetry to be filled to be filled to be filled to be filled to method method who hears method method...Unified in their expanse. Unified in letting there there there one two one two three there in a chain a chain how do you laterally in relation to auditors and obliged obliged currently” (138-9). The number system is the most illustrative metaphor Stein uses in this poem to stress the calculated control asserted over the literary canon by its bearers. More importantly, she uses this metaphor to parody the patriarchal understanding of mathematics as a rigid system of enumeration.

Critics all seem to agree that this poem marks one of Stein’s most explicit efforts to destabilize traditional literary conventions, to emphasize the need for alternative (especially female) voices, and to revivify language through new combinations and forms. However, these critics debate whether the poem adopts the formal qualities typically associated with patriarchal modes of writing in order to expose them and therefore critique them or if the poem assumes an entirely oppositional, anti-patriarchal style. As Cary Nelson asks: is the poem “*about* patriarchal poetry, or is it to be an *instance* of patriarchal poetry” (84). He continues to argue: “a critique of patriarchal poetry cannot be mounted from a position wholly outside the poetics it would critique.

The only sure strategy of demolition available is a defamiliarizing burlesque from within" (84). DeKoven, on the other hand, considers this poem as an example of Stein's larger efforts to create an separatist, anti-patriarchal form of writing: "she titles 'Patriarchal Poetry' with the name of what its writing demolishes: sense, coherence, lucidity, hierarchical order" ("Different Language" 129). Promoting a gendered notion of language, DeKoven advocates the kind of "female" writing Stein's style exemplifies: "anarchic, undifferentiated, indeterminate, multiple, open-ended," which she opposes to "male" qualities of writing: "objectivity, order, lucidity, linearity, mastery, and coherence" (xvii). Neither critic, however, gives Stein the credit she deserves: she offers a model for a feminist poetics that is not simply imitative or reactionary, but rather *illustrative* of the gender biases that inform both literary and scientific praxis.¹⁷ By drawing on the "masculine" language of mathematics to articulate a feminist poetics, Stein also complicates any easy distinctions between male and female modes of writing.¹⁸

While Stein associates patriarchal writing with rote calculation, her own writing, as we have seen, hardly eschews a mathematical sensibility. Although her writing might read as incoherent or nonsensical—or it may, as DeKoven writes, "defy reading" altogether—it is also undeniably deliberate, calculated, and purposeful in its construction. Her prose is often unemotional, detached, and robotic, qualities traditionally associated with a scientific and often associatively masculine aesthetic. Sections of "Patriarchal Poetry" appear as algorithmic rearrangements of a particular sentence: "Once threes letting two sees letting two three threes letting it be after these two these threes can be two near threes in threes twos" (107). Or again in the section that begins: "Once or twice or once or twice or once or twice this it all or next to next

this show it all or once or twice or once or twice or once or twice this shows it all or next to next this shows it all" (128-9). While these sections no doubt test the patience of their readers, they have a graphic quality that emphasize the machinic, mathematical sensibility to which Stein aspires. But her deeper aim in this is not only to stress the endless permutations that language offers and to inspire new constructions with the available tools, but also to show that language, including the language of mathematics, is deeply imbricated in gendered power relations. While mathematical language allows for a "critique from within," it also enables new linguistic patterns, so that patriarchal poetry "may be finally very nearly rearranged" (117).

Stein's turn toward a more material, discursive conception of mathematics, and her related interest in how mathematical thought shapes our perceptions of the social and natural world, is nowhere better illustrated than in *The Geographical History of America or the Relation of Human Nature to the Human Mind* (1936). The book as a whole is an attempt to distinguish between human nature, or all that has to do with our "hard-wired" instincts and behaviors, and the human mind, which, according to Stein, does not store data, such as emotions or memories, but acts as a processor of immediate sensory data, or, as she writes, "it knows what it knows when it knows it." Counting, she speculates, is perhaps what connects human nature to the human mind, joining instinct with reasoning: "What is the relation of human nature to the human mind. Has it anything to do with any number." She later suggests a mind-based or intuitionist model of mathematics, or an innate mathematical sensibility:

That is why numbers really have something to do with the human mind.

That they are pigeons had nothing to do with it but that there was one

and then that there were three and that then there are four and that then

it may not cease to matter what number follows another but the human mind had to have it matter that any number is a number. (90)

Humans, she suggests, have an innate number sense, making them capable of distinguishing one from two from three, or performing simple arithmetic. In this way, she aligns with scholars such as George Lakoff and Rafael Núñez, who argue for a mind-based model of math: “Mathematics is a product of the neural capacities of our brains, the nature of our bodies, our evolution, our environment, and our long social and cultural history” (9). Similarly, Stein suggests that our number sense develops in response to environmental, material stimuli, so that one might determine, for example, the number of pigeons in the sky. Like Lakoff and Núñez, she thus challenges the Platonist philosophy of mathematics, which holds, as Brian Rotman argues, “that mathematical objects are mentally apprehensible and yet owe nothing to human culture; they exist, are real, objective, and ‘out there,’ yet without material, empirical, embodied, or sensory dimension” (47). Instead, she suggests that the mental apprehensibility of numbers owes something to human culture and cognition.

For Stein, the connection between mathematics and human culture is well illustrated by the language that brings numbers into being, or that gives them “such pretty names”: “The thing about numbers that is important is that any of them have a pretty name. Therefore they are used in gambling in lotteries in plays in playing in scenes and in everything. Numbers have such a pretty name” (78). In context, the adjective “pretty” appears to mean that each number has a distinctive, characteristic name. She also suggests that it is only through semiotic or symbolic representation that numbers can have abstract applications, such as in gambling, lotteries, or scenes in a play. In other words, the basis of more complex, abstract mathematics is this

interdependency of language and mathematics. Without a representational system, one could do little more than perceive that “there were three and that then there are four.” “Pretty” also implies that there is an aesthetic quality to numbers that involves emotion and sensation, a perspective she reinforces in the following lines:

It can bring tears of pleasure to ones eyes when you think of any number eight or five or one or twenty seven, or sixty three or seventeen sixteen or eighteen or seventy three or anything at all or very long numbers, numbers have such pretty names in any language numbers have such pretty names. Tears of pleasure numbers have such pretty names. (79)

This passage emphasizes the embodied, sensory dimension of mathematics—the notion that one can sense that “any number is a number” and that this can produce emotional and physical effects, bringing “tears of pleasure to ones eyes.” Numbers both have “something to do with” our most fundamental reasoning skills as well as our instinctual impulses, since numbers “have something to do with the human mind,” but “tears have nothing to do with the human mind” (79).

If our number sense tells us something about how the mind processes information, Stein also theorizes that numbers have “something to do with” how we make sense of the physical world:

They have something to do with money and with trees and flat land, not with mountains or lakes, yes with blades of grass, not much a little but not much with flowers, some with birds not much with dogs, quite a bit with oxen and with cows and sheep a little with sheep and so have numbers anything to do with the human mind. (79)

She resists the common belief that mathematics is inherently inscribed in nature. Instead, she implies an observing subject for whom quantitative reasoning is a means of navigating the social and natural world. In other words, mathematics mediates between the external world and our perceptions of underlying form. As importantly, she insists on the material basis on which mathematics is founded; numbers function as a representational system through which we order the elements of our external world, such as “trees” and a “bit of oxen.” As I discuss more fully in the final chapter of the dissertation, Stein’s considerations anticipate cultural theorists of science such as Brian Rotman, Michel Serres, and Bruno Latour, who likewise problematize the rigid opposition between the material and the mathematical and argue for mathematics as a semiotic system.

While *The Geographical History of America* certainly reflects Stein’s ongoing interest in formal experimentation and abstraction, it is also arguably her most focused study on the nature of the embodied, perceiving subject. Throughout this text, Stein repeats the phrase “I am I because my little dog knows me,” a playful rewriting of Descartes’ “I think, therefore I am,” underlying which is a more serious attempt to show that identities are not essences, but rather that individuals are defined by their relation to and effect on other experiencing subjects. This notion compliments Barad’s re-articulation of Bohr’s insights—that humans are “not independent entities with inherent properties but rather beings in their differential becoming” (818). Stein’s turn to mathematics as a means of exploring subjectivity is ultimately neither an attempt to abstract nor stabilize subjectivity, but rather to emphasize the process of “differential becoming.” Like Bohr as well as later cultural theorists of science such as Barad, Rotman, Serres, and Latour, to name only a few, Stein comes to recognize the central

role mathematics plays in debating and destabilizing Cartesian oppositions between object and subject, reason and emotion, mind and body, nature and culture. Her interest in math also has important implications for literary studies; in exploring the interdependency of language and mathematics—the idea that “numbers have such pretty names”—Stein challenges one of the most enduring fictions: that literature and mathematics have little to do with one another beyond serving as disciplinary opposites.

¹ The emergence of mathematical formalism—the belief that mathematical signs function according to a set of formal rules, referring only to themselves—as well as the publication of Russell and Whitehead’s *Principia Mathematica* (1910–13), which sought to establish a logical foundation of mathematics, reflected efforts to reconfirm the certainty and precision of mathematics and demonstrated the kind of disciplinary introspection also fundamental to the burgeoning movement of literary formalism. Russian formalism, an influential literary movement during the interwar period and predecessor to American New Criticism, urged a “scientific” approach to studying literary works and sought to define a text’s intrinsic properties, its “literariness,” or “the specific properties of literary material...that distinguish such material from material of any other kind” (Eichenbaum 8). Russian formalists considered the literary object, like all supposed mathematical objects (of Classical thought), as an enclosed, perfect system subject to its own internal standards and conventions. These methodological similarities between literary theory and mathematics are not simply an example of one discipline’s influence over another, but more significantly reflect concurrently developing interests in questions of form, representation, objectivity and referentiality, fundamental to how both define their disciplinary objectives.

² See Gillian Beer, *Open Fields: Science in Cultural Encounter*. Oxford: Clarendon Press, 1996, 115.

³ In future developments of this project, I hope to consider the connections between Stein’s work and that of French philosopher Alain Badiou, who is well known for his provocative claim that “mathematics is ontology.” Like Stein, Badiou draws on the basic premises of set theory as the basis for an ontology that “does not claim to re-present or express being as an external substantiality or chaos, but rather to unfold being as it inscribes it: being as inconsistent multiplicity, a-substantial, equivalent to ‘nothing’” (Feltham, “Translator’s Preface” xxiii). Or as Badiou writes, mathematics “pronounces what is expressible of being qua being” (8). Badiou’s thesis directly opposes the traditional notion of being as “one” or as self-identity; by using set theory as a model, he does not suggest that being *is* something, but rather, like set theory, is a mode or a process rather than a pre-formed set of ideas or truths. See Alain Badiou, *Being and Event*. Trans. Oliver Feltham. London: Continuum, 2005.

⁴ Platonism holds that mathematical objects are eternal and unchanging and exist apart from human experience. This dominant perspective, as Brian Rotman argues, maintains “that mathematical objects are mentally apprehensible and yet owe nothing to human culture; they exist, are real, objective, and ‘out there,’ yet without material, empirical, embodied, or sensory dimension” See Rotman, *Mathematics as Sign: Writing, Imagining, Counting*. Stanford: Stanford University Press, 2000.

⁵ See Michael Gold, “Gertrude Stein: A Literary Idiot.” *The New Masses* (1936), republished in *Poetry* 88. Ed. Alan Filreis. Web <<http://www.writing.upenn.edu/~afilreis/88/>>.

⁶ Ashton instead persuasively argues that Stein’s work complements the mathematical perspectives of her contemporaries Russell and Whitehead, who sought to define number on the basis of logic rather than by enumeration, one of the fundamental goals of their groundbreaking *Principia Mathematica*. The principle of defining a set according to a common property, she argues, “is like Stein’s idea in *The Making of Americans* of defining ‘every one’ by kind,” a principle that allows Stein to account for a history of

“every one” (315). Stein, like many mathematicians of her time, suggests that there is something more basic or fundamental to the process of counting than number. See also Phillip E. Johnson. *A History of Set Theory*. Boston: Prindle, Weber & Schmidt, 1972.

⁷ For further explanation of Cantor’s proof, see Carl Boyer’s *The History of Mathematics*, 2nd Edition. New York: John Wiley & Sons, Inc., 1968, 566-70.

⁸ Phillip E. Johnson, *A History of Set Theory* (Boston: Prindle, Weber & Schmidt, Inc.), 1972, 28.

⁹ This is one of Frege’s axioms in which he attempts to axiomatize underlying assumptions of set theory—one that was ultimately shown to be inconsistent by Russell.

¹⁰ Marjorie Perloff similarly points out that Stein often stressed “*composition* rather than *representation*, the play of signifiers rather than the pointing relation of signifier to signified” (54). See Perloff, *21st-Century Modernism: The “New” Poetics*. Malden: Blackwell Publishers, 2002, 44-76.

¹¹ See Aristotle’s *Metaphysics*. Trans. W. D. Ross. Oxford: Oxford University Press, 1953.

¹² “narrative, *n.*” *The Oxford English Dictionary*. 2nd ed. 1989. OED Online. Oxford University Press. 13 Mar 2008.

¹³ This line originally appears in her 1913 poem “Sacred Emily” as “Rose is a rose is a rose is a rose,” but there are numerous variations of this sentence in her other works. In *Lectures in America*, Stein explains the intention behind this sentence, “When I said. A rose is a rose is a rose is a rose. And then later made that into a ring I made poetry and what did I do I caressed completely caressed and addressed a noun” (231). In *Four in America*, Stein again explains this sentence: “I think that in that line the rose is red for the first time in English poetry for a hundred years,” suggesting that the qualities of a rose are inherent in the word ‘rose’ (vi). Stein also insists that she “never repeats,” which hints at her notion that each word functions like an individual, discrete unit that has its own function within a larger phrase or sentence.

¹⁴ See Christopher Knight, “‘Tender Buttons,’ and the Premises of Classicalism.” *Modern Language Studies*. 21.3 (1991), 35-47. Knight defines the classical episteme as that “which privileges analysis and discrimination and in which space is conceived as three-dimensional; time as linear; and language as artificial yet determinately connected with the parallel plane of ‘reality,’” while the “new modern sensibility” involves a turning away from “the problems of reference and human narrative, and back toward its own plasticity. Art here is autotelic; it serves its own ends” (45).

¹⁵ See Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham: Duke University Press, 2007.

¹⁶ See Annette Lamb and Larry Johnson. “Number Systems.” *42Explore*. July 2002. 10 September 2008 <<http://42explore.com/number.htm>>.

¹⁷ Maria Farland’s work offers support for this point in her investigation of Stein’s exposure to the “sexist assumptions in the realm of professional science,” whereby women were seen as “incapable of abstract thought” and approached “brain work as intrinsically masculine” (120, 124).

¹⁸ More recently scholars have challenged the value of distinguishing masculine from feminine modes of writing. Jacqueline Rhodes, for example, argues that “dividing rhetorical strategies into masculine and feminine modes both denies women’s use of agonistic discourse through history and limits their inabilities to intervene today” (20).

Chapter 4:
Between Metaphysics and Method:
Mathematics and the Two Canons of Theory

In the previous three chapters, I explore how and why a number of late nineteenth- and early twentieth-century American writers turn to mathematics to describe not only social phenomena but also individual, subjective experience. What these writers understood about the constitutive interrelation of mathematics and culture does more than anticipate the work of cultural theorists of science such as Brian Rotman, Michel Serres, Bruno Latour, and Karen Barad, who argue for a materialist, semiotic foundation of mathematics; the fiction and poetry of these writers picks up where many of these theorists leave off by reflecting on and interpreting how exactly mathematics is culturally embedded, that is, how it functions with particular cultural, material, and semiotic practices. Thus, rather than approach the fictional works of this dissertation as conceptually or methodologically distinct from the theoretical works under consideration here, I argue that both theorize the relationship of mathematics to “reality” and of mathematical to linguistic expression in complementary ways. The critical and cultural study of mathematics is an important example of why theory needs literature as much as literature needs theory.

I.

Now that the dust has settled after the so-called Science Wars, and there is less pressure on humanists either to indict or defend poststructuralism’s penchant for mathematical imagery, it is an opportune time to reassess the ways in which poststructural theory both argues persuasively for mathematics as a culturally embedded practice—a method as opposed to a metaphysics—and, at the same time, reinscribes realist notions of

mathematics as a noise-free description of a mind-independent reality. In the wake of poststructuralist theory, in which language is considered as *the* constitutive cultural force, trails the question of why mathematics often is treated as an exception to the rule, a realm exterior to language. Brian Rotman argues that its “special” status rests on the very notion that mathematics is somehow “intransigently different from *language*”—a notion supported by an enduring version of Platonism, which “holds that mathematical objects are mentally apprehensible and yet owe nothing to human culture; they exist, are real, objective, and ‘out there,’ yet without material, empirical, embodied, or sensory dimension” (MS 47). Despite poststructuralism’s conviction that there is no extra-linguistic ‘out there,’ mathematics remains in a liminal space in much literary and cultural theory, its relationship to language left tenuous and undefined. For theorists such as Jacques Lacan, Gilles Deleuze, Julia Kristeva, and Jacques Derrida, mathematics is *both* a privileged and exceptional discourse *and* that which must be stripped of its foundational, metaphysical status.

Such paradoxical representations of mathematics arise particularly, I argue, in the work of Derrida. While I do not wish to suggest that Derrida somehow stands in for the whole of poststructuralist thought, his work is not only representative of the kind of scholarship attacked by scientific realists in the 1990s, but also a pivotal force responsible for reframing a variety of problems in contemporary philosophy and critical theory, including the truth value of language. Derrida’s engagement with scientific and mathematical theories and concepts, as Arkady Plotnitsky suggests, “play[s] a more significant role in his work than Derrida is willing to claim or perhaps than he perceives”¹ (159). Particularly in his early work, Derrida argues against the notion of geometry as a closed system, and uses mathematics as an example of non-phonetic

inscription to deconstruct the logocentric assumption that writing is secondary to speech. His later works, namely *Dissemination*, shift from his earlier reflections on geometry to the figurative use of arithmetic terminology. Drawing analogies between numeric systems and literary texts, Derrida attempts to demonstrate the inherent numerical multiplicity of the text, that is, its dissemination “by numbers” through infinite contexts and readings. This project paradoxically reinforces the presumed priority and otherworldliness of numbers and thus reinscribes the very aspects of mathematical realism he otherwise seeks to overturn.

In this article, I argue that Derrida’s paradoxical representations of mathematics are indicative of the ongoing problem—for both the humanities and the sciences—of how to distinguish mathematical from linguistic representation, whereby the former is repeatedly positioned as both homologous to and in excess of the latter. With the exception of a few scholars such as Brian Rotman and Vicki Kirby,² who have begun to describe the particular qualities that make the semiotics of mathematics both similar to and distinct from language, those in the sciences and the humanities, including Derrida, have tended to elide these concerns, casting their differences instead as a struggle between Nature and Culture or between realist and constructivist positions. Karen Barad, drawing on the work of Joseph Rouse, argues that these adversarial positions are both caught up in different versions of the same representationalist paradigm: “[B]oth scientific realists and social constructivists believe that scientific knowledge...mediates our access to the material world; where they differ is on the question of referent, whether scientific knowledge represents things in the world as they really are (i.e., ‘Nature’) or ‘objects’ that are the products of social activities (i.e., ‘Culture’)” (806). Both “cultures,” in C.P. Snow’s sense, have also tended to rely on a tepid form of

interdisciplinarity that ultimately reinforces their own self-representations and reproduces as somehow fundamental this paradoxical representation of mathematics as *both* a metaphysics *and* a method.

I want to consider more specifically, however, not the gap between the “two cultures,” but rather, in the humanities, *a divide within the divide*: the emergence of two distinct canons of theory—on the one hand, anthologized literary/linguistic theory, and on the other, science studies. The work of theorists typically included in the literary/linguistic canon, often categorized under the broad heading of “postmodern theory,” such as Derrida, Jacques Lacan, Michel Foucault, Julia Kristeva, Gilles Deleuze and Judith Butler, is too infrequently brought into dialogue with work in the cultural study of science, such as that of Donna Haraway, Bruno Latour, Michel Serres and N. Katherine Hayles, and even less with the recent scholarship of theorists such as Arkady Plotnitsky, Karen Barad, Cary Wolfe, Bruce Clarke, Ronald Schleifer, Robert Markley, and Elizabeth Wilson, to name only a few.³ One of the fundamental differences between these two canons is reflected in their different approaches to the subject of mathematics: literary/linguistic theorists tend to represent mathematics as an abstract and self-governing medium, one that is alternately an exemplary semiotics or an instrument of scientific reductionism, while, for many science studies theorists, mathematics is fundamentally a material semiotics among others, though its particular qualities remain undertheorized. We have yet to appreciate fully, however, both the ways in which science studies sheds light on poststructuralism’s engagement with science and, conversely, poststructuralist theory’s contributions to the cultural study of scientific discourses and practices. By reading these bodies of theory in relation to one another, we stand to gain a fuller sense of the critique of metaphysics that is the undercurrent of

both theoretical realms and a better understanding of what the humanities and indeed what literary theory can contribute to the burgeoning field of science studies.⁴

I begin by tracing the representations of mathematics in several of Derrida's key works, then use this analysis to contextualize Rotman, Serres and Jean-Joseph Goux's perspectives on mathematics, and finally turn to the work of Latour and Barad, which offers an alternative to the nature/culture dichotomy—a way to envision mathematics not simply *as a* social or semiotic construction but *as integral to* social and semiotic construction. Particularly for Latour, mathematics is neither a transcendent form of reason nor a purely cultural phenomenon, but an interpretive tool constituted through the ongoing breakdown of traditional divisions between nature and culture, human and nonhuman. We can thus begin to understand the notion of mathematics as a culturally embedded practice not as a conclusion, but as a starting point for considering how exactly it functions within particular cultural, material and semiotic practices, and ultimately, what connects mathematics to the discourses of literary and cultural theory.

II.

Derrida's work reflects a larger cultural dialectic: mathematics is both lauded as “the paradigm of abstract rational thought” and treated skeptically as a perceived tool of and model for reductionism and a deterministic view of the social and natural world (Rotman, “TD” 18). In both cases, math is caught in a representational paradox. To understand the evolution of Derrida's engagement with certain aspects of mathematics, we must begin his first significant publication, *Edmund Husserl's 'Origin of Geometry': An Introduction*, in which he challenges the notion of a “ready made science.” Derrida opposes Husserl's notion that ideal objects, such as those of geometry, are self-generative and form within a closed or definite system. “About the mathematical

system in general,” Derrida notes, “Husserl speaks of ‘an infinite and yet self-enclosed world of ideal objectivities as a field for study’” (OG 130). For Derrida, however, a self-enclosed system—a system closed to its own meta-concerns—does not constitute a field of study but rather signals its death. Drawing on Gödel’s well-known (and often misrepresented) concept of undecideability,⁵ Derrida argues for the impossibility of any closed structure or system:

The unity of *the* geometrical science...is not confined to the systematic coherence of *a* geometry whose axioms are already constituted; its unity is that of a traditional geometrical sense infinitely open to all *its own* revolutions...This whole debate is only understandable within something like *the* geometrical or mathematical science, whose unity is still *to come* on the basis of what is announced in its origin. (OG 52-3)

Geometry, in other words, can be both coherent and incomplete, open to ‘its own revolutions’ or multiple instantiations of the axiomatic system.⁶ Derrida then argues for the impossibility of a singular or exact origin—a claim he reiterates throughout his body of work. He thus asks, “if it is still legitimate to speak of an origin of geometry. Does not geometry have an infinite number of births...Must we not say that geometry is on the way toward its origin, instead of proceeding from it?...[W]hy have geometry begin with pure idealization and exactitude?” (OG 131). Derrida’s case for the impossibility of a definite, closed or *a priori* mathematical system explicitly challenges a Platonist philosophy of mathematics and thereby asserts the historical contingency of its discourses.

This perspective is underlined by his view that a mathematical system is

dependent on language (namely writing) for its genesis and transmission—that is, for its very systematic coherence. In the *Introduction*, Derrida extends and strengthens Husserl’s claim that ideal objectivity is transmitted by language to argue that language *constitutes* ideal objectivity: “The possibility of writing will assure the absolute traditionalization of the object, its absolute ideal Objectivity” (*OG* 87). Writing, then, is no longer simply an empty carrier of meaning, or as Husserl describes it, “a flesh, a proper body,” but the “condition of Objectivity’s internal completion” (*OG* 89). As Derrida later states in *Of Grammatology*, writing is the condition for imagining the possibility of scientific objectivity because it is only through writing that abstract ideal forms become reified:

As long as ideal Objectivity is not, or rather *can* not be engraved in the world—as long as ideal Objectivity is not in a position to be incarnation...then ideal Objectivity is not fully constituted. Therefore, the act of writing is the highest possibility of all ‘*constitution*’...(*OG* 89)

If writing constitutes our understanding of ideality, then even ideal objects, like those of mathematics, depend on writing for their preservation and translation. Geoffrey Bennington glosses this relationship in Derrida’s work between writing and ideality: “Mathematical objects are the most ideal objects; but without a written tradition there would be no progress in mathematics...[W]riting, which threatens ideality with exteriority and death, becomes more necessary as ideality becomes more ideal” (68-9). In this respect, although writing ensures the transmission of idealities over time, it is also what makes inevitable misreadings or mistranslations that continually threaten the purity of these ideal objects. Consequently, as Bennington notes, “only idealities can give a foundation to sciences, but there is only ideality through and by repetition: this

repetition brings with it an alterity that forbids the unity of the foundation it was supposed to insure" (64). Derrida's claim that writing is the 'highest possibility of all constitution' would suggest that mathematics is not 'intransigently different from language,' but is made possible by language—an argument which evolves through Derrida's overarching critique of logocentrism.

In an interview with Julia Kristeva, one of the few places where he speaks explicitly about the subject of mathematics, Derrida explains why mathematics serves as a useful counterexample to logocentrism. When asked by Kristeva if grammatology is a "nonexpressive 'semiology' based on logical-mathematical notation rather than on linguistic notation," Derrida responds:

[T]he resistance to logical-mathematical notation has always been the signature of logocentrism and phonologism in the event to which they have dominated metaphysics and the classical semiological and linguistic projects...A grammatology that would break with this system of presuppositions, then, must in effect liberate the mathematization of language, and must also declare that the practice of science in fact has never ceased to protest the imperialism of the *Logos*, for example by calling upon, from all time, and more and more, nonphonetic writing. Everything that has always linked *logos* to *phoné* has been limited by mathematics, whose progress is in absolute solidarity with the practice of non-phonetic inscription...We must also be wary of the 'naïve' side of formalism and mathematism, one of whose secondary functions in metaphysics, let us not forget, has been to complete and confirm the logocentric theology which they otherwise could contest...The effective progress of mathematical notation thus goes along with the deconstruction of metaphysics, with the

profound renewal of mathematics itself, and the concept of science for which mathematics has always been the model. (P 128-9)

While mathematics has been used to hold in place ‘the logocentric theology’ of metaphysics, Derrida argues that it paradoxically collapses this theology; as a form of nonphonetic inscription, mathematics disrupts the naturalized connections among sign, sound, and voice. As he later writes in *Dissemination*: “[T]he mark of numbers, whose nonphonetic operation, which suspends the voice, dislocates self-proximity, a living presence that would hear itself represented by speech” (D 331). In contrast to alphabetic writing—the paradigm of logocentric accounts of language—mathematics, as a fundamentally written discourse, undermines the metaphysical assumption that writing is secondary to speech. Derrida’s response points to this dialectical conception of mathematics as a privileged example of a non-logocentric semiotics and also a means through which metaphysics lays claim to a stable and objective ‘reality.’ The “renewal of mathematics,” he suggests, requires that mathematics be *deconstructive of* rather than *complicit in* the metaphysical tradition.

While Derrida considers mathematics as a practice subsumed by writing *in general*, he also suggests that mathematical writing, in its opposition to natural language, exceeds or even precedes linguistic classification. He reiterates this idea in *Of Grammatology*:

The history of the voice and its writing [i.e. phonetic writing] is comprehended between two mute writings, between two poles of universality relating to each other as the natural and artificial: the pictogram and algebra...As phonetic writing [alphabetic writing], it keeps its essential relationship to the presence of a speaking subject *in general*, to a transcendental locutor, to the voice as self-

presence of a life which hears itself speak...The consonant, which is easier to write than the vowel, initiates this end of speech in the universal writing, in algebra. (OG 302-3)

Mathematical notation, in other words, functions for Derrida as a kind of disembodied writing, or what Vicki Kirby calls an “originary writing” (426). Drawing on Rotman’s insights, Kirby argues that the “unreasonable effectiveness of mathematics” (a phrase coined by the physicist Eugene P. Wigner) has “something” to do with this uneasy relationship between mathematical and alphabetic writing:

Alphabeticism enables something that mathematics *needs*, while also providing an effective defense against something that mathematics *rejects*...Because the ‘familiar authority of the alphabetic text’ is so easily taken as the definitive stuff of writing, the ‘how and what it is,’ it follows that mathematical grams can appear as if from nowhere, a ‘writing’ that is pre- or nonlinguistic. (430)

Indeed, in its “failure” to satisfy the logocentric criterion for language, Derrida considers mathematical notation as a kind of nonlinguistic semiotics—a perspective closer to how mathematicians have traditionally understood their discipline.

The nature of mathematical language, the issue of whether it is “about anything” or “whether its signs have referents, whether they are signs *of* something outside themselves” is a contested subject among mathematicians (*MS* 5). Rotman contends that there are three dominant models of mathematics, each with its own sense of what mathematics is ‘about’: Platonism holds that mathematical language refers to an objective, external world; formalism maintains that mathematical signs function according to a set of formal rules, referring only to themselves; and intuitionism understands mathematics as a purely cerebral process through which immaterial, *a*

priori signifieds are constructed (*MS* 7). All three models, according to Rotman, tend to “sever their signifieds,” or “what they are supposed to mean,” from the “real time and space within which their material signifiers occur,” so that math always positions itself as an accurate description of a “prior reality” (*MS* 5). Ultimately, Rotman argues, these models fail to provide a solid foundation of knowledge, or more specially, how the practice of mathematics leads to the formation of mathematical knowledge. Taking particular issue with Platonism, or what he calls the orthodox philosophy of mathematics, Rotman draws on the insights of poststructuralism to contest realist claims that language functions as a mere descriptor for a preexisting world. As Derrida would have us understand, “reality” or “truth” is constructed by and through language, and language—including the semiotics of mathematics—does not give us direct access to either. Rotman likewise argues that there can be no “semiotic coherence of a *pré*linguistic referent;” while such a referent “might present itself as abstract, cognitively universal, presemiotic (in the case for mathematical objects), it will be no more timeless, spaceless, or subjectless than any other social artifact” (*MS* 31). Rotman’s work thus reveals the potential for the insights of Derrida and his contemporaries to contribute to the philosophy of mathematics, particularly to the idea that the mathematical concept is inextricable from its semiotic expression.⁷

The notion that the sign precedes mathematical understanding or intuition is implicit in Derrida’s reading of Husserl;⁸ however, Anna Tsatsaroni and Jeff Evans argue that Derrida could have developed further his analysis of the ongoing relationship between the mathematical concept and the sign:

Derrida's deconstruction—again with reference to Husserl—of the relationship between sign and mathematical truth could perhaps show in a more forceful way

how mathematics differs from itself: how mathematics cannot constitute its identity because it has to rely on the sign, the irreducible other. This could bring forth the question of the relation between mathematics and language, the structural inability to draw a rigorous distinction between the mathematical concept and its linguistic expression. (103)

Although Derrida does not carry his analysis of mathematical signs to the logical end envisioned by Tsatsaroni and Evans, he implies the codependency of the mathematical object on its sign by placing writing at the scene of geometry's 'origin,' marking geometry as both historically bound and "open to all its own revolutions." Thus, he works against the common assumption that mathematics is an independently generative, complete and merely programmatic science.

When he turns to the subject of literature, however, Derrida turns his focus to the metaphoric use of arithmetic concepts. Significantly, he shifts his attention from earlier notions of geometric objects as historically and linguistically bound to the sense that the "natural" numbers or integers are *natural*, pre-given entities. Why this discrepancy? For Derrida, the idiom of geometry—more so than arithmetic, algebra or calculus—dovetails with his overarching philosophical interest in questions of representation, form and matter, subject and object. In moving from the geometric to the arithmetic branches of mathematics, the direction of influence is reversed: whereas linguistic theory comes to bear on geometry in Derrida's *Introduction*, arithmetic concepts reveal crucial characteristics of the literary text in *Dissemination*. In his later writings on literature, Derrida considers the literary text as a kind of ideal object, based on what he described as its "already-there-ness." This notion, however, is less a divergence from his early work on Husserl than an idea that had been dormant. He has spoken about a thesis, which he never came to write,

that was to be titled “The Ideality of the Literary Object.” About this thesis, he writes: “It was then for me a matter of bending, more or less violently, the techniques of transcendental phenomenology to the needs of elaborating a new theory of literature, of that very peculiar type of ideal object that is the literary object, a bound ideality Husserl would have said, bound to so-called ‘natural’ language, a non-mathematical or non-mathematizable object, and yet one that differs from the objects of plastic or musical art, that is to say from all of the examples privileged by Husserl in his analyses of ideal objectivity” (TT 37). As in his response to Husserl, Derrida suggests that in order for a text to be “ideal,” it must be repeatable and transmissible, leading him to assert that the text is inherently numerous, that it exists “in numbers.” In order to build his case for the ideality of the literary object, however, Derrida paradoxically relies on the priority of number, the “already-there-ness” of number, leading him to reinscribe a conventional view of mathematics that he had deconstructed in his early work.

His section by the same name, “Dissemination,” an account of Philippe Sollers’ novel *Numbers*, is perhaps the best example of how Derrida draws analogies between numeric systems and literary texts. The essay begins: “These *Numbers* enumerate themselves, write themselves, read themselves. By themselves. Hence they get themselves remarked right away, and every new brand of reading has to subscribe to their program” (D 290). Though this passage describes Sollers’ text, it is through this specific analysis that Derrida begins to carve a broader understanding of the inherent numerical multiplicity of all literary texts. He argues, more specifically, that a text disseminates in countless numbers, enumerating itself within different contexts and by way of every reading: the text “begins by repeating itself,” it is “triggered off—for the first, but innumerable, time... even in its first occurrence, the text mechanically, mortally reproduces, even ‘steadier’ and

‘*deader*,’ the process of its own triggering” (*D* 292). This notion of a division at the origin is crucial to Derrida’s understanding of the literary text and to his overall theoretical framework: “[t]he beginning is plied and multiplied about itself, elusive and divisive; it begins with its own division, its own numerousness” (*D* 300). In other words, there is no singular origin:⁹

[N]umerical multiplicity...serves as a pathbreaker for ‘the’ seed, which therefore produces (itself) and advances only in the plural. It is a singular plural, which no single origin will ever have preceded...If this in itself were intended to mean something, it would be that there is nothing prior to the group, no simple originary unit prior to this division through which life comes to see itself and the seed is multiplied from the start. (*D* 304)

The notion of plurality at-the-origin extends to the idea that a reader or writer cannot claim to represent a text in its original state, nor distinguish between the first and subsequent readings, and therefore finally cannot prevent or control the text’s regeneration by a potentially infinite iteration. The text is, in a sense, “numerous” but also beyond mathematical reductionism; the text’s “numbers” proliferate without offering a means to interpret the text.

As Derrida is also careful to point out, however, the text’s dissemination by numbers does not imply that the text simply reproduces over and over identical copies of ‘itself,’ but rather that it appears differently, as ‘foreign,’ within each new context or by each new reading. Therefore, as Derrida urges, one must consider the *pluralized singularity* of the literary text. As he explains, “there is no literature...without an absolutely singular performance”—that is, through countless contexts and readings, literature offers a “singular performance,” or a unique “number”—in effect, an “event”—but at the same

time, this uniqueness does not represent the text's absolute meaning because the text never stops dividing or multiplying itself through these contexts and readings (AL 213). Derrida's notion of the singular seeks to redefine the concept of "one"—the key number of Western metaphysics—as a unique, contextual, non-repeatable, non-unitary event. For Derrida, then, what defines the relationship between literature and mathematics is the notion that a text is characterized by its nonlinear, non-systematic or systematizable, numerical *behavior*.

Derrida's metaphoric use of arithmetic terminology aims overall to show that the multiplicity or divisibility of a literary text paradoxically effaces its susceptibility to any kind of scientific analysis—a critique, in other words, of formalism's efforts to establish a "science" of literary study. And yet, this rhetorical move risks the reinscription of mathematics as a metaphysics—that is, as an abstract and universal expression of a particular literary text's dissemination. These numbers, in other words, hold the privilege of revealing or proving what we know to be "true" about the literary text. This analogy between literary texts and numeric systems relies on a notion of number as an object not related to any particular subject or context. Numbers are characterized more specifically as self-productive, *natural* entities, an impression given, for instance, by his use of recurring biological metaphors—"the tree of Numbers"—and by claims such as "[t]he literal air...cannot be disassociated from number," or "*Numbers* always maintain their links with unlimited dissemination—of germs, of the crowd, of the people, etc." (D 336, 347). This use of number to describe Derrida's crucial metaphor of dissemination lends a certain agentless agency to numbers, the sense that numbers are inscribed in nature, or as Rotman notes, the idea they are somehow "before us."

Again, Derrida's work reinscribes this nature/culture dialectic as he shifts from calling attention to the material, cultural foundation of mathematics—as he had done in his *Introduction to Husserl*—to the idea of mathematics as a kind of preformed semiotics. In *Dissemination*, he does invoke the material basis from which mathematics has been formed when he writes, “[h]ere you stand, close to the first—undecipherable—stone, which is not one, or which...*was*, numerous. *Calculus*. Pebbles used in counting. Gravel” (*D* 358). He is punning on his reader's assumed awareness that the word “Calculus,” in both Latin and Greek, refers to “pebbles,” which were used in ancient Greek and Roman cultures for counting and other basic arithmetic—implying a move from the material to the abstract rather than a “top-down” model of math's development. However, he then undercuts this perspective by representing mathematics as a kind of prelinguistic semiotics: “The ‘first’ sequence, therefore, is not a discourse, a present speech (in the beginning *was* the number, not the word, nor, in what presently amounts to the same, the act)” (*D* 339). In this instance, he works against the notion that the mathematical object and its sign are co-constitutive, as he had suggested in his earlier work on Husserl. And yet, Derrida does suggest a theoretical dependency between mathematics and literature, a relationship not defined by disciplinary opposition, as is often assumed, but a comparative, mutually illuminating relation—one that constitutes a rich site for further inquiry.

Rotman has taken the lead in investigating the linguistic properties of mathematics, specifically the codependency of mathematics and a materialist semiotics: “In no sense can numbers be understood to precede the signifiers that bear them; nor can the signifiers occur in advance of the signs (the numbers) whose signifiers they are. Neither has meaning without the other: they are coterminous, cocreative, and cosignificant” (*MS* 39). Rotman asserts the material and semiotic constitution of mathematical objects—a position Derrida

alternately embraces and resists. For Rotman, realist conceptions of mathematics as a pre-given semiotics deny mathematics the constitutive significance it deserves:

Besides making an enigma of mathematics' usefulness, this has the consequence of denying or marginalizing to the point of travesty the ways in which mathematical signs are the means by which communication, significance, and semiosis are *brought about*. In other words, the constitutive nature of mathematical writing is invisibilized, mathematical language in general being seen as a neutral and inert medium for describing a given prior reality — such as that of number — to which it is essentially and irremediably posterior. (TD 19)

Rotman's work as a whole brings mathematics out from the shadows of the Western philosophical tradition in which it has long been a silent but constitutive force and emphasizes the connections between language and mathematics; the former serves as the undisputed nexus of poststructuralist theory, while the latter is among the most fundamental and yet theoretically ignored semiotic modes. Rotman and Derrida do ultimately agree, however, on the notion that language is the exemplary and primary object of meaning, one of the driving forces behind the poststructuralist questioning of the principles of both Platonic and realist philosophy. Theorists with backgrounds or interests in science studies have taken on these same problems of representation, language and truth that have held the attention of those, like Derrida, whose work is associated with the literary/linguistic canon of theory, though scholars in science studies frame these problems in intriguingly different ways.

III.

Though the work of such theorists as Barthes, Lacan, Derrida, Kristeva and Foucault became the foundation for the “textual revolution” that dominated the French

intellectual scene in the 1960s and 70s, they were not the only theorists of the time exploring the social and semiotic bases of metaphysics. In different ways, Michel Serres and Jean-Joseph Goux were tackling a similar set of problems, but with a particular focus on understanding the broader structural similarities that underlie the seemingly disparate fields of the sciences and the humanities. To put it differently, Serres and Goux consider science not as an analogy for illuminating aspects of the humanities, but rather as a semiotic and logical sibling that shares the same epistemological parent. Indeed, their work surpasses what Arkady Plotnitsky calls “comparative-interdisciplinary” investigation—a juxtaposition of the discourses and practices of two or more distinct fields—and instead aims to uncover “epistemological convergence” among different realms of knowledge (24). For both Serres and Goux, disciplinary divisions are neither impassable nor superficial distinctions, but rather porous boundaries that can and must be productively crossed. It is both the complexity of and necessity for such cross-disciplinary exchange that leads Serres to call the division between the humanities and the sciences the Northwest Passage: “Between the hard sciences and the so-called human sciences the passage resembles a jagged shore, sprinkled with ice, and variable...It’s more fractal than simple. Less a juncture under control than an adventure to be had” (C 70). It is perhaps because of this rigorous and demanding disciplinary interweaving that Serres and Goux’s work seems to lack the kind of audience and institutional canonization that continues to make their *Tel Quel* contemporaries required reading for most introductory theory courses.¹⁰ And yet, Serres and Goux, as well as Rotman and Latour, are grappling with similar philosophical problems and similar kinds of structural dynamics within different symbolic economies. Their work offers pathways between the canons of “literary theory” and “science studies” by

exploring how and why a theoretical analysis of science and especially mathematics is crucial to any critique of Western metaphysics precisely because, as Derrida recognizes, mathematics serves as the fundamental structuring logic of this philosophical tradition.

That mathematical concepts and its early practitioners are important to Serres' work comes as little surprise given that he began his studies in physics and mathematics, only later turning to the philosophy of science and eventually completing a dissertation on Leibniz under Gaston Bachelard. What distinguishes Serres from Derrida is that the latter deems language the transmitter of mathematical truths, the primary and exemplary object, while, for Serres, there is no primary or exemplary object apart from the material conditions that make abstraction possible. He thus argues that mathematics shares its history with the "birth" of representation—of abstract thought which required the separation of form from matter—a phenomenon which makes possible the epiphenomenon of semiosis. As he writes, "mathematics is the key to history, not the contrary. The schema is the invariant of the tale instead of the tale being the origin of the schema" (H 88). Mathematics is generated by and through a representational logic—an origin and relationship which is forgotten or effaced when mathematical signs are considered mere descriptors of presemiotic forms.

Serres finds a useful model for his theoretical perspectives in the Greek figure, Thales, who is considered to be the first true mathematician, or more specifically, the "originator of the deductive organization of geometry" (Boyer 46). While much about Thales' life remains obscure, one speculative narrative that has been passed down through multiple generations of historians is that Thales developed a system for measuring the height of the Egyptian pyramids using a simple stick, or what was, according to Serres, the gnomon on a sundial. Thales' method was to wait until the shadow cast by the gnomon

was as long as the gnomon itself, at which point he measured the shadow cast by the pyramid and hence—reasoning that at any given moment the ratio of the height of an object to the length of its shadow is constant for all objects—determined the height of the pyramid. This tale reveals the extent to which mathematical expression is dependent on written language: the Thalian “origin” of geometry and the theorem associated with it are inseparable from the narrative that describes them. Kenneth Knoespel makes a similar case for Euclid’s formalization of geometry’s fundamental axioms: “The rational written response of Euclidean geometry also marks the moment when shapes are given a narrative, or even more precisely, the moment these shapes are plotted and brought under linguistic control” (41). His example drawn from geometry supports Knoespel’s overarching claim: “Language, and even more specifically the linguistic arrangement of experience found in narrative, helps determine the ways mathematics can be applied to the world” (27). For Serres, Thales is important not only because he sought to explain the world through naturalistic rather than mythic means, but also because he relies on a physical object (the gnomon) to arrive at an abstract concept (the principle now known as “similar triangles”). This move from materiality to abstraction becomes the basis for Serres’ effort to invert the Platonic ideal, to claim that particulars (material objects) beget universals (ideal forms) rather than the other way around.

That the gnomon is an equal protagonist or quasi-object in Serres’ retelling of Thales’ story anticipates key concerns in feminist science studies regarding the relationship between materiality and discursivity.¹¹ Karen Barad in particular argues for a reconceptualization of the dualisms of material/discursive, subject/object, nature/culture, whereby each element is mutually constitutive of the other through and within particular instances: “[M]ateriality is discursive (i.e., material phenomena are inseparable from the

apparatuses of bodily production: matter emerges out of and includes as part of its being the ongoing reconfiguring of boundaries), just as discursive practices are always already material (i.e., they are ongoing material (re)configurings of the world)” (822). Like Serres, Barad critiques poststructuralism’s dismissal of nonhuman agency. The significance of the gnomon for Serres is that it “helps us to place the active centre of knowledge solidly outside ourselves”¹² and thus marks the initial “scene” of representation itself:

[W]hat Thales’s mathematics recounts, at its very inception, is the de-centering of the subject of clear thought with regard to the body that casts its shadow: the subject is the sun, placed beyond the object, on the other side of the shadow...What it announces, for the first time, is a philosophy of representation...Here is the scene of representation established for Western thought for the next millennium, the historically stable contemplation from the summit of the pyramids. Thales’s story is perhaps the instauration of the moment of representation, taken up ad infinitum by philosophers. (*H* 91-2)

In this “scene where things see things,” where the object’s knowledge transcends that of the subject, Plato declares the “essential reality of idealities,” and in doing so, relegates “Thales’s story to the depths of his cave” (*H* 93). Serres expands on this point in his characteristically imagistic prose: “Plato has the pure pyramid come into existence beneath the fires of the sun, and from this tetrahedron he has fire born again: a double miracle that fulfills the scriptures, the Egyptian legend, and the initiation of intuition by positioning the source of light within the polyhedron” (*H* 95). But it is this Platonic notion of the *priority* of ideal forms that Serres ultimately challenges:

Plato kills the hen that laid the golden eggs: by cutting through the solids he nullifies history; the eternity of transcendency freezes the diachrony and the

genealogy of forms. The future of the square and the diagonal is decided as much on the sand where we describe them through the language that names them as it is decided in the sky of ideas. The realism of transparent idealities is still immersed in a philosophy of representation. (*H 96*)

For Serres, pure abstract idealities cannot exist apart from the matter—the “shadow of solids,” which casts the outline of its form—nor the language which names it. Plato’s account, he argues, denies representation a history, treating it instead as inevitable or natural. Mathematics functions according to Platonism only in a representational capacity, as an abstract mediator between the material subject and an immaterial, *a priori* reality. But as Serres contends, the Thalian “origin” of geometry bespeaks the socio-material foundations and practices of mathematics.

While Serres focuses on the historical specificity of scientific knowledge, Goux’s work identifies a transhistorical episteme underlying Western reason; for Goux, the phenomenon of exchange is the tie that binds, the logic which structures the seemingly disparate realms of semiotics, linguistics, psychoanalysis, and economics. More largely, Goux argues that a generalized concept of exchange lies at the heart of the metaphysical tradition (and its Platonic roots)—a tradition through which material objects are considered shadowy reflections of a privileged and constant ideal:

The use of coins, of alphabetic writing, or still more simply, the use in all domains of standard units, of common measures based on reciprocal agreement: from this *ideal measure of values* could be derived all of Platonism, or rather one of the most enduring and essential strata of Platonism...Broadly speaking, the relation between Platonic forms (models, ideal standards) and the concrete world is the displaced yet faithful

philosophical parallel of the relation between (fetishized) general equivalents and relative forms. (93-4)

Goux refers to this “ideal measure of values” as the “general equivalent”—a term he borrows from Marx, whose insights, Goux argues, can be extended beyond the economic realm for which they were originally devised. The notion of the general equivalent, he writes, “pertains first of all to money: what is in the beginning simply one commodity among many is placed in an exclusive position, set apart to serve as a unique measure of values of all other commodities” (3). Goux, like Serres, explores the materialist semiotics of measurement; for both, measuring itself involves the dynamical interaction between object and subject, ideal and concrete forms. Goux extends the notion of the general equivalent to the domains of semiotics, linguistics and psychoanalysis, shifting the term from a description of quantitative to one of qualitative value:

In each case, a hierarchy is instituted between an excluded, idealized element and the other elements, which measure their value in it. In short, I came to affirm that the *Father* becomes the general equivalent of subjects, *Language* the general equivalent of signs, and *Phallus* the general equivalent of objects, in a way that is structurally and genetically homologous to the accession of a unique element...to the rank of general equivalent of products. (4)

For Goux, the persistence of these dominant forms of value—and indeed, the very concept of value—help explain the staying power of metaphysics: theories and practices may change, but the basic logical structure stays the same. This logical structure is predicated on the materiality of the ideal standard as well as the practice of measurement.

Though Goux does not directly engage the subject of mathematics, its function has been traditionally described in terms of this symbolic model of exchange; mathematics has

been predominately understood as the universal language—as a general equivalent—for describing material phenomena. This is the same premise from which Derrida and Serres launch their critiques of a Platonist philosophy, which, as Rotman convincingly argues, continues to anchor mathematics as a paradigm of abstract thought. The extension of Goux's insights to the realm of mathematics is crucial to our recognition of *Number* among the general equivalents—that is, *Number* as the unmoved mover of all systems of calculation and measurement versus *numbers*, as a semiotic system whose behavior is explained and predicted by abstract models. Goux's symbolic economies, in which an idealized element is set in opposition to and deemed as the standard of all other circulating and relative elements, can help explain the dialectical representations of math as both a metaphysics and a method that have emerged in contemporary linguistic and cultural theory. Goux's insights reveal the extent to which *Language* and *Number* function in isotropic ways: as ideal standards set in opposition to material practices. His work also sharpens our understanding of how mathematics—as the “language” presumed to give us direct access to the world of ideal standards and measurements—has upheld its privileged position in Western philosophy.

IV.

While Serres and Goux shed light on the perspective that mathematics is structurally and symbolically embedded in processes of signification, Latour is interested in how mathematics gets mapped onto the material world. For Latour, there is no “meta”physics—no universal and transhistorical semiotics that pre-exists the collection, calculation and distribution of resources and knowledge formations. Latour, more so than Serres, argues against the fundamental premises of Platonism and positions his work more overtly in contrast to poststructural theory. About the limitations of poststructural and postmodern theories, Latour writes:

Whether they are called ‘semiotics,’ ‘semiology’ or ‘linguistic turns,’ the object of all these philosophies is to make discourse not a transparent intermediary that would put the human subject in contact with the natural world, but a mediator independent of nature and society alike. This autonomization of the sphere of meaning has occupied the best minds of our time for the past half-century...Language has become a law unto itself, a law governing itself and its own world. (W 62-3)

In considering mathematics as text—as a semiotics unto itself—postmodern and poststructural theorists have tended to treat mathematics as a mediator independent of nature and society. Mathematical meaning, like linguistic meaning, is bracketed off from “the question of reference to the natural world” and to the “identity of speaking and thinking subjects,” and thus can do little to overturn its Platonist underpinnings (*W* 63). Like Serres, Goux and Derrida, Latour seeks to overturn the basic premises of metaphysics, but in contrast to these theorists, he has little interest in deconstructing this philosophical tradition from within, instead altering the contexts through which the functions of mathematics have traditionally been understood.

Latour, however, is not so much invested in arguing for a constructivist view of mathematics—one that would continue to reinforce its reactive as opposed to active and creative functions—as he is in showing how mathematics is at the basis of social formation and development. What defines the *advent* of the city millennia ago, he argues, are “centres of calculation,” which make possible the continual development of society and form the basis of the distribution of all resources. The mobilization of elements is the phenomenon that leads to the construction of these centres, or as he writes, “All the distinctions one could wish to make between domains (economics, politics, science, technology, law) are less

important than the unique movement that makes all of these domains conspire towards the same goal: a cycle of accumulation that allows a point to become a *centre* by acting at a distance on many other points” (S 222). Thus, he maintains, “the history of science is in large part the history of the mobilization of anything that can be made to move and shipped back home for this universal census” (S 225). These mobilized elements are collected, recorded, reconfigured, and finally transformed and sent back to us as mathematical equations, as abstractions of raw materials and socio-material phenomena such as human labor, urban development, population growth, and resource extraction; this is the work of the centres of calculation: “Equations are not only good at increasing the mobility of the capitalized traces, they are also good at enhancing their combinability, transforming centres into what I will call centres of calculation” (S 239). These centres, his argument follows, attempt to impose an order on the world—an order confirmed by these equations—so that “everything can become familiar, finite, nearby and handy” (S 230). What Latour describes is the process by which these centres abstract the material world into the universalizing semiotics of mathematics.

But, as Latour’s work emphasizes, mathematics cannot be completely closed off from its reference to the natural/social world and the speaking/interpreting subject, just as it cannot be deemed a mere product of social enterprises. Thus, Latour’s description of quasi-objects (a term he borrows from Serres) offers a new perspective on the philosophical basis of mathematical objects—one that rejects the poststructuralist tradition which Serres and Goux critique.¹³ For Latour, quasi-objects are an attempt to overcome the dualisms of object/subject and nature/society, recognizing that none of these terms can exclusively account for material phenomena: “Quasi-objects are much more social, much more fabricated, much more collective than ‘hard’ parts of nature, but they are in no way the

arbitrary receptacles of a full-fledged society. On the other hand they are much more real, nonhuman and objective than those shapeless screens on which society—for unknown reasons—needs to be projected” (W 55). Understanding mathematical objects as constituted through the dynamics of nature/society and subject/object helps to explain why certain mathematical truths are transmissible over time and through different cultures, and yet are also, in numerous instances, culturally specific, historically marked and subject to revision and creative extension. For example, the objects which can be considered “legitimate numbers” has changed repeatedly through time: $\sqrt{2}$, 0, -1 and i were all met with skepticism and adopted only after their intimate connection with “true numbers” was established.¹⁴ Nevertheless, the mathematical circumstances that gave birth to these new concepts and ultimately vindicated them are tied to fundamental geometric and arithmetic questions common to every culture’s mathematics—a commonality that allows for dialogue across historical periods and cultures. This comparison of mathematical objects to quasi-objects resists the either/or dichotomy that continues to reposition mathematics as an *inert medium* either for describing a prior reality or ordering elements of the empirical world; instead, mathematics is considered an interpretive tool, *infinitely open to all its own revolutions*.

Latour, in effect, severs mathematics from its metaphysical roots, extracting it from a representationalist philosophy in which it is considered either the mere product of an increasingly mechanized society or the reflector of Nature’s hidden truths. But while he rejects the philosophical basis of the metaphysical tradition in which humans are deemed the purveyors of meaning to non-human entities, he argues that we still remain “within metaphysics” because of our failure to recognize the co-construction of nature and society, human and non-human.¹⁵ Like Latour, Barad similarly calls for a

“different metaphysics,” recognizing that metaphysics in the more traditional sense has been a “term of opprobrium” in twentieth century theory. Despite this, she writes, “[t]his positivist legacy lives on even in the heart of its detractors” and will not “abide by any death sentence” (812f). Barad instead calls for a “relational ontology that rejects the metaphysics of relata, of ‘words’ and ‘things,’” and acknowledges *phenomena* as the “ontologically primitive relations.” She elaborates: “The primary ontological units are not ‘things’ but phenomena—dynamic topological reconfigurings/entanglements /relationalities/(re)articulations. And the primary semantic units are not ‘words’ but material-discursive practices through which boundaries are constituted” (818). In other words, for Barad, the abstraction or mathematization of raw materials and socio-material phenomena—the work of the “centres of calculations”—is less important than calculating the relationships, or what she calls “intra-actions,” among material-discursive phenomena. Both Latour and Barad thus offer alternatives to the logical impasse faced by Derrida and other poststructuralists vis-à-vis mathematics and the metaphysical tradition that has long shaped our understanding of this discipline.

Although science studies scholars such as Latour and Barad take issue with some of poststructuralism’s fundamental assumptions, they acknowledge their interest in a similar set of problems and questions and engage in a critical dialogue with these scholars that is too often interrupted by institutional imperatives to classify and canonize. By bracketing off science studies scholarship from more “mainstream” cultural and literary criticism, we risk misunderstanding the crucial role science has played in the history of critical and literary theory, and more specifically, the centrality of mathematics to questions of representation, objectivity and subjectivity, materiality and embodiment that structure so much of the current theoretical conversations taking place across these divergent but

often overlapping realms of theory. We also risk stalling further explorations of the epistemological and conceptual overlaps of literary and mathematical study that could help to overturn the still prevalent perception that these two fields are fundamentally antagonistic or that they are disciplinary opposites. While poststructural theorists have revealed the metaphoric potential of mathematical concepts to describe aspects of literary interpretation, there is much more to be said about the use of metaphor and other figurative devices in mathematical reasoning and expression.¹⁶ By bringing literary and linguistic theory to bear on mathematics, we can begin to see the realm of mathematics and literature as, in some ways, complimentary rather than oppositional subjects. Considering the ways in which figurative devices such as metaphor, instances of paradox and ambiguity, reliance on narrative constructions, and strategies of logical and rhetorical argumentation cut across disciplinary boundaries present exciting theoretical and especially pedagogical possibilities. These conceptual parallels insist that we continue to investigate why mathematics needs literature—a line of inquiry that depends on the collaborative insights of literary theory and science studies.

¹ Plotnitsky notes that while Derrida is cautious around the subject of science, he also “acknowledges the possibility and indeed unavoidability of intersections between the problematics of his work or, more generally, deconstruction, and mathematics and science, and he even argues that ‘science is absolutely indispensable for deconstruction.’ This statement is itself worth attention, at the very least in relation to the role of mathematics and science for all modern philosophy, deconstruction included” (159). Plotnitsky argues that the criticisms thrown at postclassical philosophers during the “Science Wars,” most notably Lacan, Kristeva, Irigaray, Deleuze and Baudrillard, and especially by Alan Sokal and Jean Bricmont in their 1998 book *Fashionable Nonsense: Postmodern Intellectuals’ Abuse of Science*, were largely based on “indiscriminately extracted, isolated references to science,” and failed to place such statements in the larger context of their work or to consider *how* these theorists use scientific ideas, instead focusing on the (in)accuracy of their references (159). While careful to avoid defending the mathematical and scientific references in the work of Derrida and Lacan (the theorists on which he primarily focuses), Plotnitsky does argue for the epistemological convergence of postclassical theory with aspects of modern mathematics and physics, and believes further explorations of these connections can lead to more productive exchanges between the “two cultures.”

² As both a mathematician and cultural theorist, Rotman is uniquely positioned to make a semiotic analysis of mathematical writing legible to a non-specialized audience. Rotman ponders why mathematics has been given only passing consideration in postmodern theory: “...[T]here has been no sustained attention to mathematical writing even remotely matching the enormous outpouring of analysis, philosophizing, and deconstructive opening up of what those in the humanities have come simply to call ‘texts.’ Why, one might ask, should this be so? Why should the sign system long acknowledged as the paradigm of abstract thought and the without-which-nothing of Western technoscience have been so unexamined, let alone analyzed, theorized, or deconstructed, as a mode of writing?” See Rotman, “Thinking Dia-grams: Mathematics, Writing and Virtual Reality” in *Mathematics, Science, and Postclassical Theory*, Eds. Barbara Herrnstein Smith and Arkady Plotnitsky. Durham: Duke University Press, 1997, 18. See also Vicki Kirby’s “Enumerating Language: ‘The Unreasonable Effectiveness of Language’” in *Configurations* 11.3 (2003), 417–436 for further discussion of the relationship between math and language and a response to Rotman’s work on the subject.

³ A number of science studies scholars, particularly those indicated here, are actively engaged in bringing these two bodies of theory into dialogue with one another. See, for example, Arkady Plotnitsky’s *The Knowable and the Unknowable: Modern Science, Nonclassical Thought, and the “Two Cultures.”* Ann Arbor: University of Michigan Press, 2002, Karen Barad’s *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning.* Durham: Duke University Press, 2007, Cary Wolfe’s *Critical Environments: Postmodern Theory, and the Pragmatics of the “Outside.”* Minneapolis: University of Minnesota Press, 1998, Bruce Clarke’s *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics.* Ann Arbor: University of Michigan Press, 2001, Ronald Schleifer’s *Modernism and Time: The Logic of Abundance in Literature, Science and Culture, 1880–1930.* Cambridge: Cambridge University Press, 2000, Robert Markley’s *Dying Planet: Mars in Science and the Imagination.* Durham: Duke University Press, 2005,

and Elizabeth Wilson's *Psychosomatic: Feminism and The Neurological Body*. Durham: Duke University Press, 2004.

⁴ There is a tendency amongst humanists to overlook the fact that many of the most influential Western theorists and philosophers—on which contemporary theorists continue to draw—were students and practitioners of science. The *Norton Anthology of Theory and Criticism*, for example, begins with works by Plato and Aristotle, who contributed to the philosophy and practices of science, including mathematics and logic. The legacy of Cartesianism often overshadows Descartes' significant contributions to modern mathematics, particularly his innovative application of algebra to geometry. Kant served as a professor of mathematics and science for fifteen years at the University of Königsberg, and Derrida's exposure to mathematics as a graduate student under the advisement of Hyppolite helps explain his early interest in Husserl's "Origin of Geometry." More broadly, it is possible to trace the parallel developments of critical movements within "theory," namely formalism and structuralism, and similar trends in mathematics toward questions of form and structure. Indeed, literature's relationship to science has been one of the underlying concerns of 20th century theorists, from the formalists' efforts to create a "science of literary study" to the poststructuralist rejection of science as a model for literary interpretation.

⁵ Gödel's theorems can be summarized as follows: "In any formal system adequate for number theory there exists an undecidable formula—that is, a formula not provable and whose negation is not provable...A corollary to the theorem is that the consistency of a formal system adequate for number theory cannot be proved within the system"; see Rebecca Goldstein, *Incompleteness: The Proof and Paradox of Kurt Gödel*. New York: W.W. Norton & Company, Inc., 2005, 23. Postmodern theorists have gravitated toward the concept of undecidability, and in many cases, have disassociated it from its specifically mathematical context. It is also important to remember that Gödel was a mathematical realist and did not necessarily see his ideas as a challenge to the foundation of mathematics.

⁶ For example, both Euclidean and non-Euclidean geometry faithfully represent the traditional axioms of geometry.

⁷ Arkady Plotnitsky considers the common epistemological concerns between deconstruction and nonclassical ideas in quantum mechanics. More specifically, he analyzes Heisenberg's 1929 lectures as "deconstructive" in Derrida's sense and argues that Heisenberg's critique of classical concepts are analogous to Derrida's sense of "play," his concept of *différance*, and the inextricable link he finds between writing and technology. *The Knowable and the Unknowable*, 226.

⁸ As Derrida writes later in *Writing and Difference*: "Meaning must await being said or written in order to inhabit itself, and in order to become, by differing from itself, what it is: meaning. This is what Husserl teaches us to think in *The Origin of Geometry*" (11).

⁹ The history of mathematics appears to confirm this notion; according to Carl Boyer's *A History of Mathematics*. New York: John Wiley & Sons, Inc., 1968, in earliest known concepts of number, fingers were presumed to be used to "indicate a set of two of three or four or five objects, the number one generally not being recognized at first as a true 'number'" (3).

¹⁰ Neither Serres nor Goux, for example, are included in the *Norton Anthology of Theory and Criticism*, gen. ed. Vincent B. Leitch. New York: WW Norton & Company, 2001.

¹¹ In *The Parasite*, Serres explains his now widely circulated concept of the ‘quasi-object’: “This quasi-object is not an object, but it is one nevertheless, since it is not a subject, since it is in the world; it is also a quasi-subject, since it marks or designates a subject who, without it, would not be a subject.” Serres continues, using a ball as an example: “A ball is not an ordinary object, for it is what it is only if a subject holds it. Over there, on the ground, it is nothing; it is stupid; it has no meaning, no function, no value. Ball isn’t played alone...Let us consider the one who holds it...The ball isn’t there for the body; the exact contrary is true: the body is the object of the ball; the subject moves around this sun.” Michel Serres, *The Parasite*. Trans. Lawrence R. Schehr Minneapolis: University of Minnesota Press, 1982, 225–226.

¹² See Serres’ “Gnomon” in *A History of Scientific Thought: Elements of A History of Science*, eds. Michel Serres & Michel Authier. Oxford: Blackwell Publishers, 1995, 80.

¹³ I refer here to mathematical objects not as physical or material entities, but nonetheless as the substance of which mathematics is composed—the numbers, equations, triangles and lines that comprise mathematical thought. Latour himself implicitly draws a link between math objects and quasi-objects: “Reason today has more in common with a cable television network than with Platonic ideas. It thus becomes much less difficult than it was in the past to see our laws and our constants, our demonstrations and our theorems, as stabilized objects that circulate widely, to be sure, but remain within well-laid-out metrological networks from which they are incapable of exiting—except through branchings, subscriptions and decodings,” *We Have Never Been Modern*, 119.

¹⁴ See Morris Kline, *Mathematics: The Loss of Certainty*. Oxford: Oxford University Press, 1980.

¹⁵ Latour writes, “Where are we, then? Where do we land? As long as we keep asking that question, we are unmistakably in the modern world, obsessed with the construction of one immanence or the deconstruction of another. We still remain—to use the old word—within metaphysics,” *We Have Never Been Modern*, 128.

¹⁶ Several scholars have begun to explore the common use of figurative devices and other shared practices between mathematical expression and so-called natural language. Paul Ernest argues that mathematics relies on rhetorical and argumentative strategies common to disciplines in the humanities. In particular, he asserts that the practice of mathematical proof is essentially dialogical in nature; a mathematician constructs an argument with the intention of convincing a presumed listener whose potential objections must be taken into account. See Paul Ernest, “The Dialogical Nature of Mathematics” in *Mathematics, Education and Philosophy*, Ed. Paul Ernest. London: The Falmer Press, 1994. George Lakoff and Rafael E. Núñez’s *Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being*. New York: Basic Books, 2000 consider how metaphor functions within math, arguing that mathematical knowledge is grasped and transmitted through conceptual metaphors, or through the use of concrete terms to conceptualize abstract concepts. Citing mathematical metaphors such as “Numbers are Points on a Line,” “Numbers are Sets,” or their “Basic Metaphor of Infinity,” Lakoff and Núñez consider metaphor not only as a linguistic phenomenon but as a cognitive mechanism. In his *How Mathematicians Think: Using Ambiguity, Contradiction, and Paradox to Create Mathematics*. Princeton: Princeton University Press, 2007, William Byers argues that despite the perception that mathematics is the practice by which ambiguity, contradiction and paradox are purged, logical inconsistencies are instead fundamental to

mathematical development. For example, Byers cites Euclid's parallel postulate as an ambiguous statement in traditional geometry, which has given birth to modern theories of Euclidean and non-Euclidean geometries. Although the resolution of ambiguities and paradoxes are integrated into mathematics as logical advancements, Byers argues that they remain integral markers of the discord between our mathematical perceptions and their "realities."

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