ESCAPING THE REAL: POPULARIZING SCIENCE AND LITERARY REALISM IN THE VICTORIAN MARKETPLACE

By

ANDREW BANGHART

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Department of English

CASE WESTERN RESERVE UNIVERSITY

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SCHOOL OF GRADUATE STUDIES

We hereby approve the thesis/dissertation of

Andrew Banghart

candidate for the degree of

Doctor of Philosophy*.

Committee Chair
Kurt Koenigsberger

Committee Member
Athena Vrettos

Committee Member
Todd Oakley

Committee Member
Alan Rocke

Date of Defense
5/9/2016

*We also certify that written approval has been obtained
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Abstract

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This dissertation examines the literary strategies that Victorian realist novelists and popular science writers shared to draw readers into imaginary worlds. Just as realist novelists convinced readers that their fictional worlds were real, popular science writers took readers on textual journeys to the edges of galaxies or through the geological history of the planet. Novelists and popularizers tried to make these experiences both real and engaging. They also hoped to expand the readers’ sense of what could be represented. Realist novels and popular science conveyed sometimes challenging content – whether technical and specialized science or difficult social and psychological insights – and, in order to make their work approachable and commercially viable, these works adopted similar literary techniques. These techniques created reading experiences that made audiences more receptive to difficult content. I argue that novelists popularized realism by using the same wonder, mystery, surprise, or absorption that popularizers used to make disciplinary science understandable and marketable. Literary critics have long acknowledged that Victorian realism borrowed theories or methods from then contemporary science, but little work has been done to compare the experience of reading
Victorian science and realism. Popularization stressed the entertaining experience that readers could have through science, but tended to minimize the controversial aspects of new theories or the technicality of professional science. Therefore, the science that permeated Victorian culture began to assume a different appearance from that being pursued in laboratories or specialized journals. This dissertation illuminates Victorian realism by comparing it with overlooked aspects of popular science. My dissertation takes four authors – Charles Dickens, George Eliot, Thomas Hardy, and George Gissing – as examples of the many ways popularization strategies emerged in Victorian realism. These authors represent a broad chronological survey of Victorian realism, including the rise of social realism with Dickens, the move into psychological realism with Eliot and Hardy, and finally naturalism with Gissing.
Introduction

In *The Mill on the Floss*, George Eliot has her fashionable, well-to-do set discuss texts for an up-coming book club. Though published in the 1860s, the novel is set in what is probably the 1830s, so the characters consider two recent publications – Robert Southey’s *Life of Cowper* (1836) and William Buckland’s *Bridgewater Treatise* (1836) on geology. Even though Southey’s work is more obviously literary, Stephen chooses to wax more poetically on the geological tract. Soon the whole room is swept into the grand story of the Earth’s formation:

Stephen became quite brilliant in an account of Buckland’s Treatise, which he had just been reading. He was rewarded by seeing Maggie let her work fall, and gradually get so absorbed in his wonderful geological story … with an entire absence of self-consciousness. (384)

Literary critics have viewed this passage as a connection between Eliot’s novel and specific geological theories or methodologies. Sally Shuttleworth and Jonathan Smith argue that *The Mill on the Floss* engaged in the debate between geologists about uniformitarianism and catastrophism – two theories about the way geological change occurs over time. More recently, Adelene Buckland has contended that the passage exposes how Eliot’s “primary interest lay in a methodological dispute about the nature of scientific evidence” (228).

While these readings have shown how deeply *The Mill on the Floss* is indebted to Victorian science, they tend to overlook Maggie’s and Stephen’s absorption in the non-technical aspects of Buckland’s work. Maggie is lost in his “wonderful geological story”
and Stephen goes on to tell Maggie “There are many illustrations in it that you will like to see” (228). It is not theory or methodology that absorbs Maggie’s attention, but the entertainment of being lost in wonder and transported through time. Buckland’s *Bridgewater Treatise* brought readers in contact with exotic places in stretches of deep time. While Buckland was undoubtedly a participant in disputes between uniformitarians and catastrophists, to the general public he was more often known for the striking way he was able to conjure up the Earth’s past. In speeches, articles, and books, Buckland built a reputation as an entertainer as well as a scientist. When the *Quarterly Review* took up Buckland’s Treatise, the reviewer gushed about “the powerful interest with which he has endowed his subject” (“Dr. Buckland’s *Bridgewater Treatise*” 43). For the reviewer, Buckland’s writing and speech are designed to create the absorption that Maggie feels:

> Those who have listened spell-bound to that conversational eloquence with which the Professor is so peculiarly gifted – an eloquence which, when dilating on such subjects, absolutely calls up before his audience

> ‘the monstrous shapes that one time walk’d the earth,

> Of which ours is the wreck,’

> will, however, imagine the vivid and fascinating manner in which he brings out the abundant stores of his favourite Paleontology illustrations. (43)

Maggie’s rapt attention is not idiosyncratic. It was a feeling that Buckland consistently encouraged in his audience. Historian Ralph O’Connor has shown how popular Victorian geology – including that of Buckland’s – created an experience that he calls
“virtual tourism” (10). Audiences lost themselves “spell-bound” in imaginary travels through distant geological epochs.

Buckland’s *Treatise* was a popularization of Victorian geology, and it appealed to lay readers because it could move them. Many reviewers found the actual science wanting in the *Treatise*. *The Magazine of Popular Science* found that Buckland had “humored an idle taste for what was especially amusing” (341), instead of elevating readers into soberer scientific study. Charles Darwin concluded that Buckland was “incited more by a craving for notoriety, which sometimes made him act like a buffoon, than by a love of science” (129). But it was precisely this entertaining aspect of Buckland’s work that allowed Victorian geology to break out of professional societies and specialist journals – moving into wider appreciation, and eventually into the novels of George Eliot. Nor was Buckland alone in popularizing geology. A wide range of geologists from Charles Lyell to Gideon Mantell and Hugh Miller published commercially success popularizations that sold thousands of copies. These works attempted to transcend the narrow disciplinary discussions in which geology was embroiled, and instead create wonderful pictures of past geological ages.

Maggie’s reaction to Buckland, then, mirrors a larger reception of Victorian science, and was one that Eliot herself shared. Eliot’s correspondence shows that she often read science for pleasure, as much as education. She remarks of Lyell and Buckland: “I have read Buckland’s *Treatise* on geology with much pleasure, and I believe Lyell’s is good though it differs in Theory” (8). Enjoyment hinges less on matters of theory or methodology, but more on the experience one has reading. She read John Nichol’s *Architecture of the Heavens* as exactly the kind of virtual tourism
described by O’Connor: “I have been reveling in Nichol’s ‘Architecture of the Heavens and Phenomena of the Solar System,’ and have been in imagination winging my flight from system to system” (69). Meanwhile, she criticized more disciplinary science for its poverty of entertainment and style. In William Whewell’s *Philosophy of the Inductive Sciences* – which taught readers the correct methodology of rigorous science – Eliot found only “dreary dryness” (*Selections* 151). She considered Darwin’s *Origin of Species* “ill-written, and sadly wanting in illustrative facts” – concluding “This will prevent the work from becoming popular…, but it will have a great effect in the scientific world” (179). Eliot was aware that a gulf was opening up between what would have broad appeal and what would affect “the scientific world.”

In this dissertation, I examine what was involved in the distinction Eliot was drawing between the “popular” and what stirred scientific circles, and how it affected the science that entered the Victorian novel. Popularizations like Buckland’s were not merely a conduit between scientists and the public. Rather, they recreated science as a form of amusement that could capture the attention of mass Victorian audiences. Buckland was just one of many popularizers who mixed scientific instruction with escapism, spectacle, and wonder. To be successful, he had to accommodate the desires, beliefs, attention spans, and literary sensibilities of the audiences that were emerging for new forms of mass entertainment. Urbanization created crowds for museums, lecture halls, and local exhibits. Steam printing opened a market that popular science publications streamed in to fill. Historians have shown how Buckland’s *Treatise* capitalized on the beginnings of these changes. Jonathan Topham, for example, points out that “the treatises represented a nascent publishing form that would later be called
‘popular science’ – a form that publishers were very soon to find highly remunerative, but one that in 1832 was only beginning to be formulated as a commercial reality” (241). Within the decade Buckland would be joined by many others producing their own highly successful geology primers. Not surprisingly, then, when Eliot looked for a text that would capture her heroine’s imagination, she chose a text that had already seized many readers and the market for popular science itself.

Eliot’s allusion also signals a deeper similarity between popular science and her own novel. Just as Buckland was trying to draw readers into his depictions of the Earth’s distant past, realist authors like Eliot were absorbing readers in elaborate fictional realities. The realist novel was itself an immersive experience that sought to present the actual as an engaging spectacle. Literary critics have recently drawn attention to the careful ways Victorian realist writers created their own virtual reality for their readers. Like the “virtual tourism” of geology popularizers, novels like *The Mill on the Floss* take readers into other worlds. Audrey Jaffee has called this the “fantasmatic nature of Victorian realism” (2). Eliot invokes exactly this kind of travel into a virtual world at the beginning of *The Mill on the Floss* when her narrator slips into reveries before the scene of her own novel:

And this is Dorlcote Mill. I must stand a minute or two here and look at it…. The rush of the water and the booming of the mill bring a dreamy deafness, which seems to heighten the peacefulness of the scene. They are like a great curtain of sound, shutting one out from the world beyond…. Now I can turn my eyes

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1 See Alison Byerly’s *Are We There Yet* (U of Michigan: 2013), Rachel Ablow’s introduction to *The Feeling of Reading* (U of Michigan 2010), and Audrey Jaffee’s *The Victorian Novel Dreams of the Real* (Oxford 2016)
toward the mill again, and watch the unresting wheel sending out its diamond jets of water. That little girl is watching it too; she has been standing on just the same spot at the edge of the water ever since I paused on the bridge…. It is time, too, for me to leave off resting my arms on the cold stone of this bridge. Ah, my arms are really benumbed. I have been pressing my elbows on the arms of my chair, and dreaming that I was standing on the bridge. (2-3)

The narrator becomes so engrossed in the scene that she mistakes the pressure of her armchair for the imagined feeling of a railing on a fictional bridge. The sense of absorption mirrors the exact feeling that her novel is meant to inspire. When Maggie later drifts off at the hearing of Buckland’s Treatise, she replays both the Victorian reaction to popular science and the reader’s response to the novel in her or his hand. Eliot’s passing allusion to Buckland’s work does not amount to much of an engagement with Victorian geology as a discipline, but it exposes one of the ways that novelists and science popularizers hoped to generate similar experiences.

This dissertation investigates the different ways Victorian science popularizers and novelists each used the same strategies to engage readers. I do not set out to show how science influenced literature or literature influenced science, but rather to show how popular science and literary realism tried to create similar experience for their readers. The chapters below examine the places where this confluence is most apparent, but I approach science and literature as sometimes jointly and sometimes separately developing the same strategies to engage their readers. Absorption was just one experience that both tried to create. In each of my chapters, I show how popular science and novels developed a series of literary methods to attract their readers’ attention – and
even make them more receptive to the more difficult ideas that either science or Victorian realism tried to present. Novelists and science popularizers were often vying for the same readership within a print environment that placed science and literature in close proximity. Magazines mixed articles on psychology, physics, chemistry, and geology with novels by Dickens, Gaskell, Hardy, and others. Eliot’s *Romola* appeared in installments in the same *Cornhill Magazine* that published George Henry Lewes’ articles on physiology and natural history. Robert Young has referred to this as the “common context” (126) in which science and literature existed during the Victorian period. Publishers presented science and literature as complementary, and writers intentionally began to present their material in similar ways. In this context, Eliot could easily imagine her readers falling into the same trance that Buckland’s readers had in previous decades. Buckland, then, is not so much an influence on Eliot, as a partner in the same project.

Moreover, while popularizers and realist novelists like Eliot used similar literary techniques, they also tried to communicate difficult extra-literary content – such as the technical methodologies or complex theories of the sciences or the careful social and psychological investigations of realist novelists. Buckland earned a reputation as a showman, but his works did introduce readers to new developing theories in geology. When William Whewell distinguished between the competing schools of geology, catastrophists and uniformitarians, he credited Buckland as one of the major theorists on the catastrophist side. Popularizers like Buckland, Lyell, Miller, or Mantell were also respected geologists in their own right, and should not be thought of as only entertainers. Their works mixed amusement with scientific instruction, and often the role of amusement was to put readers in a receptive mood for more thorny scientific discussion.
As I will show in this dissertation, the scientific content was frequently overlooked or misinterpreted. But it was there, and its difficulty required the elaborate literary flourishes that accompanied popularization.

Realist novelists like Eliot often found themselves in a comparable situation. The canonicity of realist novelists can give the retrospective impression that contemporary readers welcomed the introduction of prosaic detail, psychological analysis, grand social perspectives, or any of the other hallmarks of Victorian realist novels. But, more often, realism pushed against the boundaries of what was considered worth literary treatment. Critics complained that *The Mill on the Floss* was too true to life. It depicted religiosity, passion, and meanness that many thought should be left out of novels. An unsigned review in the *Guardian* puts the case bluntly: “the actual course of human things is not necessarily the pattern for a work of art” (*George Eliot* 130). *The Saturday Review* even suggested “There are emotions over which we ought to throw a veil” (119). Realism was far from the established vogue for Victorian readers, and we can sometimes overlook the difficult task that novelists had when trying to present what Eliot had called “a faithful account of men and things as they have mirrored themselves in my mind” (*Adam Bede* 2).

Realist novels strained readers’ expectations and attention, and Eliot was not the only novelist to feel the push-back from critics. Charles Dickens’ shift from his earlier comic novels to the more complicated plots of his later novels – often considered by recent literary critics to happen around the writing of *Dombey and Son* (1848-49) – was greeted with confusion. One contemporary critic found himself lost in “the wilderness of *Little Dorrit*” (486), and lamented: “we sit down and weep when we remember thee, O *Pickwick!*” (486). Today, Dickens’ later fiction is considered the greater artistic
achievement, but Victorians feared that Dickens may have lost something in his movement from humorist to more ambitious novelist. Hilary Schor summarizes the mood when she notes that “Literary critics in London in the 1850s found themselves obsessed with one question: What had happened to the Dickens novel?” (12). Eliot’s psychology and Dickens’ complicated plots pushed new and difficult content and forms. Later, Hardy and the naturalist writers would startle readers with probing investigations into sexuality.

Suzanne Keen has introduced the helpful term “narrative annexes” to describe these attempts to add territory to the acceptable realm of the Victorian novel. Keen describes these annexes as “sites of Victorian novelists’ negotiation with the conventional” (1). They demarcate “zones in which Victorian novelists struggle to present improbable, awkward, unsuitable, embarrassing, or downright threatening ideas, characters, actions, and social problems” (9). Narrative annexes upset the readers’ expectations and prompt effort, but they also extend the scope of what can be faithfully represented. Keen focuses on schematizing the various types of narrative annexes that the Victorian novel was capable of making. But I am more interested in how Victorian novelists attempted to make readers more receptive to such annexes. My chapters expose how novelists were by no means assured that their annexes would be successful. Instead, they developed literary strategies to keep readers engaged in their fictional worlds while simultaneously encouraging readers to expand their sense of what could be represented beyond what was easy, comfortable, or even desirable.

Novelists found themselves in similar situations to science popularizers who were trying to explicate technical and sometimes controversial scientific theories to
readers unused to tackling such content. The science that emerged from professional societies and disciplinary journals stressed methodological discussion, mathematical calculations, competing explanations, and tentative theorizing. Lay audiences lacked the training and time to appreciate the slow, careful way scientific knowledge was created. Even when popularizers cut out much of the technical content, though, new scientific theories can unsettle accepted notions. Gillian Beer has argued that the process of theorizing itself involves radical shifts in perspective: “Most major scientific theories rebuff common sense. They call on evidence beyond the reach of our senses and overturn the observable world” (1). Technical content could confuse or bore some readers, but new theories could shock and dismay others.

When Robert Chambers wrote his immensely popular *Vestiges of the History of Natural Creation* (1842), he condensed the findings of many different disciplines – from astronomy to geology, biology, and anthropology – into one grand evolutionary epic about the gradual formation of the universe from physical principles. Critics admitted the work was well-written and pleasing to read, but evolutionary theory was still controversial in the 1840’s. Benjamin Disraeli parodied the work in *Tancred* – his sequel to *Sybil* – by showing just how counter-intuitive its ideas were. The novel’s protagonist Tancred meets with the cultured lady of society Lady Constance who is agog with the latest science popularization titled *The Revelations of Chaos*, a play on the *Vestiges of Natural Creation*. She explains:

“It explains everything, and is written in a very agreeable style.”
“It explains everything?” said Tancred. “It must, indeed, be a very remarkable book!”

“It is treated scientifically; everything is explained by geology and astronomy, and in that way. It shows you exactly how a star is formed. Nothing can be so pretty! A cluster of vapor – the cream of the milky way – a sort of celestial cheese – churned into light – you must read it – ‘tis charming.”

“Nobody ever saw a star formed,” said Tancred.” (247)

When Lady Constance explains the stages in the evolution of man, Tancred simply responds “I do not believe I ever was a fish.” Chambers’ Vesitges and Disraeli’s Revelations cut out the technicalities of science to present a simple story of development – one that Lady Constance believes “explains everything.” But the works cannot shake the kind of incredulity and resistance typified by Tancred’s response. Even when science popularization avoided technical discussion and achieved what Lady Constance would call “a very agreeable style,” their work could still incite resentment from conservative readers.

Just as realist writers were making annexes onto the expectations of novel readers, science popularizers had to extend their audience’s comprehension and interest beyond what was familiar and intuitive. This dissertation will explore the literary strategies that popular science and the realist novel shared to keep their works engaging while pushing the boundaries of what could be represented to a mass readership.
Rhetorician of science Jeanne Fahnestock has used the term “accommodating”\(^2\) to describe the moves recent popular science has used to adapt to lay audiences. This dissertation looks at realist novels because I argue that these works shared with popular science a set of literary strategies to accommodate similar audiences. With a focus on popular science, one might expect that I turn to more commercial forms of mass fiction—such as mid-century sensation fiction or late-century science fiction. H.G. Wells, for example, wrote what he called “scientific romances” with the explicit purpose of doubling as science education. He even wrote into *Nature* to explain how science popularization could best be done. More work certainly could be done on the connection between popular fiction and popular science. Anne Stiles points out that criticism on Victorian literature and science “has tended to focus on high realist fiction at the expense of genres with less academic prestige” (4). I draw special attention to the interaction of popular science and realism, however, because they shared similar goals. They were not just forms of entertainment, but also worked to expand readers’ sense of what could be represented and understood.

Each of my chapters shows how popularizers and Victorian realist novelists used absorption, wonder, mystery, and surprise to entertain, but also to make readers more receptive to more difficult content. I use *absorption* to refer to mental states that abstract characters and readers away from their immediate surroundings, and position them within imaginary worlds. *Wonder*, in this dissertation, will indicate reactions to entities that defy easy categorization and remain strange—no matter how much they are investigated.

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Mystery will refer to experiences of uncertainty. Lastly, I will use surprise to signal instances where expectations are established and then upset. Victorian science popularizers and realist novelists deployed these experiences to generate readers’ interest in the real.

If, as Eliot explained in her defense of The Mill on the Floss, the “ethics of art are too narrow, and must be widened to correspond with a widening psychology” (Letters 160), then the novel must encourage such widening – or “annexing” as Keen would have it. Fiction and popularization worked along similar lines to achieve this movement. By allowing the reader to enter into the kind of uncritical absorption that she attributes to reading Buckland’s popular Treatise, The Mill on the Floss can begin to accommodate the “widening psychology” to which she refers. I will show how realist novelists throughout the Victorian period made similar moves. My dissertation takes four authors – Charles Dickens, George Eliot, Thomas Hardy, and George Gissing – as examples of the many ways popularization strategies emerged in Victorian realism. These authors represent a broad chronological survey of Victorian realism, as well the rise of social realism with Dickens, the move in psychological realism with Eliot and Hardy, and finally naturalism with Gissing. I will also take in a wide swath of Victorian popular science – from Buckland’s Treatise published five years before Victoria ascends the throne to Grant Allen’s Grub Street science in the early twentieth century. I do not intend a complete description of the interaction between popular science and the Victorian novel. Rather, this dissertation hopes to draw attention to popularization as a category that helps us understand how challenging content is delivered in science and literature.
Studies of Victorian science and literature are common in literary criticism, but little work has acknowledged the ways popularization modulated the expression of science in Victorian culture. Critics tend to elide the role of popularizers in suiting science for the understanding and interests of a wide audience. Gillian Beer, in her foundational text *Darwin’s Plots* (1983), goes so far as to argue that Victorian science did not require accommodation. For Beer, popularization is a distinctly twentieth-century invention that the Victorians could dispense with:

In our own century scientific ideas tend to reach us by a process of extrapolation and translation. Non-scientists do not expect to be able to follow the mathematical condensations of meaning in scientific journals, and major theories are more often presented as theorems than as discourse…. In the mid-nineteenth century, however, it was possible for a reader to turn to the primary works of scientists as they appeared, and respond directly to the arguments advanced. (2-3)

Beer assumes that mathematical sophistication is the only barrier to lay audiences, and that the linguistic accessibility of Victorian science meant it was easy to absorb. But this underestimates the challenges moving knowledge beyond disciplinary boundaries. Non-specialists are ill-equipped to respond to methodological discussions, competing theories, and the careful, circumscribed claims of disciplinary scientific. Successful nineteenth-century popularizations like Buckland’s *Treatise or The Vestiges of Natural Creation* had to synthesize great amounts of research and present an attractive – and not merely readable – explanation of the natural world.
More importantly, the Victorians did not confuse these popularizations with “the primary works of scientists.” Even Charles Dickens, a writer not known for his scientific literacy, could astutely note the role of popularization in awakening the Victorian interest in science. He observed that the *Vestiges of Natural Creation* had “by rendering the general subject popular, and awakening an interest and spirit of inquiry in many minds … created a reading public – not exclusively scientific or philosophical – to whom such offering can be hopefully addressed” (*Works* 135). Nor were professional scientists fooled into thinking popularizations were primary works. The noted geologist Adam Sedgwick wrote a vituperative review of the *Vestiges of Natural Creation* in *The Quarterly Review* where he expressed his dismay at “The sober facts of geology shuffled, so as to play a rogue’s game” (*Life and Letters* 83). The biologist T.H. Huxley called the work “a mass of pretentious nonsense” (*Memoirs* 18). Professional scientists often felt called upon to police the claims of popularizations. They were keenly aware of the diverging paths of popular and disciplinary science in the nineteenth century.

Yet literary critics have tended to forget what the Victorians acknowledged about their own science literacy. Even when recent literary scholarship brings up the means through which Victorian novelists learned about science, popularization is treated as a middleman. George Levine’s classic *Darwin and The Novelist* begins with an overview of the ways science permeated Victorian culture:

Popularizations of science were filling lecture halls, journals, and workmensmen’s institutes; “lay sermons” were displacing religious ones; amateur fossil hunting, insect collecting, seashell study were holiday diversions and potential
contributions to rapidly expanding scientific knowledge. “Evenings at a Microscope” were pleasant hours of quasi-educational amusement. (4)

Levine shows the multitude of avenues through which science infused Victorian life, but this backdrop quickly gives way to a discussion of catastrophism and uniformitarianism – _isms_ that belonged more to professional societies like The Geological Society of London than to the popular science invoked at the book’s opening. Literary critics frequently use popular science as a way of establishing a more tenuous connection between obscure scientific discussions and literary fiction.

Scholarship proliferates on almost every discipline of science and Victorian literature. Biology\(^3\), psychology\(^4\), astronomy\(^5\), physics\(^6\), and geology\(^7\) all have been extensively linked with Victorian literature. These readings have shown the extent that science interacted with Victorian culture, but the emphasis on particular disciplines or theories can lead scholars to believe that nineteenth-century novelists and their audiences had a much more rigorous appreciation of science than they actually did. When critics

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\(^4\) Psychology has been a particular active field with the last ten years, and a complete survey would be unwieldy. This is small sample: Sally Shuttleworth *Charlotte Bronte and Victorian Psychology* (Cambridge: 1996); Vanessa Ryan *Thinking Without Thinking in the Victorian Novel* (John Hopkins: 2012); Jill Matus *Shock, Memory, and the Unconscious in Victorian Fiction* (Cambridge: 2009); Nicholas Dames *The Physiology of the Novel: Reading, Neural Science, and Form of Victorian Fiction* (Oxford 2007)

\(^5\) There are only two recent monographs on astronomy, but more scholarship can be found in the journal scholarship: Pamela Gossin *Thomas Hardy’s Novel Universe: Astronomy, Cosmology, and Gender in the Post-Darwinian World* (Ashgate: 2007); Anna Henchmen *The Starry Sky Within: Astronomy & the Reach of the Mind in Victorian Literature* (Oxford 2014)


place passages of novels alongside the discourse of professional scientists, it can give the impression that literary fiction and professional science shared the same concerns and cultural space. But this can skew our view of the kind of engagement science and literature shared. Anna Henchmen, for example, correctly records that “many Victorian writers followed the developments in astronomy detailed in periodicals, newspapers, public lectures, and popular treatises” (131), but she uses this connection to argue that Victorian novels reflected narrow disciplinary discussions about parallax, astrophysics, and optics. Victorian scientists, however, frequently complained that these concerns were little understood by the public. James Clerk Maxwell opined in 1873 that “it is difficult, especially in these days of the separation of technical from popular knowledge, to expound physical optics” (817). Adalene Buckland details the multitude of sites geology entered Victorian popular culture – even showing its classed and gendered valences – but then regards fictional forms as providing “an imaginative realm in which the methodological and epistemological difficulties that racked geological science might be fully and finally reconciled” (104). While literature may have helped in “methodological and epistemological difficulties,” perhaps a more superficial reading of popular geology is that it used literary forms to make science more attractive.

Anne Dewitt has recently criticized literary scholars for hastily accepting what she class the “one culture model” (2-6) of how literature and science interacted in the Victorian period. She explains:

Work in this subfield usually involves demonstrating that Victorian science and literature pursued the same questions, employed the same metaphors, and partook of the same ways of knowing; the novel was influenced by developments in
science, but science was also influenced by the novel. This approach obtains even when the scholar does not explicitly state that Victorians lived in a one-culture world. In fact, in the past few years explicit statements to this effect have become rarer – the sign that they have become the doxa of this particular subfield and therefore do not need to be spoken. (4)

Dewitt faults such an approach for precluding any reading that shows science and literature to be antagonistic, rather than complementary. The one-culture model also renders the work of popularizers invisible. If science and literature already used common language and worked on the same questions, then popularization would be extraneous for literary authors already steeped in the pervasive scientific culture. As Dewitt points out, the one-culture model may have been useful to scholars in the 1980s trying to establish the connection between Victorian science and literature, but today it can blur the different projects that scientists and novelists pursued through the period. It also gives the impression that Victorian readers were primed for complicated methodological discussions, obscure theories, and technical language.

Dewitt complicates the one-culture model by showing how science and literature can oppose, as much as complement, each other. In this dissertation, I suggest that the interactions may be even more multiform. I argue that there is third category that needs to be considered in the interaction between science and literature: the mass audiences that consumed them. These audiences often valued amusement or comfort over the ambitions of scientists and novelists, and their demands shaped the popular culture in which science and literature interacted. Historians of science have already extensively shown how lay audiences influenced the presentation of popular science. In fact, the study of science
popularization has become an active subfield in history over the last twenty years. In one of the seminal articles in this field, Cooter and Pumfrey make a claim that had been central to this work: “In short, ‘popular science’ may diverge from ‘learned science’ not because the latter is poorly understood, but because it is developed by its recipients for different purposes” (249-50). In this analysis, popularization is not simplification, so much as it is a refashioning of science for the “different purposes” of its audience. This shift in the understanding of popularization has led to an explosion in writing on popular science. Work on Victorian popular science by historians such as Roger Cooter, James Secord, Aileen Fyfe, Jonathan Topham, and Bernard Lightman\(^8\) has demonstrated that the active interests of lay audiences molded the creation of popular science. In Lightman and Fyfe’s words, this approach “encourages us to think about audiences: where might people encounter and interact with the sciences, and what sort of experiences might they have there?” (4). Topham stresses “the agency of all those involved in the communication circuit, including readers” (233). Historians of science have reversed the notion that popularization is a top-down process of diffusing professional science to the uninformed. Instead, popularization represents a new form of science that accommodates the goals of a broad, non-technical audience.

Science popularizers and realist novelists often shared this audience in the pages of monthly magazines, commercial publishers, and lending libraries. This dissertation

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focuses on the similar experiences that popularizers and novelists tried to give their readers. Past studies have looked at the interaction of science and literature in the themes or language of the Victorian novel, but I will show that an important interaction occurred in the “experiences” – as Lightman and Fyfe put it – of lay readers. It was their sense of absorption, wonder, mystery, or surprise that allowed scientific ideas to spread. These were the same experiences that realist novelists called on to make readers more receptive to challenging new content. Novelists even explicitly invoked popular science in places where this connection is strongest. Eliot’s off-hand allusion to Buckland is one small example, but each of the authors I cover – Dickens, Eliot, Hardy, and Gissing – were well-read in popular science. They often echoed the words of popularizers in their novel.

Because I will use the word *popular* and its cognates throughout the dissertation, it is important to properly define the term before moving into the chapters. Raymond Williams noted that the meaning of “popular” and “popularization” was in flux throughout the nineteenth century – generally moving from a positive sense of *something for the people* to the negative sense of “simplification” (237) by the twentieth century. Many historians of science caution that the phrase “popular science” contains a great deal of twentieth and twenty-first century freight that may mislead. Lightman explains that “It would seem advisable for historians dealing with the nineteenth century to avoid the use of terms that are loaded down with so much baggage, much of it collected after 1900” (9). But Lightman and others continue to use these terms, as there are no good alternatives. I will use “popular science” throughout this dissertation, but first I will delimit some central characteristics of this category. I employ popular science to refer to scientific works produced for mass audiences and commercial gain. This science could
appear in many genres, sites, and media – and it often did. But its main defining characteristics were its wide audience and profitability, or as Lightman explains “it meant attracting large audiences and financial prosperity” (11). I will use the terms “professional” or “disciplinary” science to refer to science that is specialized, advancing independent research, written to persuade other scientists, and pursued without regard to financial consequences.

Popular, in this sense, does not mean anything that garnered general approval or attention. Some professional scientists achieved celebrity in the culture, but their work often stayed more specialized and designed to advance disciplinary discussions. Charles Darwin’s *Origin of Species* (1859) sold 59,000 copies – making it more widely read than many of the works of popular science writers, yet Darwin was rarely credited for popularizing evolution. That fell to writer and lecturers like Robert Chambers, T.H. Huxley, John Tyndall, Edward Clodd, or Grant Allen. These popularizers synthesized evolutionary theory from different disciplines and told a coherent and emotionally engaging story. Darwin could be regarded as an excellent scientist, but he fell short as a science communicator. Allen concluded at the end of the century that Darwin was a “biological specialist … who stuck to his spécialité with that infinite patience and that infinite capacity for taking pains about detail which constitute genius” (21). However, he lacked “philosophic roundness and completeness” which allowed Tyndall, Huxley, and writers like himself to render evolution important. Darwin’s work grew increasingly specialized in later decades with careful studies of plants and fungi. He worked with different goals in mind from science popularizers. While a writer like Allen produced science writing for a living and had to perennially find interesting angles to take on
evolution, Darwin had inherited enough capital to pursue whatever narrow investigations were most relevant to his theory. The differences were keenly felt by scientists and readers.

As financial situations changed, scientists, magazines, or institution could change from targeting professional scientists to appealing to the lay public. Perhaps no place was this more apparent than at the Polytechnic Institute. In 1838, The Polytechnic Institute officially opened its doors at Regent Street, London. It included spaces for inventors to work, a gallery to show their creations, a hall for science lectures and other displays like magic lantern shows, an oxyhydrogen microscope capable of projecting images several feet across, or an electric train that carried pillars around the building’s interior. The Polytechnic sought to educate and amuse lay audiences, but it also aimed to capitalize on the mid-Victorian demand for urban entertainment. Historian Bernard Lightman, describes The Polytechnic as “a hybrid space” (Science 186) that brought together spectacle, entertainment, and learning. Lightman asks “Was it a museum, or a laboratory, or a lecture theater, or an exhibition hall, or even an amusement park?” (116). Victorians were equally aware of The Polytechnic’s dual purpose as both fun diversion and serious instruction. A writer for the Pictorial Times, noted that “in no exhibition in London are amusement and instruction so thoroughly combined” (“Easter Monday and Its Amusements” 233). In 1850, Charles Dickens opened a two-part article on mass entertainment in his journal Household Words with a discussion of the Polytechnic Institute in London. For Dickens, The Polytechnic held up its claim to instruct, but feel short in entertaining:
an infinite variety of ingenious models are exhibited and explained, and …
lectures comprising a quantity of useful information on many practical subjects
are delivered… but we think a people formed entirely in their hours of leisure by
Polytechnic Institutions would be an uncomfortable community. (13)

Audiences preferred drama and fiction, Dickens argues, and The Polytechnic was too
rooted in fact and machinery. Dickens diverted his readers, then, to other “escapes out of
the literal world” (13) since “There is a range of imagination in most of us, which no
amount of steam-engines will satisfy” (13).

The managers of The Polytechnic were well aware that they were in competition
with theater and fiction. In 1854, John Pepper was designated the new manager of the
institution and would begin taking steps to allay Dickens’ criticism. Pepper was already
the most famous lecturer at The Polytechnic. His lectures connected chemistry with
contemporary controversies. He gave talks on everything from strychnine and scares
about adulterated water supplies to munitions used in the Crimean war to the scientific
controversy surrounding the spontaneous combustion in Dickens’ own Bleak House. As
Richard Altick explains, Pepper “portrayed science in context, socially connected,
bearing upon industry and conditions of living” (“A Victorian Showman” 539). But
perhaps Pepper’s largest contribution to the Polytechnic was to take the institution in the
direction that Dickens suggested: He would introduce more dramatic entertainment to the
Polytechnic. In 1862, he introduced a new magic lantern show that used a slanted piece
of glass to produced ghost-like images that hovered in the center of a stage. Instead of
using the device for an optic lecture that would demystify the illusion, Pepper used it to
put on a stage production of Bulwer-Lytton’s popular ghost tale “A Strange Story.” The
work was a hit, and Pepper would use the new device to stage several more plays. Eventually, Pepper would write to Dickens himself to request permission to stage the Christmas ghost story “The Haunted Man.”

This was all part of what Lightman refers to as Pepper’s “ambitious project of institution fashioning” (Science 123) which brought the Polytechnic closer to Dickens’ idea of amusement, but increasingly conflicted with its scientific reputation. As such, it was a commercial success, but a compromise of the institution’s status as a science communicator. Historian James Secord points out that Pepper avoids bogging his audience down in mathematics or the stickier problems of more disciplinary work (Secord “Quick and Magical” 1649). Many Victorians felt that the Polytechnic may have overshot the mark in its drive for entertainment. A few years after Pepper left the Polytechnic, Punch rejoiced that the new directors were dropping the façade of science instruction. The new directors “did not seek to disguise the fact that in their opinion chemistry had been unduly sacrificed to comic entertainments, and that mechanical engineering had been altogether put on one side to make room for ‘ghosts’ and optical illusions” (qtd. in Science 123). Pepper frequently courted the opinion of established scientists to bolster the reputation of the institution, but his role in scientific community was always on the periphery. The Polytechnic granted him the honorary title of “professor,” but it was a name only. Science in Pepper’s Polytechnic took a different form – one which appealed to larger audiences, but sacrificed instructional content.

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9 The Illustrated London News estimated that 109,000 had already attended Pepper’s productions by 1866 (See Lightman Science 121)
Compromises like Pepper’s were of a particularly Victorian character. Science had emerged as a popular attraction for many Victorians, but low public funding made it difficult to survive as a scientific institution or as professional scientist without accommodating non-technical audiences. There were few university posts, laboratories, or professional societies that could provide careers to aspiring scientists until the end of the century. Professional scientists either occupied the few paying positions available, or, more likely, were independently wealthy. For example, Charles Babbage obtained high standing in several fields in Victorian science, and even was instrumental in the founding of professional societies. But his research could be self-funded through his large inheritance. His *Reflections on the Decline of Science in England* was a long screed against the lack of funding for scientific work. Babbage warned the careerist scientist “There are no situations in the state; there is no position in society to which hope can point, to cheer him in his laborious path” (36). Science could confer status, but frequently not an income.

Even scientists who eventually gained paid positions often had to rely on popular science early in their careers. T.H. Huxley became the Fullerian Professor at the Royal Institution in 1855, but before that he struggled to find paying work – resorting to writing occasionally pieces for middlebrow magazines such as *The Westminster Review* and *The Leader*. In the early 1850’s Huxley was a decorated member of the Royal Society and president of other scientific societies, but he was always rather penniless. He complained to his fiancée “A man of science may earn great distinction, but not bread. He will get invitations to all sorts of dinners & conversaziones, but not enough income to pay his cab fare” (*Life and Letters* 72). While accomplishments within particular disciplines could
confer status, they simply did not pay. Popularizations were an easy recourse for scientists like Huxley in financial straits, and all of the popularizers in this dissertation were concerned with how many pounds per page they could squeeze out of their work. For this reason, James Secord has suggested the term “commercial science” (Victorian Sensation 437-80) as a replacement for “popular science.”

Popularizations like Huxley’s or Pepper’s also adapted themselves to mass audiences and the technologies that communicated with them. The Polytechnic hoped to capture the attention of crowds that emerged from increasing urbanization and mid-century wealth. Huxley wrote in magazines that benefited from decreased printing costs and increased literacy. Popular science had existed before the Victorian years, but it now had its largest audience to address. Historians of science have extensively described these new conditions. Lightman explains that popular science was “intimately tied to the changing conditions in the world of publishing and the emergence of a mass reading audience” (Victorian Popularizers 493). Secord even makes the stronger claim that “never before had there been a mass market for knowledge” (30). Speaking to this new audience meant mastering new techniques and technologies for distributing ideas. Pepper’s ghost illusion shows how popularizers sometimes had to invent their own technologies for this purpose.

More commonly, though, popular science used literary techniques to hook readers. Victorian science writers have left behind a wealth of writing about the literary techniques they used to better communicate and enthrall audiences. They describe their use of metaphor, narrative, and rhetoric to generate certain experiences in their readers. They were also self-aware about their relationship with literature. When Richard Proctor,
the most prolific astronomy writer in the late nineteenth century, wrote a book about making an income through science writing, he plainly aligned popularization with literature:

But it need hardly be said, perhaps, that of all forms of science literature, so-called popular science-writing is the most steadily remunerative. We need look no further for the cause of this than the circumstance that the literary qualities required for the effective popular treatment of scientific subjects are the same which are required for success in the literature of history, biography, fiction – nay, even for success in poesy and the drama. (7)

Proctor stressed these “literary qualities” throughout his own work and review of other science popularizers. The directors of the Polytechnic Institute knew the power of literature, and used their inventions to stage productions of literary hits. Buckland’s “wonderful story” presented geology as an engaging narrative, rather than an argument. These are just examples of what Proctor thought “need hardly be said”: popular science was literature.

Historians have been thoroughly exploring this connection in recent years. Lightman argues that studying popular science “transports us to the literary dimensions of science” (xi), and Ralph O’Connor has agreed that “literature was central to the business of science popularization” (290). Historians have pointed out that readers of popular science and literature were having similar experiences – or as Secord puts it: “A great novel could move its readers, but so too could a profound work of science” (Visions of Science 140). Literary critics have thoroughly mined more disciplinary science for
thematic and linguistic overlap with Victorian literature. Popularization, though, had received little attention despite its well-acknowledged literary qualities. This dissertation extends the insight of historians into the literary nature of popular science. But I go beyond historians of science by investigating how the strategies of popular science underpin a key problem in literary realism: how to make readers interested in and attracted to the real. Literary critics frequently remark on realist novel’s desire for reality. For example, Audrey Jaffee explains that “the real, for the Victorian novelists who seek to represent and capture it, is an object of desire” (12). Yet little work has been done to show how novelists make the real desirable to the reader. Literary criticism has spilled considerable ink over how realism comes to represent reality, but more needs to be said on how that representation appeals to its audience. Exploring realism’s connection to popular science exposes how both communicated with the interests of a broad readership.

The connection between popular science and literature may have been particularly strong as both were trying to capitalize on the same mass readership. Just as science popularizer became a viable career over the century, novelists began to earn living incomes. Anne Dewitt summarizes this change when she notes “On a very basic level, in 1900 it was easier to support oneself through writing or through practicing science than it had been in 1800” (9). Successfully cornering the market, though, meant catering to the tastes of new audiences and the affordances of communication technologies. Richard Salmon has recently tracked the effects of this change on the professional identities of literary authors. He finds that Victorian authorship often involved jettisoning Romantic notions of genius for more pragmatic and marketable forms of self presentation. He calls this process “the disenchantment of the author” (8). When novelists prominently moved
into the marketplace, they found themselves in similar waters as the directors of the Polytechnic when they looked around to market their inventions. Science and literature now had to establish common ground with their audience. While Darwin could be a “genius” in his specialty, as Grant Allen had observed, popularizers and novelists needed broader appeal.

However, neither science nor the novel merely pandered to their audience. Indeed, it is hard to read a page of George Eliot’s *Mill on the Floss* or Buckland’s *Treatise* without sensing greater ambitions. Buckland was an established scientist who hoped to introduce readers to the latest discoveries in geology, and Eliot’s novel contains sophisticated analysis of psychology, gender, and religion. These works could challenge or confuse readers, and their authors developed literary strategies that would make readers more receptive. These strategies generated experiences that allowed authors to expand the limits of readers’ comprehension and interest. From our current perspective, the realist novel may seem like the obvious and inevitable victor of Victorian fiction. But, at the time of composition, the status and marketability of the realist novel was not assured. Reviews and correspondence expose how tenuous its cultural position actually was. Now-canonical realist novels could and did face pushback from then-contemporary readers and critics unwilling to accept the “annexes” that these works were trying to make on Victorian fiction. The “literary qualities” of popular science and novels created experiences that drew readers into their works.

While these experiences could disarm readers, this is not to say that novelists sought to pacify audiences or suppress all critical readings. Instead, the experiences common to realist novels and popular science were more active, and designed to
encourage readers to participate in the process of knowledge creation. When the narrator of *The Mill on the Floss* slips into reverie, she invites readers into the world of the novel and introduces the heroine whose thought and actions will so puzzle critics. Absorption becomes a creative act in *The Mill on the Floss*, as Eliot makes the reader complicit in the construction of challenging content. This dissertation will track the variety of experiences produced by popular science and realist novels, and look at the literary strategies both employed to encourage readers into these states. I address absorption – which many literary critics have already begun to study as a central experience of realist fiction – but also wonder, mystery, and surprise. These experiences linked science and literature during the Victorian period in a way that has not yet been acknowledged. Literary criticism tends to focus on linguistic or thematic similarities between science and literature, but I argue that the experiences of readers constitute an important intersection between these two disciplines.

Each of my chapters traces the similar literary techniques that novelists and realists deployed to create a particular experience. I then chart how that experience encouraged readers to expand the boundaries of representation and understanding. My chapters follow chronological order and roughly cover the years of the Victorian period. The connection I draw between science and literature must be situated historically. Novelists and popularizers shared literary techniques largely because they faced similar situations. New communication technology, expanding audiences, and commercial ambitions affected the development of both science and literary writing during this time. Wonder, mystery, surprise, and absorption can be thought of as trans-historical experiences that affect readers today as much as Victorians, but the impetus for their
deployment is contextual. Authors and readers used these experiences for ends particular to their situation and goals. A historical lens is necessary to appreciate why this connection existed between science and literature.

My first chapter connects Dickens’ science journalism with his turn from the lighter, picaresque novel *Pickwick* that had made his reputation to the grand social vision of his later novels. Dickens commissioned several articles on science entertainment for his magazines *Household Words* and *All the Year Round*, and he also wrote a review himself of “The Poetry of Science” – a popularization of mainly chemistry and physics. These works spent less time analyzing particular scientific theories than in remarking on the wonderful and otherworldly objects that popularizations could conjure up. In his own review, he praises the work for “leading the students’ mind from wonder on to wonder, until his is wrapt and lost in the vast world of wonder” (135). Dickens’ reading is not misleading, as science writers played up nature’s monstrosities or curiosities to enthrall audiences. This meant that science and literature could be closely aligned since both gave readers what he called “an escape from the literal world” (187) – temporarily lifting them out of oppressive contact with their immediate surroundings. I argue that Dickens used language and examples lifted from popular science to relieve readers from the difficulties that a too-rigorous realism could exert. Dickens’ relationship to realism has always been unstable since his works contain so much caricature, sensationalism, and improbable plotting. I position three novels – *Dombey and Son*, *Bleak House*, and *Our Mutual Friend* – alongside Dickens’ science journalism to show how he used the wonder of popular science to encourage readers to follow the elaborate and sometimes dreary plots of these later novels.
The second chapter shows how George Eliot’s fiction and George Henry Lewes’ popular natural history used mystery and surprise to fascinate readers and keep them working through intellectually demanding content. Literary critics frequently point to Eliot and Lewes’ close romantic and working relationship as evidence that her fiction engaged with particular scientific disciplines or theories. But professional scientists regarded Lewes as a popularizer in his own day, and his works exert significant energy to entice the reader to keep reading. Lewes presents scientific study as a series of shocks and unsolvable problems. He maintains interest by reversing expectations just when readers seem most assured of their conclusions. My chapter explores how Eliot used similar strategies to get readers to understand and sympathize with psychologically complex characters. Eliot’s psychological realism was new and experimental for the Victorian novel. I show how her works relied on surprise and mystery to get readers to appreciate the novelty of her works. Eliot famously declared that a work of art “surprises even the trivial and selfish into that attention to what is apart from themselves” (145). While much comment has been given to the latter half of that quotation, little had been written on how Eliot’s fiction “surprises” the reader. This chapter reads Lewes’ popularizations alongside Eliot’s The Mill on the Floss and her short novella “The Lifted Veil” to expose how both authors employed similar strategies to frustrate simplistic and terminal readings in favor of surprising, open-ended investigations.

The third chapter follows the connection between Thomas Hardy’s novels and Richard Proctor’s popular astronomy texts. Proctor composed works of what O’Connor has called “virtual tourism” – imaginary voyages that took readers from the surface of barely explored planets to the edge of the galaxies. While astronomers had little
information to make claims on, Proctor speculated about what life forms could exist on planets and what supernovae look like up close. Through extrapolation, metaphor, and allusion he constructed whole worlds for readers to explore. Professional scientists lambasted Proctor in reviews for straining credulity, but his works sold well and were avidly read by Hardy. For Hardy, popular astronomy spoke to the difficulties involved in imagining fictional worlds. He found that readers increasingly demanded meticulous realism, and that maintaining conviction in a fictional world was becoming harder as the nineteenth century progressed. In the 1917 preface to his works, Hardy would only venture the claim that his novels represent a “series of fugitive impressions which I have never tried to coordinate” (12), rather than a coherent whole. Sustained belief was a problem for both Proctor and Hardy. In this chapter, I demonstrate that Hardy relied on similar literary strategies to sustain the reader’s conviction in the imaginary worlds his novels constructed. Proctor worked to make his virtual tourism believable because he hoped to convey some details about astronomy while making sales. But I argue that Hardy believed that emotional engagement was only possible through sustained conviction. The chapter compares the literary strategies of Proctor’s popular science with Hardy’s three novels Return of the Native (1878), Two on a Tower (1882), and Tess of the D’urbervilles (1891).

The fourth chapter describes how George Gissing used popular geology to show that the compromises of popularization and realist fiction were becoming untenable at the turn of the century. Gissing had read the works of geologists like Charles Lyell and Hugh Miller before writing his major novels in the 1890s. He was also friends with two of the more prolific popularizers of the late nineteenth century – Grant Allen and Edward
Clodd. With these science writers in mind, Gissing showed how impossibly difficult it was to break into professional science, and how spiritually crushing it could be to write for popular audiences. Gissing characterizes science writers in *New Grub Street*, *The Odd Women*, and *Born in Exile* as desperate to achieve stability, but unable to find ways of accommodating their audiences. These science writers parallel his novelists and artists who find themselves in similar financial straits. While previous novelists had portrayed popular science as a way to show how artistic ambitions could be reconciled with reader demands, Gissing uses popular science writers to demonstrate that these goals were no longer reconcilable. Just as science had professionalized during the nineteenth century, Gissing’s late novels suggest that novelists needed similar market protections and intellectual space for development.

These chapters chart the progress of Victorian realism from the social realism of Dickens through the psychological realism of Eliot and Hardy and finally to Gissing’s naturalism. I also connect it to the popular science, as it existed from Buckland’s *Treatise* in the 1830s to Grant Allen’s popular evolutionary works in the 1890s. But this project has larger applications for how we think about interdisciplinarity beyond the Victorian period. In my conclusion, I discuss how popularization continues to affect how literary studies views the sciences. Popularization is not only a Victorian phenomenon. It promises to bring non-specialists closer to highly technical fields, but involves refashioning science into something new, accessible, and literary.
“Wrapt and lost”: The Popularizing Language of Wonder in Victorian Natural History and Dickens’ Literary Realism

In 1851, Charles Dickens commissioned the science writer F.K. Hunt to report on new exhibits at The Hunterian Museum of natural history and anatomy for his new monthly *Household Words*. Hunt chose to begin the resulting article by drawing a contrast between the natural history museum and the adjacent law offices in Lincoln’s Inn Fields: “London is full of strong contrasts, and one of them may be met with in Lincoln’s-Inn Fields. Two large public buildings adorn that fine open square – as different in character, appearance, associations, and objects as two structures can be” (Hunt 277). While the legal structure accords with its English surroundings, Hunt points out the otherworldly appearance of the Hunterian. Entering the Hunterian makes the difference more pronounced:

In two minutes we are in a different world. Without, we left an atmosphere of life and living bustle; within, we find a stiller, calmer company. We walk amidst an abundant harvest yielded by death to teach the lesson of how life continues, and we come in absolute contact with some things that moved upon the earth before the Flood.... Very few minutes are generally enough to calm down the minds of those who may visit the two buildings in succession – who, after seeing the Hall of Lincoln’s Inn, will pass along the square and the Hunterian Museum. (277)

The Hunterian, like much of Victorian popular science, transported its audience. For Hunt, the museum’s antediluvian life created a kind of escape that counteracts the bustle
and confusion of Lincoln’s Inn Hall while immersing audiences in a new world of wonder.

Less than a year later, Dickens recreated Hunt’s stroll across Lincoln’s Inn Fields at the beginning of *Bleak House*:

London. Michaelmas Term lately over, and the Lord Chancellor sitting in Lincoln's Inn Hall. Implacable November weather. As much mud in the streets as if the waters had but newly retired from the face of the earth, and it would not be wonderful to meet a Megalosaurus, forty feet long or so, waddling like an elephantine lizard up Holborn Hill. (3)

The narrator begins in both the location and voice of the Chancery courts at Lincoln’s Inn Hall, but the megalosaurus – a genus of dinosaur popularized by the Hunterian’s director, Richard Owen – appears to escape from the museum and inhabit the square. The “wonderful” image disrupts the sentence fragments of legal discourse and squalid description to introduce a colorful simile that ornaments what would otherwise be an oppressive scene. The narrator quickly lapses back in short snippets of description:

“Dogs, undistinguishable in mire. Horses, scarcely better; splashed to their very blinkers. Foot passengers, jostling one another’s umbrellas in a general infection of ill-temper, and losing their foot-hold at street-corners” (3). But, for both Hunt and Dickens, the wonders of natural history offer a small break from the atmosphere of Lincoln’s Inn Field. Popular science diverts as much as it educates, and the novelist employs the wonder of the Hunterian’s displays to enliven his scene and keep readers engaged. Dickens set out to describe Victorian London, but also, as this chapter will argue, to resist its dismal
atmosphere. The narrator’s deployment of popular science typifies how Dickens uses wonder to mediate the connection between reader and novel.

Literary critics have noted how the language of natural history enters Dickens’ novels, but they have tended to map specific scientific theories onto Dickens’ novels. For example, George Levine and Virginia Zimmerman find that the novelist modeled his narratives upon specific geological theories – *gradualism* and *catastrophism* – of debate for Victorian scientists. While these readings have done excellent work exposing places where natural history appears in Dickens’ fiction, they overlook the immediate, affective reaction that Victorians had when confronted with popular natural history displays like those at the Hunterian. Popularizers presented natural history as a fanciful escape, while theoretical or methodological discussion was minimized. For Hunt and Dickens, popular science was defined by otherworldly attractions, and its value lay in the way it could connect a lay audience to a highly technical field like paleontology.

When *Bleak House* shifts into the register of natural history, the narrator seems less interested in explaining geological theory than in investing the scene the with interest and making the reader affectively engaged with the novel. While this may seem a pedestrian goal, for Dickens the stakes are rather high. *Bleak House* sets out to describe the atomization of English society, while at the same time resisting that force and reconnecting individuals. I argue that Dickens’ use of popular science indexes the way his prose offers readers temporary escapes from the oppressive force of the social world he describes. This chapter looks at Dickens’ use of natural history in three novels – *Dombey and Son* (1846-48), *Bleak House* (1852-53) and *Our Mutual Friend* (1864-65) – where the author complements a broad social vision with language borrowed from
popular science. I work with these novels, not only for their interaction with Victorian science, but also because they represent three of Dickens’ most panoramic views of London society. *Dombey and Son* is often marked as the beginning of the author’s mature output because of its vast social perspective\(^\text{10}\), and *Our Mutual Friend* – Dickens’ last completed novel – stands as his last complete effort in this regard. This chapter shows how Dickens uses the otherworldly and wondrous language of popular science as part of a larger strategy of engaging the reader in this broad perspective.

The other worlds of mid-Victorian popular science

Dickens has long had to shake the reputation of scientific provincialism. His public belief in stories of spontaneous combustion, as well as his satires of scientific societies in *Pickwick Papers* and *Hard Times*, have made him appear anti-scientific to many readers. George Henry Lewes famously condemned Dickens in *The Fortnightly* as remaining “completely outside philosophy, science, and the higher literature” (152). Lewes would become one of many to deem Dickens lacking in scientific literacy. In a summary of Dickens’ reception history, Ben Winyard and Holly Furneaux have found that “Lewes’s damning verdict quickly became part of the critical consensus and Dickens was long considered ignorant of, unresponsive to, or even antagonistic towards the scientific endeavors, findings and insights of his era” (1).

But this view has been gradually replaced by a finer understanding of both Dickens and Victorian scientific culture. Dickens may not have read as deeply into science as novelists such as George Eliot or Thomas Hardy, but he did forge connections

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\(^{10}\) For example, Kathless Tillotson explains that “It [Dombey and Son] is the first in which a pervasive uneasiness about contemporary society takes the place of an intermittent concern with specific social wrongs” (157)
with some of the most successful popularizers of science during the mid-Victorian period. Ann Wilkinson’s seminal article in 1967 on Dickens and thermodynamics drew attention to Dickens’ correspondence with the leading physicist of the day, Michael Faraday. Dickens had close contact with several important scientific figures, such as the comparative anatomist Richard Owen and the natural history popularizer F.K. Hunt, and critics have shown how these relationships gave the novelist access to the latest scientific ideas. Dickens also solicited for science writers to contribute to his journals *Household Words* and *All the Year Round*. These articles pursued topics from museum openings to evolutionary theory while they remade science into topics of general interest. Through his correspondence with Faraday, Dickens was able to ply Faraday for the notes to his “Christmas Lectures” – which Dickens then handed over to one of his writers to rewrite for *Household Words*. *Household Words* and *All the Year Round* have proved productive areas for scholars to find connections between Dickens and geology, evolutionary theory, and psychology. In George Levine’s words, these journals were “important popularizers of scientific ideas” (124). Through these connections, scholars argue that Dickens was aware of the contemporary scientific debates and employed their language in his novels. For Wilkinson, Dickens’ correspondence with Faraday led to the use of thermodynamics in *Bleak House*, and, for Levine, *Household Words* and *All the Year Round* allowed Dickens to participate in controversies over the processes behind geological change.

These approaches have done excellent work overturning the assumption that Dickens wrote *against* science. But neither did Dickens write as an informed scientist. Instead, he participated in the translation of science into popular entertainment. Jay Clayton has pointed out that “Dickens loved a good show” and his “attitude toward …
scientific interest, should be put in the context of his delight in popular entertainment” (97). Similarly, Adelene Buckland has recently suggested Dickens created a kind of “science-as-entertainment” (273) in his novels and magazines. Literary critics have shown how Dickens involved himself in a popularization process that turned science into a diversion. Their work has focused particularly on the visual display of science in shows, panoramas, and lectures – placing Dickens’ reception of science in the context of his response to other popular shows like melodrama or pantomime. This research builds on earlier studies of Dickens’ reception of popular entertainment. Gillian Beer, for example, argues that Dickens worked the spectacle of popular theatre into the style of his novels: “Dickens draws upon the theatre’s power of manifestation in his subject matter, characterization and in the activities of his style. His style is spectacle” (179). Paul Schlicke positions Dickens at a moment of historical change in English popular entertainment: “there was a decisive shift away from gregarious, participatory activities toward large-scale spectator entertainments” (98). These “large-scale” entertainments traded on “spectacle and diversity” (53). The newly large and passive audiences of Victorian popular entertainment needed great stimulus to maintain attention, and, as literary critics have pointed out, theatre and shows gave it to them. Clayton and Buckland adopt the common view that popularization, for Dickens, meant shocking and stunning. In an analysis of Dickens’ relation to geology, Buckland concludes that Dickens, like other science popularizers, “was a maker of geological spectacle” (273). Meanwhile, Clayton shows that Dickens saw science through the lens of “commercialized spectacles” (98).
These readings have expanded our sense of how Dickens engaged with Victorian science, but their focus on surprise and shock have obscured the other ways that popularizers engaged their audiences. As Dickens would write in *Household Words*, popular science’s main attraction was a sense of wonder that it could lend to ordinary life. In 1848, while reviewing a new popular science title, the novelist took the time to comment on the emerging market for popular science. Like many commentators, Dickens pointed to the runaway success of the anonymously published *Vestiges of Natural Creation* in 1844 as a breakthrough moment for popularizations. Indeed, the *Vestiges of Natural Creation* was already in its sixth edition by the time Dickens’ review came out, and by 1860 it had sold 20,000 copies. The work was a capacious overview of the natural sciences, and described everything from the beginning of the universe to the geological developments of the earth and the evolution of species. An early proponent of evolutionary theory, it was both sensational in its claims and vivid in its descriptions. Yet, its readability came at the expense of scientific rigor, and the scientific community furiously attacked the book in reviews. For Dickens writing in 1848, *The Vestiges of Natural Creation*’s commercial success was just the latest signal that popularization was taking its own path away from the conventions of disciplinary – or as Victorians would have termed it “serious” – science. As Dickens remarks, the new interest in popular science was creating “a reading public – not exclusively scientific or philosophical” (*Works* 135).

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This public read science, not for its ability to dispassionately represent the natural world, but rather for the sense of awe that it could create. Dickens praises the science that is “always leading the students’ mind from wonder on to wonder, until his is wrapt and lost in the vast worlds of wonder by which his surrounded from his cradle to grave” (135). One is reminded of the first issue of *Household Words* in which Dickens promises that the magazine would “cherish that light of Fancy which is inherent in the human breast” and “show to all, that in all familiar things, even in those which are repellent on the surface, there is Romance enough” (181). Critics have pointed out that “Fancy,” “Romance,” or “wonder” represented a certain form of attachment to the world that Dickens claims is both psychologically regenerative and socially responsible. The wonders of popular science, for example, are “elevating to the soul” as well as “salutary to the spirit of the age” (136, 35). Yet, the spiritual benefits of popular science often came at the expense of rigorous representation of the actual world. To be “wrapt and lost in the vast worlds of wonder” was to lose oneself and awareness of the external environment. Readers of popular science indulged in what Dickens called “escapes out of the literal world” (*Works* 187). If books like the *Vestiges of Natural Creation* were go-betweens – connecting lay audiences with scientific discoveries – these works succeeded because they inserted a layer of fancy and romance between the natural sciences as practiced by researchers and the affective desires of the audience. Readers were gradually introduced to difficult ideas in a controlled way that ensured they stayed connected to the work. Popularization was a point of connection, but it was also a cushion.
Dickens’ science readers shut out the actual to immerse themselves in imaginary worlds opened up by science, and Dickens was not the only reader to find this enjoyment in books like the *Vestiges of Natural Creation*. One reviewer of the *Vestiges of Natural Creation* praised the author who could “create worlds with a dash of his wizard pen … animalise the dull lump of inorganic matter – and spiritualise, like another Frankenstein, the animal to which his fancy had given birth” (383). Popularizers brought to their reader new worlds at the beginnings of geological time or at the extent of astronomical space. *The Vestiges of Natural Creation* brought together views of monstrous dinosaurs in Cretaceous jungles with speculations about the forms of alien life on distant planets. This science taxed the imagination to create otherworldly scenes.

Popularizations often succeeded based on their ability to construct such scenes. Hugh Miller’s well-selling *Old Red Sandstone* (1846) literally opens its views of geological periods with stage direction. Miller offers a guided tour of the earth’s past that pauses to take in such scenes as the opening of the Silurian Period described here:

> The curtain rises, and the scene is new. The myriads of the lower formation have disappeared, and we are surrounded, on an upper platform, by the existences of later creation. There is a sea all around, as before; and we find beneath a dark-coloured muddy bottom, thickly covered by a dwarf vegetation …. Forms of life essentially different career through the green depths, or creep over ooze. Shoals of Cephalaspides, with their broad arrow-like heads and their slender angular bodies, feathered with fins, sweep past like clouds of cross-bow bolts in ancient battle. We see the distinct gleam of scales, but the forms are indistinct and dim….
A huge crustacean, of uncouth proportions, stalks over the weedy bottom, or burrows in the hollows of the banks” (245).

Miller does not create a narrative to link his scenes, nor does he offer much in the way of theory. Instead, he absorbs readers in detailed descriptions of places about which scientists could only speculate. Popularizers set out to do more than just outline the latest scientific knowledge – they vivified science by setting out highly detailed scenes.

Works like Thomas Milner’s *Gallery of Nature* (1846) and William Martin’s *Pictorial Museum of Animated Nature* (1848-9) tried to capitalize on the demand for scenic science by illustrating with a wealth of full-page woodcuts. In popular science, nature was not theorized, but experienced in epiphanic moments of transport that take the reader into another world. Historian of science Ralph O’Connor has called such scenes “virtual tourism, imaginary travel for an untraveled public” (15). O’Connor argues that print offered the main occasion for readers to experience virtual tourism, but notes that museums, lectures, and shows also participated in spreading this escapist pleasure. He notes that natural history was also displayed:

within, and in competition with, an enormous range of theatrical reconstructions of the landscape and assorted natural disasters, from pantomime stage-sets to outdoor simulations of volcanic eruptions. Most of these sites would not be considered ‘scientific’ today … yet they all contributed to the science’s public appeal. (212)

Popularization used a range of media to transport readers, but the draw was often the same. O’Connor explains that “Much of the appeal of virtual tourism, as with the real
thing, was the change of scene it provided” (178). Whether reading Miller’s vivid prose or watching a recreation of the eruption of Mt. Vesuvius, Victorian audiences looked for something in which to lose themselves.

Popularization did bring discoveries from natural history to a lay audience, but it presented them in a manner that sometimes overshadowed the message. In a study of the prose of Victorian natural history, Lynn Merrill concludes that “Natural history texts are grounded in fact, but their tone is not scientific. They employ rhetorical strategies … to generate wonder in the reader” (53). Popularization creates a “hybrid” that is “part scientific exactitude, part emotional pleasure” (53). The popular science reader, who Dickens describes as “wrapt and lost in the vast world of wonders,” is suspended in a fantasy that only occasionally brings him or her into contact with the facts of natural history. In this mode, difficult concepts or methodological questions can be introduced gradually or entirely glossed over. Popularization slows down and renders palatable discussions that would otherwise confuse or bore readers whose patience and understanding would be taxed. This process does not simplify science, so much as it regulates the flow of information to ensure the audience stays engaged.

As conductor of Household Words and All the Year Round, Dickens employed similar popularizing strategies to hold his readership. His journals skimmed over the content of scientific theories to focus on the more otherworldly aspects of scientific discoveries. F.K. Hunt’s sense of teleportation on entering the Hunterian is found in many of the journal’s scientific offerings. When Household Words reported on the natural history displays in the Crystal Palace, the article tries to simulate the whirring feeling of traveling between different parts of the globe and different geological times.
The reader sees the eruption of Mt. Vesuvius before taking a trip to the tropics and then into past eras. Upon entrance, the visitor “shall be transported in one minute from this, your native cold and wet” (“Fairyland in Fifty-four” 313) into different environments. The exhibits create such jarring change that the article remarks that they “begin to assume a pantomimic appearance – so many and so sudden are the transitions” (316). While the article assures the readers that the displays are explained through prints and lecture tours, none of that content is relayed to the reader here. Instead, Household Words tries to recreate the feeling of “virtual tourism” that O’Connor found common in Victorian popular science.

Dickens’ journals praised this kind of popularization because its sense of wonder could inject imagination into an overly mechanistic understanding of the universe. The HW article on the Crystal Palace begins with the lament that scientific theories are unseating myths and fairy tales. The article asks “What have I done that all the gold and jewels and flowers of Fairyland should have been ground in a base mechanical mill and kneaded by you unimaginative philosphers?” (313). But the popular displays at the Crystal Palace turn science into “fairyland” that recuperates a sense of wonder in the natural world. Dickens’ comments on popular science in Household Words reveal similar worries that science is antagonistic to feeling and imagination. But works like the Vestiges of Natural Creation show that:

Science, truly expounding Nature, can, like Nature herself, restore in some new form whatever she destroys; that, instead of binding us, as some would have it, in stern utilitarian chains … she offers to our contemplation something better and
more beautiful, something, which rightly considered, is more elevating to the
soul, nobler, and more stimulating to the soaring fancy. (136)

In Dickens’ journals, popularization had to overcome both science’s technical content
and its stifling materialism. While the tone of the articles in Household Words is
undoubtedly breathless and grandiose, it shows that science was capable of engaging the
reader’s attention and emotion. Just in the place where Victorians might expect to find
dry information or an alienating inhuman view of nature, popularizers introduced fancy
and wonder.

At the beginning of Bleak House, Dickens attempts to make a similar move by
replacing the broken language associated with the Chancery Courts with a fanciful
analogy drawn from popular science. Just as the mechanistic forces of science threaten to
remove imagination from nature, impersonal institutions in Bleak House render urban
London oppressive and opaque. Dickens, like the science popularizer, has to represent a
realm of activity separate from human feeling, while at the same time resisting the sense
of alienation it creates. As literary critics have pointed out, one of Bleak House’s goals is
to describe the fragmentation of London society, but also to show how “within … the
fragmentary world is hidden historical continuity, a story, a human significance” (Miller
167). James Buzzard suggests that the novel complements a wide sociological analysis
with “imaginary solutions for the breakdown of communication and commitment” (105).
Moreover, this realist drive to accurately portray the workings of society is often at odds
with the moral mission to reestablish lines of “communication and commitment.”
Amanda Anderson notes that
On the one hand, Dickens ambitiously strove in his novels to comprehend a social whole …. On the other hand, insofar as the knowledge embodied in the narratives, and accessible to select characters, involves exposure to scathing truths about economic inequities or system corruption, it actually becomes a negative force as well, threatening the individual’s sense of purpose and capacity for clear moral vision. (70)

Truthful representation and “moral vision” take Dickens in opposite directions. Like the popular science writer who had to balance scientific rigor with entertainment, Dickens negotiated between social analysis and emotional engagement.

While popular science developed as a “hybrid” of “part scientific exactitude, part emotional pleasure,” Dickens’ style reflects a compromise between social analysis and fantastic distortion. Critics have often had a difficult task placing Dickens’ novels in relation to the dominant realism of the mid-nineteenth century because his works swerve between close social observation and unrealistic exaggerations. As Freya Johnston has summarized the problem, Dickens’ “vivid, fecund, prodigal style … his violent, theatrical caricatures, distended plots and grotesque inflations; all of these, and more, pose flagrant challenges to reality and its advocates” (137). John Reed has recently suggested the term “hyperrealism” to capture these monstrosities in Dickens’ style. By seeing these stylistic monstrosities alongside the monsters of the Hunterian Museum or the displays in the Crystal Palace, however, we can better understand the stakes of the wondrous and fantastic in Dickens’ novels. The opening of Bleak House draws this comparison directly, but, throughout Dickens’ novels, the language of popular science enters to mark places where oppressive social analysis yields to a more engaging representation.
One of the images that Dickens invokes to counteract urban fragmentation in *Bleak House* is that of the atmosphere. Fog, diseased miasma, and thunderstorms all expose the hidden connections between characters that society obscures. Critics have already observed the important roles atmosphere plays in the novel, but less attention has been played to the context in which popular science viewed gaseous processes. In Dickens’ 1848 review of F. K. Hunt’s *The Poetry of Science*, the novelist quotes Hunt at length on gaseous exchanges:

A plant exposed to the action of natural or artificial decomposition passes into the air, leaving but a few grains of solid matter behind it. An animal, in like manner, is gradually resolved into ‘thin air.’ Muscle, and blood, and bones having undergone the change, are found to have escaped as gases, ‘leaving only a pinch of dust,’ which belongs to the more stable mineral world. Our dependency on the atmosphere is therefore evident. We derive our substance from it – we are, after death resolved again into it. We are really but fleeting shadows. Animal and vegetable forms are little more than consolidated masses of atmosphere. *The sublime creations of the most gifted bard cannot rival the beauty of this, the highest and truest poetry of science.* (Works 137-38, emphasis added)

The resolution of all organic matter into gas released into the atmosphere provides both Hunt and Dickens here with renewed hope that science can encourage imaginative and emotional engagement with nature. Dickens borrows Hunt’s sense of wonder in *Bleak House* during the thunderstorm in which Esther and Lady Dedlock first meet. Esther explains to the reader that:
It was grand … to hear the solemn thunder, and to see the lightning; and while thinking with awe of the tremendous powers which our little lives are encompassed, and how upon the smallest flower and leaf there was already a freshness poured from all this seeming rage, which seemed to make creation new again” (180).

Hunt’s wonder at the “beauty” of atmospheric changes is reproduced here in Esther’s “awe.” Both Hunt and Esther set their lives in relation to larger forces that unite them to a grander story – a romance of continuing growth and development. As with the opening of the novel, the shift into the language of popular science is accomplished through analogies. Creation “seemed” to be renewed in the “seeming rage” of the storm. The text signals that Esther’s spiritual awareness of “tremendous powers” is a slippage away from the real and immediate situation.

Esther’s unique vision often allows her to connect figures from different places and times – overcoming the fragmentation that characterizes the rest of the novel. But the connection between Esther’s vision and popular science raises questions about the validity of her speculations. In an early scene of the courtship between Richard and Ada, Esther catches glimpses of their future:

Ada sat at the piano; Richard stood beside her, bending down. Upon the wall, their shadows blended together, surrounded by strange forms, not without ghostly motion caught from the unsteady fire, though reflecting from motionless objects…. The mystery of the future and the little clue it afforded to it by the voice of the present seemed expressed in the whole picture. (76)
Esther presages Ada and Richard’s union in the joined shadows of the pair, but she reminds readers that these “ghostly” shapes are actually projected from “motionless objects” and not real representations. Hunt’s *Poetry of Science* encourages similar wondrous predictions from limited empirical evidence. In a section on geological formations, Hunt calls attention to how the rocks give partial clues about the course of the earth’s development: “the past preaches to the present and from its marvelous discourses we venture to infer something of the yet unveiled future” (356). Just as popularizers extrapolated from the “marvelous discourse” of the natural world, Esther’s narrative is filled with moments of prolepsis and impossible insight.

J. Hillis Miller has remarked how discontinuous such scenes can seem to the rest of the novel. For Miller, if this larger vision “enters the human world at all, it enters to renew it by rest, by bringing a moment of repose” (213). Like the fanciful image of the megalosaurus in the novel opening, Esther’s “awe” is a break from the oppressive weight of the novel’s topic. But, neither, properly speaking, belongs there. Miller poses the question: “Does this mean that Esther’s sense of an intimate contact between her life and Providence is a fiction, that she merely thinks she sees something which is not really there at all?” (215). The way Dickens brackets off Esther’s vision with “seems” and “seeming” points to a certain detachment from the rest of the narrative world. Lady Dedlock’s entrance from the storm does substantiate Esther’s sense that larger forces are in play, but far less “freshness” is “poured” from their interaction than the character hopes. The “seeming rage” will turn out to claim lives, and Esther will be psychically and physically scarred. Esther’s “awe,” like the imaginative escapes of popular science, is a temporary respite from the social dysfunction at the heart of the novel.
Yet, for Dickens, these temporary flights from reality provide more than pauses for weary characters and readers. They also encourage greater emotional engagement by translating the inhuman dynamics of society into wondrous visions of “tremendous forces,” as Esther depicts them – or grotesque exaggerations like the megalosaurus of the novel’s opening. *Bleak House* could use language lifted from natural history because the goals of science popularizers were closely aligned with Dickens’ own. Popularization courted readers’ imaginations while at the same time describing physical processes divorced from human feeling. Both Dickens and the popular science from which he borrowed spoke to readers through what Lynn Merrill referred to as a “hybrid” style that was, at once, realistic and fanciful. In *Dombey and Son* and *Our Mutual Friend*, Dickens would continue to use popular science to renegotiate the relationship between the reader and the novels’ close scrutiny of society. But these novels indicate more powerfully how such mediation can be morally regenerative.

The “pensive fiction” of *Dombey and Son*

In a frequently cited passage from *Dombey and Son*, Dickens describes the construction of a railroad as a natural disaster – a disorienting earthquake shattering poor communities as it displaces them:

The first shock of a great earthquake had, just at that period, rent the whole neighbourhood to its centre. Traces of its course were visible on every side. Houses were knocked down; streets broken through and stopped; deep pits and trenches dug in the ground; enormous heaps of earth and clay thrown up; buildings that were undermined and shaking, propped by great beams of wood…. 
There were a hundred thousand shapes and substances of incompleteness, wildly mingled out of their places, upside down, burrowing in the earth, aspiring in the air, mouldering in the water, and unintelligible as any dream. Hot springs and fiery eruptions, the usual attendants upon earthquakes, lent their contributions of confusion to the scene. (78)

The large-scale construction project becomes a seismic event with matching “hot springs and fiery eruptions.” The volcanic language is probably drawn from popular natural history displays which recreated eruptions and earthquakes for large audiences. Several London theatres refitted their stages to simulate natural disasters, and they became part of the entertainment scene in the 1840’s and 50’s. Household Words reported on shows at the Crystal Palace which recreated the eruption of Mount Vesuvius, and another show at the Egyptian Hall in Piccadilly which simulated the Lisbon earthquake.

Adelene Buckland has argued that these displays “convert geology into pictorial spectacle” (262), and that Dickens’ allusion to them in Dombey in Son is meant to convert the railroad into another urban spectacle. In Buckland’s reading, Dickens intends to recast large-scale social and historical change as an entertaining scene: “readers respond with awe, wonder, and fear to historical processes that are always experienced at one remove, abstracted into a series of images for perusal and contemplation” (262). Again, popular science causes readers to “experience at one remove.” By transforming a construction project into an earthquake show, Dickens shields readers from the shock and confusion that the local community feels. For the community, the railroad is “unintelligible as any dream.” A bit later, Dickens notes that “But as yet, the neighbourhood was shy to own the Railroad” and “The general belief was very slow”
As with *Bleak House*, natural history creates a break from an overwhelming and immediate experience. In *Dombey and Son*, though, these breaks are only temporary stops along the way to a final confrontation with reality. Dickens shows that the community alongside the rail construction will eventually understand the scope of the changes around them. The process may be unfolding “very slow” and not have completed “as yet,” but realization is inevitable.

*Dombey and Son* contains a long list of shocking realizations that characters gradually have to embrace: Florence realizes her neglected place in the family, Dombey acknowledges the emotional cost of neglecting his family, Edith finds she has been bought, Dombey is shocked to learn that Edith runs off with Carker, and Carker is unmanned when he realizes Edith does not love him. The intrusion of the railway into the Stagg’s Garden neighborhood is just the novel’s most visual representation of such a shocking realization, but the novel is filled with slowly unfolding catastrophes. For Florence and Dombey, though, moments of repose offer opportunities to come to grips emotionally with these situations. Dickens often shows Florence and Dombey secluded in thought, and lets the reader delve into the characters’ minds where progress is made.

In solitude, memories of Florence haunt Dombey and point the way toward his eventual regrowth. Early in the novel, while reflecting in his conservatory, Dombey remembers Florence’s face and it sends him back into a string of reproachful memories:

The last time he had seen his slighted child, there had been in that sad embrace between her and her dying mother, what was at once a revelation and a reproach to him… That, at the bottom of its clear depths of tenderness and truth, lay those
two figures clasped in each other’s arms, while he stood on the bank above them, looking down – a mere spectator – not a sharer with them. (83)

These quiet moments, with the world shut out, provoke painful considerations that slowly break down Dombey’s reserve. Shortly after this remembrance, Dickens relates that “his previous feelings of indifference … changed to uneasiness of an extraordinary kind” (83). Dombey has seen this scene before, yet the actual experience of it left his indifference unchanged. Only when the scene is translated into an otherworldly image in his memory can he reflect on it and emotionally react. Like the popular shows that Buckland argues convert geology into pictorial spectacle, Dombey’s memory creates scenes that affectively engage both him and reader.

Later, in a train car, Dombey feels his uncomfortable awareness growing again:

It troubled him to think of this face of Florence.

Because he felt any new compunction toward it? No. Because the feeling it awakened in him – of which he had had some foreshadowing in older times – was full-formed now…. More than once upon this journey, and now again as he stood pondering at this journey’s end, tracing figures in the dust with his stick, the thought came into his mind, what was there could interpose between himself and it? (356)

Dickens traces the growth of Dombey’s consciousness in these secluded moments – here, the feeling is now “full-formed.” Dombey asks what he can do to lessen the force of the revelation coming upon him, but remembrance has already softened the blow by reducing it to a series of images for private contemplation. In these scenes, the character becomes
a spectator to his own emotions, and is allowed to determine how much he chooses to identify with these new feelings. Like the community shaken by railway construction, Dombey dimly perceives the change coming over him and is locked in a process of gradual recognition. While Dickens uses a seismic metaphor to distance social and historical change in Stagg’s Garden, though, Dombey keeps the force of recognition at bay with memory. Even after Dombey learns to acknowledge Florence and invest emotionally in his family, the novel continues to suggest that remembrance is the best way for Dombey to stay engaged in his family’s life. The novel ends repeating the injunction: “let him remember” (934). If Dombey and Son sets out to show the persistence of “spontaneous emotion and familial feeling” (107), as Audrey Jaffe has called it, then the novel achieves this commitment only by transforming events in the narrated world into fantastic images experienced in moments of repose.

For Florence, the artificiality of such images is even more pronounced. When she imagines what a closer knit family would look like, she has no memories to recall to mind. Instead, she fabricates them:

She imagined so often what her life would have been if her father could have loved her and she had been a favourite child, that sometimes, for the moment, she almost believed it was so, and bourne on by the current of that pensive fiction, seemed to remember how they had watched her brother in the grave together; how they had freely shared his heart between them; how they were united in the dear remembrance of him. (396)
While Dombey detaches from immediate experience and immerses himself in memory to reconnect with his family, Florence has to disconnect from reality itself and imagine new circumstances. Florence invents new memories that she “seemed to remember.” This “pensive fiction” allows her stay connected to Dombey, and ultimately provide the moral force of the novel. But, as with Dombey’s memory, imagined scenes interpose between reality and the character to insulate him or her from harsh realizations.

Florence and Dombey’s strategy of psychologically distancing unpleasant realities often parallels the same strategies that Dickens uses to engage the reader. In one of Florence’s fantasies, she imagines her father’s tearful reaction: “Yes, she thought if she were dying, he would relent” (426). Here, Florence adopts one of Dickens’ more obvious and manipulative ways of eliciting pathos: killing a child. Just as Dickens had sacrificed her brother several chapters earlier, Florence uses her privacy to create the same effect in her imagination. In these scenes, Dickens narrows the space between his characters’ fantasies and the novels he creates.

If the characters in *Dombey and Son* must confront powerful changes throughout the novel, Dickens suggests that recognition happens best in a fantastic register separated from the narrated world. Dickens sets himself in a position similar to the science popularizer who has to mediate the flow of difficult information. And, just as science writers learned to recast their topic as imaginatively and emotionally engaging, Dickens invented more satisfying ways characters and readers could recognize personal and social change. The language of natural history enters the novel to indicate just one key place where Dickens swerves into a more fantastic register, but the novelists’ style has been defined by such moves. Dickens’ hyperrealism – with its fanciful distortions and creative
exaggeration – temporarily dislodges the reader from the narrated world and allows them to engage with the novel more productively.

Moving the Novel into the Museum in *Our Mutual Friend*

Throughout this chapter I have made the argument that Dickens uses popular natural history as part of a generally fanciful style that helps readers connect with the difficult issues of social realism. But literary critics have questioned whether Dickens’ flights into creative exaggeration and metaphor-making are not distractions from the novels themselves. In places where Dickens may want to cultivate the reader’s sympathy, rhetorical pyrotechnics may distance the reader too far from the content of the novel. Catherine Gallagher has gone as far as to conclude that Dickens’ metaphors “especially when they attempt to disguise an ugly reality, are useless even pernicious things” (162). Writing of *Hard Times*, Kate Flint has sensed a “double movement at work in [its] rhetoric” (xix) between close observation and imaginative transformation. She argues that Dickens “is not immune to his own rhetorical effects” and “cannot escape from the habits of his own transformative imagination, turning the town into a giant-inhabited fairyland” (xix). Imagination, then, obscures the realism needed to bring readers’ attention to the social ills that the novel anatomizes.

Dickens’ characteristic style can distort the novel’s representation beyond recognition, and his leaps from immediate experience into the “fairyland” of popular natural history can distance readers so much that it no longer encourages engagement. In *Our Mutual Friend*, popular science begins to indicate places where language and style have quit mediating between reality and reader – and, instead, begin to simply misdirect
attention from what is meaningful. Dickens’ late novel follows the spread of language in
a society that is no longer able to sense the difference between appearance and reality.
Characters get deceived by false narratives that represent nothing. Mr. and Mrs. Lammle
marry on reports of each other’s wealth only to be disappointed by the ruse they were
each simultaneously playing. Charley Hexam is taken in by Bradley Headstone’s
promises that education leads to social ascendency. Headstone himself is overcome by
oft-repeated commonplaces. In a key moment, when Headstone is deciding whether he
loves Lizzie Hexam, the narrator shows how easily influenced Headstone can be:

Love at first sight is a trite expression quite sufficiently discussed; enough that in
certain smouldering natures like this man’s, that passion leaps into a blaze… as a
multitude of weak, imitative natures are always lying by, ready to go mad upon
the next wrong idea that may be broached. (354)

Some characters are even taken in by their own invented stories – like Silas Wegg who
begins to believe the lies that are meant to entrap others. Our Mutual Friend tracks the
contagious spread of these narratives, produced from within and without, across different
segments of society.

Popular science repeatedly marks places in Dickens’ novel where language
unduly affects characters. And, while popular science emerges in Dombey and Son and
Bleak House only occasionally, Dickens continually borrows from natural history in Our
Mutual Friend. London has become “a dismal swamp” (215) where ancient forms of life
crawl through the slime and soar through the air. Alligators, pterodactyls, prehistoric fish
and beetles make up the fauna of this world. Even human beings have become
“amphibious human creatures” (91). Dickens shows that his characters and the world they inhabit can be reduced to natural history displays. Charley Hexam identifies pieces of drift wood as “coming out of a bit of forest that’s been under the mud that was under the water in the days of Noah’s Ark” (29). The narrator classifies Silas Wegg as a form of primitive bird, and calls Mrs. Podsnap a “fine woman for Professor Owen” because of her “quantity of bone” (11). Whereas *Bleak House* momentarily let Owen’s Megalosaurus out of the Hunterian Museum, *Our Mutual Friend* seems determined to move the entire novel into the museum.

Mortimer Lightwood attempts to do this when he describes the novel’s main plot. Lightwood retells the story of the Harmon murder throughout the novel – recapping the story for a periodical readership that would be catching the story in parts, but also showing how the story spreads through society: “Thus, like the tides on which it had been borne to the knowledge of men, the Harmon Murder—as it came to be popularly called—went up and down, and ebbed and flowed” (32). In Lightwood’s telling of the story, the dust heaps of Harmon’s father become “his own mountain range” thrown up “like an old volcano, and its geological formation was Dust” (14). As the lawyer handling the family’s property, Lightwood has unique access to the story, but he also acts as one of the main popularizers of the Harmon murder in London society. Just as a science popularizer, too, Lightwood is conscious to avoid the jargon and technicalities of his discipline. When explaining the story to Lady Tippins, Lightwood has to apologize for slipping into legal discourse: “You will excuse the phraseology of the shop, but as I never had another client, and in all likelihood never shall have, I am rather proud of him as a natural curiosity probably unique” (430). The lawyer slides out from dry legalese by
finding the language of natural history. Boffin becomes “a natural curiosity.” Lightwood later continues: “The natural curiosity which forms the sole ornament of my professional museum” (430). He then gets carried away relocating parts of the Harmon murder into this “professional museum.” Boffin’s secretary, Harmon himself, turns into “an individual of the hermit-crab or oyster species” (430). The reader has already heard what Lightwood relates to Lady Tippins, but in this scene Dickens chooses to reestablish what the reader already knows in the frame of popular natural history. *Our Mutual Friend* repeatedly performs these shifts into popular science.

Lightwood acts as the popularizer of the Harmon murder case, but, like the science popularizers he imitates, he has to transform the story into one of wonders. This strips away the individuality of the characters involved, and reduces the story to a few plot points. Boffin is simply a “natural curiosity.” Harmon is first presented as “the Man from Somewhere” until Lightwood simply admits his “actual name doesn’t in the least matter” (431). The lawyer transforms the real tragedy of the Harmon murder into entertaining episodes shareable with members of gossiping society. Popularization in *Our Mutual Friend* means commodifying narratives for mass consumption.

Natural history often appears to mark the difference between felt experience and commodified narratives. When Lizzie shows Charley “pictures” (28) she sees in the fire, Dickens counterpoises the somber lessons Lizzie has learned living with her family with the overly-sanguine narrative of self-improvement that her brother has internalized. Staring into the glow of the fire, Lizzie mournfully describes the family drifting apart, but hopefully moving on to better things. Her interpretation is personal. When Charley asks where to find these pictures, Lizzie admits that “it needs my eyes” (29). This vision is
informed by her experience closely working with her father who she seen watching
intently at the opening of the novel. Charley’s sense that his education will raise his and
his family’s status is a symptom of his credulity. Charley has internalized his
schoolmaster’s optimism, and his quick acceptance of external narratives plays out in this
application of natural history. As Lizzie begins to see pictures in the fire, Charley sets
out to demystify her visions: “That’s gas, that is … coming out of a bit of forest that’s
been under the water in the days of Noah’s Ark. Look here! When I take the poker – so –
and give it a dig” (29). His interpretation connects the blaze to the kind of antediluvian
flora and fauna that Owen reconstructed in the Hunterian Museum. But it deflates the
more associative and emotionally resonant reading that Lizzie gives.

The connection between natural history and commodified circulation becomes
even more apparent during the introduction of the taxidermist Mr. Venus whose
collection of preserved animals begins to resemble Lightwood’s “professional museum.”
Venus’ own description of his shop echoes reporting in *Household Words* on the
Hunterian Museum. While F. K. Hunt found “skulls from all parts of the globe … brains
of various creatures, beautifully preserved … and stomachs sufficient to startle any
number of alderman” (278) in Owen’s Hunterian Museum, Venus points out similar
items in his shop to Silas Wegg:

dear me! That’s the general panoramic view. (80)
Venus’ shop reduces animals and humans into “warious” – an unspecified collection of parts. Like Lightwood stripping down the Harmon murder to make it consumable for society, the taxidermist breaks down life into saleable “warious.” Venus boasts to Wegg that:

I’ve gone on improving myself in my knowledge of Anatomy, till both by sight and by name I’m perfect. Mr Wegg, if you was brought here loose in a bag, to be articulated, I’d name your smallest bones blindfolded, equally your largest, as fast as I could pick ‘em out, and I’d sort ‘em all, and sort your vertebrae in a manner that would equally surprise and charm you. (83)

Venus shows how the study of anatomy can both “surprise and charm,” but characters express anxiety, rather than wonder, in the face of this science.

Here, the creation of specimens is always a grotesque distortion, and characters are wary of the latent threat of being converted into “warious.” When a customer unknowingly leaves with a tooth from the shop, Venus explains “You’ve no idea how small you’d come out, if I had the articulating of you” (83). Meanwhile, he informs Wegg that his skeleton has value purely “as a Monstrosity.” These transformations of anatomy do not encourage engagement with science, but keep characters at a distance. Pleasant Riderhood refuses to marry Venus because she does not want “to be regarded, in that bony light” (84). She only agrees to marriage after Venus agrees to stop articulating the bones of women, and the threat from his anatomizing science is lifted. In Our Mutual Friend, the transformations of natural history create alarm rather than emotional engagement. The language and practice of science threatens the identity of characters, as
they are repurposed to fit into systems of exchange. Lightwood turns Harmon and Boffin into “natural curiosities” to be shared at a dinner table, but Venus would sell the actual bodies of characters to consumers as a collection of bones.

 Literary critics have noted the thickness of natural history references in *Our Mutual Friend*, but have tended to read science through the lens of particular theories. These readings take Darwinian evolution, Lyell’s geological gradualism, or Owen’s anatomical functionalism as underlying the narrative structure of the novel. While this work has exposed the considerable presence of natural history in *Our Mutual Friend*, critics have overlooked the popularizing medium through which Dickens encountered science. Popular science converted technical theories into tours through imaginative worlds, and it remade the natural world into a “fairyland” that courted its audience’s emotions and attention. For Dickens, good science involves transformation. In this way, natural history could be made consonant with what Kate Flint calls Dickens’ “transformative imagination.” Just as Dickens’ novels attempted to capture large-scale social and historical situations in an engaging and imaginative light, popularization recast scientific theory and fact as fanciful and affectively compelling. *Our Mutual Friend*, however, expresses fear that such transformations can be obscuring. Lightwood’s popularization of the Harmon murder renders it palatable to a general audience, but his narrative fails to grasp who Harmon is and why the story the matters. In this way, Dickens’ own characteristic style – prone to exaggeration and distortion – can distract readers from the social reality he sets out to describe. J Hillis Miller has remarked on this tendency in *Our Mutual Friend* – concluding that “What begins as a *jeu d’esprit*, a vivid way of describing a character or event, undermines the human reality it names and infects
it parasitically with its own inane unreality” (“Our Mutual Friend” 129). Dickens’ late novel shows unique awareness of this danger in its handling of natural history, and, like Pleasant Riderhood curtailing Venus’ projects, tries to limit purely verbal play. Dickens grounds the novel’s characterization in close observation. When Lizzie describes her “pictures” in the fire, they are informed by long, familiar contact with the family. The novel’s main plot is even one of close observation: Harmon returns anonymously so he can learn about Bella Wilfer first-hand. In Our Mutual Friend, the strategies of popular science that are endemic in Dickens’ prose have to come into balance with direct experience. Lizzie, Harmon, and Pleasant Riderhood are informed by familiar contact with other characters, and these perspectives seek to offset the distancing effect of overly wonderful description.

Conclusion

By reading Dombey and Son, Bleak House, and Our Mutual Friend in the light of popular science we can begin to see how Dickens chose to weigh representation against fancy in different situations. Dickens shows awareness of the affective costs of realism – that representing an oppressive reality can wear down the reader – and he embraces the strategies of popular science that counteract these effects. But, at the same time, the fanciful transformations inherent in popular science can distract readers too far from the subject at hand. To be “wrapt and lost in the vast worlds of wonder” has the potential to obscure representation. Dickens develops a realism that swerves between representing and transforming reality to avoid these opposing problems. In Dombey and Son and Bleak House, Dickens uses language borrowed from natural history to engage readers in the larger social vision the novels are trying to create. But, in Our Mutual Friend, the author
shows awareness that these borrowings can distort. Charley Hexam’s pedantic use of natural history or Lightwood’s museum-making aligns natural history with the swirl of competing narratives that characterize London society. Here, Dickens anticipates the criticisms of Flint and Gallagher that the strategies of popularization may be “pernicious.” As Flint argues, Dickens’ prose represents a “double movement” between close observation and imaginative transformation. Flint and Gallagher suggest that Dickens may have underestimated the effects of wonder, but, by reading Dickens alongside popular science, we can better appreciate how Dickens anticipated the tensions that wonder creates. *Dombey and Son, Bleak House,* and *Our Mutual Friend* represent a sustained examination of the kinds of transformations that wonder creates for readers.
The Aesthetics of Surprise in Victorian Natural History and Eliot’s *Mill on the Floss* and “The Lifted Veil”

In *The Mill on the Floss*, Mr. Glegg, newly retired from the wool trade, finds “a double source of mental occupation, which gave every promise of being inexhaustible” (122). The first is wonder at the local insect life of St. Ogg’s – Mr. Glegg “surprised himself by his discoveries in natural history, finding that his piece of garden-ground contained wonderful caterpillars, slugs, and insects, which, so far as he had heard, had never before attracted human observation” (122). Critics have shown that Mr. Glegg’s interest in natural history is not contained to himself, but suffuses much of the novel, as well as Eliot’s early fiction. Indeed, the careful focus on obscure and often overlooked forms of life recalls mid-Victorian realism’s drive to depict the ordinary and quotidian. Yet, less acknowledged is the other interest that Eliot parallels with natural history in Mr. Glegg’s mind: “And his second subject of meditation was the ‘contrariness’ of the female mind, as typically exhibited in Mrs. Glegg” (123). The former wool-stapler looks across the breakfast table at his wife with “with that quiet, habitual wonder with which we regard constant mysteries” (126). Both subjects in Mr. Glegg’s mind draw him into “inexhaustible” mysteries that are never fully explained. Eliot dwells on the shocks and surprises that attend this study of garden insects and women’s minds, and not any definite knowledge that comes of it.

In this chapter, I argue that Eliot constructs both natural history and her characters (like Mrs. Glegg) as objects of wonder and mystery. I show how Eliot picked up on and even participated in popularizations that presented natural history as a source of frequent surprise and infinite variety. Unlike the more rigorous discipline of biology that was
forming during the nineteenth-century, popular natural history focused less on certain knowledge and more on stirring the reader’s curiosity. This chapter will show how Eliot’s fiction engaged with popular natural history, and sought to generate a similar sense of mystery around plots or characters. The reader was to be drawn in by the feeling of “inexhaustible” wonder in both “zoological phenomena” (Mill 121) and the novel itself. In a well-known passage from her review of *The Natural History of German Life*, Eliot suggests that such surprise plays a key role in the appreciation of any artistic work: “a picture of human life such as a great artist can give, surprises even the trivial and the selfish into that attention to what is apart from themselves” (145). Literary critics have thoroughly interrogated what Eliot means by sympathizing with “what is apart from themselves,” but little attention has been paid to the way this sympathy relies on “surprises.” Just as Mr. Glegg “surprises himself” in his garden, both Eliot’s novels and popular natural history sought to startle readers into an appreciation of the mysterious depth of their topics.

The first section of this chapter will show how popularizers of natural history embraced mystery and wonder at the expense of definite claims or disciplinary rigor. I will show how such methods invoked criticism from professional biologists who thought that popularizers were assuming authority without the disciplinary credentials that warranted it. Biologists feared that the interest in popular natural history could blind readers to its dubious status as science. As editor of the *Westminster Review* during the 1850s, Eliot was at the center of these arguments between popularizers of natural history and professional scientists. In the second section of this chapter, I will show how Eliot sided with popular science, and adopted the same emphasis on surprise, mystery, and
wonder in her novels. While much of Eliot’s work is touched by her engagement with natural history, this chapter will focus on two of her works that most explicitly engage natural history: *The Mill on the Floss* and “The Lifted Veil.”

**Popularizing Mystery**

The previous chapter of this dissertation observed how natural history could be presented as a visual spectacle in which audiences would lose themselves. Whole theatres were used to recreate earthquakes, volcanic eruptions, or other violent natural disasters. The Crystal Palace staged past geological periods with life-sized prehistoric flora and fauna. Illustrated guides printed full-page images of exotic locations and life. The prose itself of such books could take on a dramatic quality, and invite readers on mental journeys to distant planets or past ages. Natural history – particularly its geological and archaeological elements – could be turned into what Dickens referred to as “escapes out of the literal world” (*Works* 187). But just as natural history could be fashioned into enormous displays of the exotic, it could also draw attention to the local, ordinary, and microscopic. Natural history writers often used the life sciences to add wonder and mystery to the common forms of life found in the average English countryside or coastline. Eighteenth-century collectors had long found interest in local plant and animal life, but this was primarily a pastime of the wealthy. In the nineteenth-century, lower prices for microscopes, aquariums, and collecting equipment allowed natural history to “filter down to the middle and working classes” (11) – as historian Lynn Merrill suggests. This interest was probably helped by a uniquely Victorian love of scientific fact, as well as an urban nostalgia for the countryside.
But nineteenth-century natural history also added an investigatory zeal that went past the collecting and classifying that went into eighteenth-century natural history. In *Country Rambles* (1825), J.L. Knapp draws the distinction between the natural historian – as he or she was emerging in the nineteenth-century – and the idle enjoyment of nature:

But the natural historian is required to attend to something more than the vagaries of butterflies and the spinning of caterpillars; his study, considered abstractedly from the various branches of science which it embraces, is one of the most delightful occupations that can employ the attention of reasoning beings: a beautiful landscape, grateful objects, pleasures received by the eye or the senses, become the common property of all who can enjoy them, being in some measure obvious to everyone; but the naturalist must reflect upon hidden things, investigate by comparison, and testify by experience. (41)

Nineteenth-century natural history would turn away from the visible landscape to speculate on “hidden things.” Abstract speculation takes over in the naturalist where the casual observer would only see outward appearance. In this way, nature became “inexhaustible” (vi) for the natural historian – just as it was “inexhaustible” (*Mill* 121) for Eliot’s Mr. Glegg.

This kind of natural history became immensely popular by mid-century. Books (often collections of essays) by naturalists such as Philip Henry Gosse, J.G. Wood, Charles Kingsley, and Grant Allen would sell thousands of copies each. J.G. Wood’s *Common Objects of the Country* (1858) would sell 100,000 copies in a week, and become the best-selling British science text of the century. While much critical attention has been
paid to the influence of Darwin’s *Origin of Species* published a year later, relatively little
collection has been given to the much more culturally prevalent and commercially
successful works of natural history that saturated Victorian England. Eliot herself
participated in the natural history craze with her common-law husband George Henry
Lewes. Eliot and Lewes made scientific expedition to Ilfracombe and Tenby along the
English coast in 1856 where they studies marine life in preparation for Lewes’ *Sea-side
Studies* to be published in *Blackwood’s Magazine*. In the late 1850s, Lewes wrote three
sets of essays for Blackwood’s and the Cornhill that turned into *Sea-side Studies, Studies
in Animal Life*, and *The Physiology of Common Life*. Eliot recorded her experience of the
expedition in her “Ilfracome Journal,” which she briefly considered for publication.

    Literary critics have tended to consider Eliot’s engagement with natural history a
phase in her artistic development. Sally Shuttleworth argues that Eliot based her social
vision in *Adam Bede* on her experiences with natural history, but by *The Mill on the Floss*
“The world George Eliot is presenting retains no vestiges of simple natural history” (55).
Amy King agrees that “Eliot’s naturalist phase” (134) does not extend past *Adam Bede*.
Similarly, Anne Dewitt sees the prevalence of natural history waning in Eliot’s work –
starting again with *The Mill on the Floss* (82-83). These critics tend to read natural
history as practicing an appreciation of static forms, rather than actively investigating
nature. Shuttleworth argues that Victorian natural history was “a science which … was
concerned with the measurement and classification of the visible surface of nature” (3).
King finds that “the observation and naming of natural objects is epistemologically the
central fact of natural history” (163). Similarly, Eliot’s early fiction is construed as
taxonomizing its characters like natural history, and placing them in an unchanging social
Eliot’s narrator is considered a passive observer who looks after the events of the novel. For critics, Eliot does not strongly impose a creative form to her novels until later, as natural history begins to give way to more rigorous discipline of Biology. King talks of “Darwin’s storm” on the horizon in the 1850s which will effectively end natural history as a viable scientific method.

Yet, Eliot estimated that Darwin’s *Origin of Species* would only be a storm for a small circle of scientific elite, rather than the general reader. In a letter, she gave her opinion of the *Origin of Species* as “ill-written, and sadly wanting in illustrative facts…. This will prevent the work from becoming popular…, but it will have a great effect in the scientific world” (*Letters* 120). Eliot concluded that Darwin’s storm would “produce a feeble impression compared with the mystery that lies under the processes.” This attitude of respectful disinterest was characteristic of Eliot’s reception of scientific authority. Reading William Whewell’s *Philosophy of the Inductive Sciences* – considered a paragon of rigorous science – Eliot reported only “dreary dryness” (231) in her letters. She also quarreled with one of England’s most vociferous advocates for professional science T.H. Huxley over his reception of popular works. Literary critics have argued that Eliot’s novels follow the opinion of scientific authorities, and abandon natural history as Darwin and Huxley revolutionize the field into Biology – a science focused around the laboratory and experimentation, as opposed to observation and reverence for outward form. But, Eliot’s acceptance of trends in professional science appears far more partial at closer inspection. Eliot seems willing to divorce her own interest in “mystery” from what “will have a great impact in the scientific world.” I argue that Eliot’s interest in natural history
outlasted the publication of Darwin’s *Origin of Species* because natural history continued to present nature as a source of inexhaustible mystery.

During the 1850s, as editor of the *Westminster Review*, Eliot had seen first-hand how professional science could conflict with popular natural history. The magazine’s founder John Chapman was eager to blend popular science with more respectable scientific authorities. While Chapman often failed to draw financially established scientists, he did enlist the help of John Tyndall and T.H. Huxley early in their careers before they found established scientific posts. Huxley, despite his notoriety in the scientific community, was unemployed when he began writing for the magazine. He confided in letters that “A man of science may earn great distinction – great reputation, but not bread. He will get invitations to all sorts of dinners & conversaziones, but enough income to pay his cab fare” (Letters 171). The penniless scientist could not afford to pass on Chapman’s offer to review popular science works for the new magazine. Huxley agreed to the work, but he used his reviews as a place to police the claims of popularizations that crossed his desk. His review *The Vestiges of Natural Creation* accused the author of using “a spurious, glib eloquence” to sheen over unfounded arguments: “We look for original research, and we find reason to doubt if the author even performed an experiment or made an observation in any one branch of science” (*Memoirs* 18). Similarly, Huxley skewered Lewes’ *Comte’s Philosophy of the Sciences* (1854) for making claims without sufficient authority. After running through a list of Lewes’s mistakes, Huxley laments “how impossible it is for even so acute a thinker as Mr. Lewes to succeed in scientific speculations, without the discipline and knowledge which result from being a worker also” (“Scientific Method” 134). For Huxley, authority came from
“being a worker also” and following the procedures of the discipline in question. Popularizers like Chambers and Lewes overstepped the line.

Lewes immediately responded in *The Leader* to Huxley’s attack, but Eliot took the matter even farther and wrote to Chapman to “expunge Mr. Huxley’s notice altogether” (Letters 34). Eliot complained that the “editors of the Review will disgrace themselves by inserting an utterly worthless & unworthy notice” (34). Eliot failed to scuttle Huxley’s notice, and the unfavorable review would establish the context for much of Lewes’ natural history work undertaken in the following years. To make his work commercially successful, Lewes knew he would have to appeal to lay readers’ sense of wonder and mystery, but he also now had to fear the censure of professional scientists. *Sea-side Studies* (1858), which appeared two years after Huxley’s review, includes humble nods to the author’s ignorance: “I came down to the coast as an amateur, ignorant, but anxious to learn” (101) and “of direct knowledge I had next to nothing” (5). But, the majority of the book inclines to speculation and reveling in the surprises and mysteries of nature.

Lewes presents the value of natural history lying in its ability to continually provoke curiosity. Ten pages of *Sea-side Studies* are devoted to an extended comparison of hunting to natural history. Whereas hunting’s pleasure ends at the eating of the catch, Lewes contends:

> No such anticlimax was mine; no such terminal enjoyment; my finale was not final. If, as a matter of fact, the dissecting-table was the scene on which my captures made a last appearance, this last appearance was the end of a long series
of episodes intermediate between the capture of prey and incision of the scalpel. And even this finale was not, strictly speaking, a finis; for when the last shred of delicate tissue had been examined under the microscope, when various parts of the animal had been made into “preparations” for after-study, when everything to the physical eye may have seemed concluded, no end was reached, no dead wall of terminal blankness; on the contrary, the metaphysical eye followed devious paths of speculation, into which new facts conducted. (43)

Victorian natural history stressed the inexhaustible nature of their study. Literary critics have tended to read nineteenth-century natural history as only interested in classifying life according to outward form. But work like Lewes’ shows how Victorian natural history was invested in pushing past appearance. Here, the naturalist does not just observe the specimen, but dissects, investigates its tissues under a microscope, and then leaps from there into metaphysical speculation. At any stage, knowledge provokes further questions: “The facts are the least of the attractions in this study, although they are the bricks with which you build” (55). Lewes declares, “If you happen to be of a speculative turn, every fresh observation will start new trains of thought” (55). Shuttleworth’s claim that natural history is “the measurement and classification of the visible surface of nature” may have been tenable for eighteenth-century naturalists, but Lewes is suggesting a far more active engagement with nature.

In *Studies in Animal Life* (1860), Lewes turned his attention away from marine life on the shore to the flora and fauna in ponds and rivers, but his focus remained on the continual wonder of natural history. Again, nature is “truly inexhaustible. We may begin where we please, we shall never come to an end; our curiosity will never slacken” (14).
In both *Sea-side Studies* and *Studies in Animal Life*, Lewes does more than just refer to his own wonder at nature. He tries to invoke the same feelings in the reader by drawing attention to surprising specimens that defy categorization. His subjects are plants that swim, parasites that live inside other parasites, animals that have appendages that may or not belong to the animal, or other boundary cases that serve for speculation. Far from just taxonomizing specimens based on external appearance, Lewes’ natural history makes nature a collection of surprises that overturn early assumptions.

Lewes invites the reader to observe some worms on his table:

You have chosen a phial in which a quantity of thread-like worms are wriggling like uninspired Pythonesses. You are mistaken in supposing them to be worms,--they are nothing of the kind; they are not even individuals. In spite of your stare, I repeat the statement: they are not individuals, they are organs. Why then do they live and wriggle? (*Sea-side Studies* 55-56)

Worms are not worms – not even separate organisms – but organs of a single being. Reversals such as this take the reader by surprise and introduce mysteries that are never fully explained. Lewes uses his faux-worms to launch into a discussion of organs and their relationship to the organism as a whole, but by the end of the discussion Lewes and the reader are not completely sure whether such things as organs even exist. Another of Lewes’ specimens has a head that may or may not be part of its body. A bird, the Corkscrew Coralline, has an appendage where its head would be that snaps at other animals as they get close. Whereas the reader may have assumed the appendage was the head of the animals, snapping at other animals to feed itself, Lewes reveals that the head
may be just a benign growth or a parasite living off the bird. The revelation puts the reader on guard against the “tendency to attribute psychological motives to the actions of animals” (368). Natural history tries to make the reader feel the infinite alterity of nature, and the too anthropomorphizing reader has to be shocked out of the habit of drawing the wrong conclusions.

In *Sea-side Studies* and *Studies in Animal Life*, shock, mystery, and wonder are always motivating the discussion, rather than the pursuit of a particular argument. Most of the question Lewes raises are left unanswered, but the reader still feels drawn into the topic. Every certain fact seems to open out into wider discussion. “The crowning glory” of natural history, Lewes claims “is the knowledge which ever opens into newer and newer vistas, quickening our sense of the vastness and complexity of Life” (*Sea-side Studies* 53). This is natural history as a passion as much as a science. Half way through *Sea-side Studies*, Lewes recalls his passion for natural history taking over and turning into a sort of mania:

I felt that I had “suffered a sea change” into something zoological and strange. Men began to appear like molluscs; and their ways the ways of creatures in a larger rock-pool. When forced to endure the conversation of some ‘friend of the family’ … I caught myself speculating as to what sort of figure he would make in the vivarium. (179)

Lewes’ interest in natural history spills over any boundary, and begins to consume the author. This is a different view of the natural historian from the one presented recently by literary critics, who tend to consider “the role of natural historian, a passive observer
of organic life, concerned only to record the unchanging details of external form” (Shuttleworth xii). In Sea-side Studies, author and reader are bound by a shared sense of wonder at nature’s ability to surprise one’s assumptions. “External forms” are only a starting place that leads into deeper speculations. When Amy King argues that “the observation and naming of natural objects is epistemologically the central fact of natural history,” she overlooks that natural history was appreciated affectively, as much as it was epistemologically. Readers were entertained as well as informed by natural history.

In the next section, I show the continuity that existed between the affective appeal of Lewes’ natural history and George Eliot’s fictions. Literary critics have claimed that Eliot’s early novels are structured by the epistemology of natural history, but no work has been done to explore how Eliot and Lewes both tried to use mystery and wonder to draw their readers in. I will focus on two of Eliot’s novels, The Mill on the Floss and “The Lifted Veil,” which are both assumed to show Eliot’s disenchantment with natural history as a model for art. Yet I upset this narrative by arguing that Eliot continued to use natural history favorably in these later works. Reading these novels alongside natural history will also help us interpret how Eliot’s constructs each woman who captures the narrators’ attention in The Mill on the Floss and “The Lifted Veil.” Each character is presented as constantly surprising society, themselves, and the reader. I examine how their unpredictability reflects a general narrative strategy of keeping the reader in a state of wonder similar to Lewes’ natural history.

Mystery and Surprise in The Mill on the Floss and “The Lifted Veil”
The Mill on the Floss rather famously begins with a moment of intense absorption. The omniscient narrator becomes so engrossed in the scene that she slips from her detached position of observer to actually being included in the scene:

How lovely the little river is, with its dark changing wavelet! It seems to me like a living companion while I wander along the bank, and listen to its low placid voice, as to the voice of one who is deaf and loving. I remember those large dipping willows. I remember the stone bridge…. Now I can turn my eyes toward the mill again, and watch the unresting wheel sending out it diamond jets of water. That little girl is watching it too; she has been standing on just the same spot at the edge of the water ever since I paused on the bridge…. It is time, too, for me to leave off resting my arms on the cold stone of this bridge. Ah, my arms are really benumbed. I have been pressing my elbows on the arms of my chair, and dreaming that I was standing on the bridge. (2-3)

The narrator’s reverie un hinges the scene’s focalization, and we move from narrated scene to remembered visions to immediate presence in the scene to the perspective of the “little girl” watching the mill to narrator in her room composing the story. Eliot narrates the shifting perspectives that novel readers experience during their contemplation of the story they are reading. Just as the narrator moves between the moment of writing and remembered scenes, absorption in the story allows readers to slip out of their immediate surroundings and enter the fictional world.

While this passage is one of the most analyzed sections of the entire novel, what has been overlooked is that Lewes was writing a similar passage around the same time
for his *Studies in Animal Life*. Lewes’ natural historian looks out at Wimbledon Common and begins to feel the same wistful charm:

The gaunt wind-mill on the rising ground is stretching its stiff, starred arms into the silent air, a landmark for the wanderer – a landmark, too, for the wandering mind, since it serves to recall the dim early feelings and sweet broken associations of a childhood when we gazed at it with awe, and listed to the rushing of its mighty arms…. The vanishing visions of elapsing life bring with them thoughts which lie too deep for tears, and this wind-mill recalls such visions by subtle laws of association. Let us go toward it, and stand once more under its shadow… But, in spite of the sun, we must not linger here: the wind is much too analytical in its remarks. (42)

In Eliot’s novel, the watermill takes on the associations of past life, and narrator, reader, and heroine all gaze at it in dreamy wonder. In *Studies in Animal Life*, a wind-mill draws the natural historian backward to moments in “childhood when we gazed at it with awe.” Lewes had shown in *Sea-side Studies* how natural history could consume one’s attention, and the above passage invites the reader into the scene much as Eliot’s does. We are told to stand under the windmill and feel the cool wind. But what links the passages most strongly is how they both encourage wonder at the act of remembrance, and depict it as an always broken, incomplete project.

In *Sea-side Studies*, Lewes emphasized that natural history is always incomplete. Scientific facts always encourage new speculations which bring in new facts. In *Studies in Animal Life*, Lewes tried to show that recreating past life is a similarly mysterious and
incomplete project. Lewes asks readers to dig down into the earth to find fossilized remains or speculate on past species that set the stage for life today. While the past recedes from view, he claims, “there are traces, not obvious except to the inner eye, left by every ray of light, every raindrop, every gust” (60). But this retrieval is partial and filled with mystery. For Lewes, scenes like the windmill remind us that one can only hope for an incomplete feeling of renewal: “Well may the mind … linger on those scenes of the irrecoverable past, and try, by lingering there, to feel that it is not wholly lost, wholly irrecoverable” (41). *Studies in Animal Life* presents natural history as an inexhaustible process of partial recoveries. Never fully restored, the past lingers on the horizons of the text, and engages the readers’ attention.

*The Mill on the Floss* foregrounds similar wonder in remembrance. The story is presented as an interrupted retrospective. The mill and river speak to the narrator “as to the voice of one who is deaf and loving,” but the content is not entirely clear. Just as Lewes suggests “lingering” can help recover more of the past in the “inner mind,” Eliot’s narrator and the “little girl” pause over the dreamy scene. Eventually, though, Lewes feels recalled to action by a cool breeze. Eliot’s narrator, too, senses the pressure of her arms on the chair, and begins to narrate the novel. The two passages convey their subject as wonders just on the edge of comprehension. Eliot shares with natural history, not an epistemology as King was would have it, but marvel at the depth of their subject.

*The Mill on the Floss* borrows liberally from natural history, as well. The characters in St. Ogg’s are frequently compared to flora and fauna, and Eliot often draws directly from her experience with Lewes on the English coast. The novel’s first of many tragedies is the careless suggestion of the wrong schoolmaster for young Tom. But, Eliot
cautions the “too-sagacious observer” (20) who may have imputed selfish motives for the suggestion: “Plotting covetousness … [is] nowhere abundant but in the world of the dramatist…. We live from hand to mouth…. We do little else than snatch a morsel to satisfy the hungry brood, rarely thinking of seed-corn or the next year’s crop” (20). The narrator goes so far as to compare his consciousness with that of a parasite mindlessly attaching to its host: “Nature herself occasionally quarters an inconvenient parasite on an animal toward who she has otherwise no ill will” (20). The allusion to parasites puts us back in the territory of Lewes’ natural history. Indeed, the warning about “too sagacious” theorizing recalls Lewes suggestion to “guard against the tendency to attribute psychological motives to the actions of animals.” Eliot often uses natural history to check the reader’s assumptions, and introduce a level of skepticism about others’ consciousness. Lewes cautions that “we are incessantly at fault in our tendency to anthropomorphise” (365). In *The Mill on the Floss*, Eliot borrows Lewes’ arguments about the animal-human gap to gesture to the alterity of other minds.

When the novel parallels Mr. Glegg’s wonder at natural history with his incredulity at his wife’s behavior, Eliot reminds readers again of the mystery that can lie in other minds. Mrs. Glegg is presented as an inexhaustible source of awe and wonder – just as Mr. Glegg’s gardening “discoveries” were moments earlier. *The Mill on the Floss* relies on natural history repeatedly for this effect. When readers may begin to wonder at Mr. Stelling’s inflexible teaching method, Eliot asks “how should Mr. Stelling be expected to know that education was delicate and difficult business, any more than an animal endowed with a power of boring a hole through a rock should be expected to have wide view of excavation?” (170). Eliot refutes readers who would assume thoughtful
intent on Mr. Stelling’s part. St. Ogg’s itself is a town that “impress one as a
continuation and outgrowth of nature, as much as the nests of the bower-birds or the
winding galleries of the white ants” (116). Like Lewes’s surprising specimens, Eliot’s
natural history upsets the reader’s first assumptions. Natural history continued to be
useful for Eliot past *Adam Bede* because it helped her police the judgment of the “too
sagacious” reader who might reach stultifying conclusions that foreclose further
investigation. Eliot maintains a sense of mystery surrounding the characters and the plot
by contradicting the reader’s expectations – just as Lewes had done in previous years.

Victorian reviewers of *The Mill on the Floss* complained that Eliot reveled too
much in frustrating her characters and readers. They censured the novel for weakening
its ethical position by including so many confusing reversals. The reviewers for the
*Dublin University Magazine* concluded: “George Eliot seems too fond of showing fate
triumphant not only against human happiness… but still more against human virtue.
‘The good that we would, we do not; the evil that we would not, that we do’ is a text
which she never tires of illustrating, to the loss of artistic contrast” (151). The *Saturday
Review* agreed that “What does it all come to, except that human life is inexplicable, and
that women who feel this find the feeling painful?” (117). Reviewers were particularly
troubled by the heroine’s religious questioning and tragic romantic choices. They
contended that Eliot had abandoned moral and artistic duty to give definitive and
uplifting solutions to the problems that the novel raises, but they felt that Eliot
sidestepped her responsibility and hid in ambiguity. The reviewer for the *Saturday
Review* laments that fiction itself allows novelists an easy escape:
Fiction has … the great defect that it encourages both the writer and reader to treat the most solemn problems of human life as things that are to be started, discussed, and laid aside at pleasure. The conduct of the story always affords an opening to escape from the responsibility of definite thought. (117)

Fiction allows writer and reader to skirt around “the responsibility of definite thought” and contemplate issues from tenuous and changing positions. Reviewers thought Eliot had abused this freedom and needlessly frustrated readers’ expectations – creating a painful reading experience.

By reading The Mill on the Floss alongside Victorian natural history, though, we can see that Eliot was not trying to generate pain, so much as wonder. For Eliot, characters and plot are mysteries the novelist guards from complete understanding. As readers are given developments, new mysteries are opened up to continue the pleasure of reading. The novel repeatedly tries to mystify the reader about the fate of the heroine – whose life reviewers deemed too improbable and inartistic for novelization. At the start of the novel, Mr. Tulliver muses on the unexpected traits of his children. His son takes after his mother, while his daughter inherits personality from him. “That’s the worst on ‘t wi’ the crossing o’ breeds: you can never justly calcilate what’ll come on ‘t” (7). Before Maggie is even named in the novel, she has already surprised characters, and provoked wonder how one “can never justly calcilate.” The narrator will remind readers of the incalculable course of her life throughout the novel. Maggie’s fate is “a thing hardly to be predicted even from the completest knowledge of characteristics” (406). A paragraph later, the narrator explains that “Maggie’s destiny, then, is at present hidden, and we must wait for it to reveal itself like the course of an unmapped river” (407). Like Lewes’
promise of “new vistas which open with increasing knowledge” (*Sea-side Studies* 14), Eliot assures readers that even the “completest knowledge” could not pierce the mystery that surrounds Maggie’s future.

While Eliot encourages the reader to invest wonder in the open-endedness of her narrative, many characters in the novel desperately try to pin down reality into “definite thought.” After Maggie’s rendezvous with a family enemy, Philip Wakem, her brother asks her for a definitive renunciation of Philip. Tom asserts “I can’t trust you, Maggie. There’s no consistency in you. Put your hand on the Bible, and say ‘I renounce all private speech and intercourse with Philip Wakem” (348). When Maggie resists, Tom pushes for a statement in those exact words. Throughout the novel, precise language is used to curtail mystery of open-ended plot and psychological depth. In another confrontation with her brother, Tom accuses Maggie of starting an affair with Philip, and the accusation, clearly stated, painfully closes down Maggie’s perception of her own possibilities: “There was a terrible cutting truth in Tom’s words… as if he were a prophetic voice predicting her future” (398). Even less antagonist characters demand narrative closure from Maggie. When Philip confronts Maggie about who she loves most, he demands “with a desperate determination to have a definite answer” (452). Later, he laments the demand since it “hurried [Maggie] into words that [she has] felt as fetters” (513). Characters in the novel seek their own form of narrative closure by trying to push Maggie into what the *Saturday Review* called “the responsibility of definite thought.”

But, neither Tom nor Philip successfully limit Maggie’s narrative possibilities. After Tom accuses her of an affair, Maggie puts up a spirited defense that she cannot be
blamed for “faults that I have not committed yet” (398). Maggie dodges her brother’s “prophetic voice,” and both Tom and Philip will fail to drive the story to conclusion. Instead, the narrative is driven to crisis by Stephen Guest. Stephen’s temporary seduction of Maggie relies on his ability to open up new narrative possibilities rather than foreclose them. Like a good novelist or science popularizer, Stephen constructs visionary plots that provoke wonder and rapt attention. His first seduction of Maggie is not romantic, but actually scientific as he explains Buckland’s Bridgewater Treatise to company: “Stephen became quite brilliant in an account of Buckland’s Treatise, which he had just been reading. He was rewarded by seeing Maggie let her work fall, and gradually get so absorbed in his wonderful geological story … with an entire absence of self-consciousness” (384). Stephen takes on the engaging rhetoric of popular science to first seduce Maggie.

Rather than presenting nature as a series of established opinions, popularizers presented nature itself as infinitely novel and wondrous. Stephen relies on a similar strategy to seduce Maggie on the river when he tries to convince her that he has seen a new way for them to be together. He makes new possibilities tangible without demanding definitive statements from Maggie. This makes Stephen far more effective in leading Maggie. When Stephen first suggests they elope, the narrator explains that Maggie “sat quite still, wondering; as if Stephen might have seen some possibilities that would alter everything, and annul the wretched facts” (475). Maggie is hoping for the kind of reversal common in popular natural history – that the facts and assumptions around a subject will melt away into new avenues for thought. Unlike Tom and Philip who try elicit definitive statements, Stephen remains largely quiet during the boat trip:
“Some low, subdued, languid exclamation of love came from Stephen from time to time… otherwise they spoke no word; for what could words have been but an inlet to thought?” (474). His speech merely presents possibilities, rather than demanding commitments. This becomes a pleasant fantasy that Maggie indulges in temporarily: “Stephen’s passionate words made the vision of such a life more fully present to her than it had ever been before” (479). Stephen seems to co-opt the rhetoric of popularizers like William Buckland and Lewes who had developed strategies for pulling the reader into their visions of past ages or microscopic marine life. He also seems to take on the qualities of a novelist, as he set the horizon of expectation for Maggie – opening new possibilities and shutting out others. For Eliot, these two activities are tied together.

Stephen’s control over Maggie is short-lived, though, and quickly she finds herself back in familiar circumstances. The remainder of the novel involves Maggie communicating her story to her now estranged friends and family. Interestingly, Maggie transmits her story wordlessly. When she apologizes to Lucy, language again feels too painful to broach: “Each felt that there would be something scorching in the words that would recall the irretrievable wrong” (519). When words do come, they are sobbed forth. For Maggie, “every distinct thought began to be overflowed by a wave of loving penitence” (519). Tom learns of Maggie’s past in an even more silent fashion. Maggie’s countenance seems to convey the entire story:

It was not till Tom had pushed off and they were on the wide water, -- he face to face with Maggie, -- that the full meaning of what had happened rushed upon his mind. It came with so overpower a force,-- it was such a new revelation to his spirit, of the depths in life that had lain beyond his vision, which he had fancied so
keen and clear,—that he was unable to ask a question. They sat mutely gazing at each other. (531)

No longer is there a push to “definite thought” in precise language. Instead, Tom becomes absorbed in Maggie’s story— which breaks on him as a “new revelation.” He begins to regard his sister with “a certain awe” (531). At the end of *The Mill on the Floss*, Maggie’s story finally becomes available to St. Ogg’s, and it arrives as a shock that awakens reverence for the depth of Maggie’s experience. Maggie, who had been a source of surprise, mystery, and wonder for the reader as she winds her way through an undefined plot, now becomes the object of “revelations” and “awe” for the characters of the novel.

In this way, Eliot develops her characters and plot in line with Victorian natural history. Literary critics have argued that Eliot dispatched with natural history after *Adam Bede* and the publication of Darwin’s *Origin of Species*. They treat natural history as a pre-science that gave way to the more rigorously disciplinary biology. Yet, biology and natural history co-existed for many decades side by side, as they were designed for different audiences. Natural history sold well in commercial presses, and regardless of its status a science it earned a wide readership. Natural history depicted nature as a field of inexhaustible surprise, mystery and wonder. It was this affective appeal that drew Eliot to Infracombe in 1856, and it was this appeal that saturated her fiction. In *The Mill on the Floss*, Eliot created characters and a plot that constantly reversed readers’ expectations and presented a fictional world that existed somewhere beyond full comprehension of either the reader or the characters.
Eliot expanded on the appeal of mystery in her novella “The Lifted Veil,” which she wrote while composing *The Mill on the Floss*. The shorter work is a first-person account of Latimer, a socially isolated son in a cosmopolitan family, who increasingly develops telepathic insight into everyone but his vain wife, Berthe. But Latimer’s mind reading does not bring him into sympathy with other characters. Instead, total knowledge leads to crushing ennui and alienates the narrator even further. The obscurity of Berthe’s mind draws Latimer to her, but she grows disgusted with her husband and plans to kill him. The story ends with a gruesome blood transfusion that reanimates the corpse of a maid who lays bare Berthe’s plot and removes the last mystery from Latimer’s mind.

The novella has long been viewed as an anomaly in Eliot’s canon. Its morbid gothic tone, sensational pseudoscience, and novella format has set it apart from her other works. Sally Shuttleworth goes so far as to say “the tale can be seen as an inversion of all the values and ideals proclaimed in Eliot’s other works” (50). Eliot’s publisher John Blackwood found the story disturbing and only advocated publication based on its strong prose. He considered the final experiment particularly painful for readers, and suggested that Lewes’ morbid experiments on animals must have been seeping into Eliot’s fiction: “I cannot help thinking that some of our excellent friend’s experiments on some confounded animalcule” (145) had inspired the ending.

Blackwood has not been the only reader to note Lewes’ influence on the story. More recently, Kate Flint has demonstrated the story’s many connections to Lewes’ *Physiology of Common Life* which was published in the same year. Flint, like many other critics, argues that Latimer’s bleak take on the other characters as well as his own life stems from the incompatibilities of Lewes’ science with the construction of sympathetic
characters. For Flint, Latimer’s telepathy and Lewes’ investigations are both “invasive” (112), as they may expose repulsive truths that distance the reader. Similarly, Richard Menke argues that Latimer uses a method like that of Lewes’ in the *Physiology* to “flay the figures around him alive, in order to reveal their inmost thoughts and passions” (629). Menke and Flint set up Lewes’ work as a counterpoint to Eliot’s own aesthetic principles: “In *The Lifted Veil* Eliot entered into a dialogue with Lewes … in which she implicitly pitted herself against his physiological emphasis” (Flint 113).

Yet a closer reading of Lewes as a writer and popularizer – rather than a scientist – shows how similar Lewes and Eliot’s goals were. “The Lifted Veil” does borrow from Lewes’ text: *The Physiology of Common Life* includes sections on the circulation of blood and argues that a transfusion could revivify tissue. *The Physiology of Common Life* also includes several first-person accounts of patients near death that share similarities with Latimer’s visions of his own death. Lastly, Lewes intends to probe into the mysteries of both mind and body in a way that anticipates Latimer’s dubious gift.

While literary critics are right to place “The Lifted Veil” alongside *The Physiology of Common Life*, though, they overlook how Lewes’ popularization inflects his science. For Lewes, these investigations are not invasive, but startling in a way that provokes interest and understanding. For example, Flint quotes a passage from *The Physiology* on the wonders of the circulatory system:

If for a moment we could with bodily eye see into the frame of man, as with the microscope we see into the transparent frames of some simpler animals, what a spectacle would be unveiled! Through one complex system of vessels we should see a leaping torrent of blood, carried into the depths and over the surfaces of all
the organs, with amazing rapidity, and carried from the depths and surfaces through another system of vessels, back again to the heart…. Such a spectacle is unveiled to the mental eye alone, and we cannot contemplate it, even in thought, without a thrill. (271)

The discoveries of Lewes’ “mental eye” are not invasive, so much as they are “amazing” and a “spectacle.” The vision of minute processes sends a “thrill” through the reader as they explore “the mysterious actions” (271) behind circulation. As with Seaside Studies and Studies in Animal Life, The Physiology continues to use mystery and surprise to motivate readers. In this way, it shares Latimer’s concern that total knowledge may weaken the curiosity.

Blackwood and more recent critics have cast Lewes’ influence on the story as inartistic and something that would be overcome in other, more typical, Eliot novels, but I want to show how “The Lifted Veil” shares with Lewes’ popular science and Eliot’s other novels a common aesthetics of surprise and mystery. In The Mill on the Floss, Eliot created characters and a plot that remained opaque to the anticipating reader – thus shocking them into “attention to what is apart from themselves.” In “The Lifted Veil,” Eliot takes a different route, and designs characters and a plot that are instantly revealed. Latimer’s knowledge precludes any possibility of shocking the reader into sympathy with the outside world. Rather, the narrator becomes more insular and disgusted with everyone around him.

While Flint draws comparisons between Lewes’ “mental eye” and Latimer’s telepathy, Eliot differentiates them by showing how Latimer’s visions foreclose mystery
rather than invite it. When Latimer eventually sees into the mind of Berthe, his vision painfully terminates his last bit of desire: “The terrible moment of complete illumination had come to me, and I saw that the darkness had hidden no landscape from me, but only a blank prosaic wall” (206). In *Seaside Studies*, Lewes found “no dead wall of terminal blankness.” New facts only served to launch new speculations. However, Latimer’s telepathy exhausts all mysteries and presents the world as stale recurrence without any hope of change. When Latimer looks into the past of Prague, he sees nothing but “a people doomed to live on in the stale repetition of memories” and stuck “in the rigidity of habit” (183). His father is “one of those people who are always like themselves from day to day” (179) whose stasis becomes permanent when he literally dies of paralysis. Almost in anticipation of the critics of *The Mill on the Floss* who wanted more consistent characterization, Eliot presents characters so constant that they become painfully repetitive.

Likewise, Latimer presents the plot as already complete without any chance of alteration or detour. The novella begins at the story’s end – Latimer’s death – and all key plot points are revealed by prevision. While *The Mill on the Floss* compared Maggie’s fate to an unmapped river, the reader finds Latimer’s life perfectly predictable. Not only is the plot revealed to the reader, but Latimer’s commentary constantly points out how stale and uninteresting the story is: “it is an old story” (195) or “this is a trivial schoolboy text” (178). Literary critics have cast this attitude as a critique of Lewes’ invasive studies in *The Physiology of Common Life*, but Lewes repeatedly reminds the reader of the very different affects he wants to provoke -- “We are passing from surprise to surprise” (147) or “we cannot contemplate it, even in thought, without a thrill” (271). Here, Eliot and
Lewes appear to agree that mystery and surprise are necessary to relieve the overwhelming sense of ennui that Latimer feels toward everyone around him and even his own story. Latimer even makes the point explicitly when he concludes that “So absolute is our soul’s need of something hidden and uncertain for the maintenance of that doubt and hope and effort which are the breath of its life” (203).

Eliot further borrows from Lewes’ text by using physiological language to depict Latimer’s dying interest in the world. Lewes’ *Physiology* represents the body’s tissues as consuming engines that drink in water, food, blood and oxygen to survive. He includes many instances of suffocation, hunger, thirst, and blood loss to show what happens when this system brakes down. Eliot uses these conditions to represent the oppressive ennui that creeps over the narrator. Mystery becomes quite literally “the breath of life” for Latimer, as his forecasts his own death by suffocation. He explains that he “thirsted for the unknown” (174), compares his love for Berthe before her mind is revealed to “the sense of thirst” (195), and asks at the horrific revivification of the maid “Is this what it is to live again – to wake up with our unstilled thirst upon us” (216). He remarks of his Prague vision that “The city looked so thirsty” and “unrefreshed for ages” (183). Latimer compares the feeling of speculation to “the beating of our heart, or the irritability of our muscles” (203). He turns the desire for mystery into a physiological need. By reading “The Lifted Veil” alongside Lewes’ *Physiology*, we can better appreciate how both texts rely on similar language and affects. Latimer suggests that a good story would look much like Lewes’ popular science in its partial revelations that would lead the reader deeper into a series of mysteries.
Eliot composed “The Lifted Veil” while she was beginning the longer *Mill on the Floss*, which would attempt to give such incomplete views of its plot and characters. I have argued that popular natural history informed Eliot’s approach in these two works, but the influence did not end there. Eliot’s later fiction continues to embrace unpredictability. In *Middlemarch* (1871-72), much like in *The Mill on the Floss*, the heroine proves impossible to judge accurately. Dorothea shocks everyone – including many readers – by marrying Casaubon. Mr. Brooke reflects on the mystery only for the narrator to conclude that: “woman was a problem which, since Mr. Brooke’s mind felt blank before it, could be hardly less complicated than the revolutions of an irregular solid” (27). Even Dorothea’s prescient sister Celia is fooled: “She was seldom taken by surprise in this way, her marvelous quickness in observing a certain order of signs generally preparing her to expect such outward events as she had an interest in” (31). Just as the narrator in *The Mill on the Floss* warns the reader not to reach conclusions too soon about Maggie from past experience, *Middlemarch* shows characters tricked by “a certain order of signs.” The narrator points out that such misinterpretations are easy since “Signs are measurable things, but interpretations are illimitable, and in girls of sweet, ardent nature, every sign is apt to conjure up wonder, hope, belief, vast as a sky, and coloured by a diffused thimbleful of matter in the shape of knowledge” (15). In this way, Eliot’s narrator often steps in to prevent the reader from reaching easy conclusions. A more complete discussion of Eliot’s intrusive narrator and the role of mystery in *Middlemarch* is beyond the scope of this chapter. But, it should be noted that Eliot’s interest in mystery and surprise continues beyond *The Mill on the Floss* and “The Lifted Veil.”
Lewes, however, began to move away from natural history in the 1860s. The *Physiology of Common Life* would be the last book that tried to popularize his findings in the field. Lewes committed his later scientific work to the growing literature on psychology. Yet even here Victorian readers tended to look at Lewes as a popularizer rather than a contributing scientist. Upon his death, *Nature* commented:

> Science owes a good deal to Mr. Lewes; for, though he made little or no pretension to be an original investigator in physical science, he did very much by his writings to give to the general public an idea of what real science is, and to help forward the good work of carrying it into every-day life. (24)

In this chapter, I have tried to recover Lewes as popularizer, and placed Eliot’s work in relation to the popular science that her companion was writing. Popular natural history complemented Eliot’s novels because it presented itself as an ongoing investigation that never fully exhausted its subject. In her novels, Eliot works to preserve the mystery surrounding her characters and plots – using surprises to check the prying assumptions of “too sagacious” readers. By reading Eliot and Lewes in the same context, we can better appreciate how main exponents of popular science and of the Victorian novel shared many of the same strategies and goals.
"A more lonely, loneliness": Space Travel in Victorian Popular Science and the Novels of Thomas Hardy

In *Return of the Native* (1878), a world-weary Clym Yeobright lets his mind wander over the moon’s geography:

More than ever he longed to be in some world where personal ambition was not the only recognized form of progress – such, perhaps, as might have been the case at some time or other in the silvery globe then shining upon him. His eye travelled over the length and breadth of that distant country – over the Bay of Rainbows, the somber Sea of Crises, the Ocean of Storms, the Lake of Dreams, the vast Walled Plains, and the wondrous Ring Mountains – till he almost felt himself to be voyaging bodily through its wild scenes, standing on its hollow hills, traversing its deserts, descending its vales and old sea bottoms, or mounting to the edges of its craters. (230)

Clym, disappointed to find that the vanity of urban life operates in the Wessex countryside as well, begins to learn an uncomfortable lesson in so many realist novels: The world does not conform to one’s expectations. In a solitary moment, though, the moon can serve as a stage for an imaginative journey away from harsh reality. During the nineteenth century, astronomy often served as such a diversion for Victorian readers who want to “be voyaging bodily” through the universe. From early nineteenth-century popularizers like John Herschel and John Nichol to Victorian popularizers like Agnes Clerke and Richard Proctor, astronomy became common leisure reading that turned science into a form of virtual travel. Despite popular astronomy’s success, however, it
status as trustworthy or “serious” science was frequently questioned by reviewers and professional scientists. Popularizers tried to make their depictions of other worlds or deep space as vivid as possible – even when such a depiction could not be confirmed with observation. Their creative departures from established fact triggered public debates in the pages of both scientific and popular magazines over the role of imagination in science.

In this chapter, I show how Hardy draws upon popular astronomy and the debates surrounding its credibility in the astronomical passages of his novels. In *Return of the Native*, Clym’s sense of virtual travel on the moon quickly dissolves. When an eclipse begins, the moon stops being a site of imaginative travel and turns into a signal for his meeting with Eustacia, who will push the kind of “personal ambition” he hopes to escape: “The celestial phenomenon had been pressed into sublunary service as a lover’s signal. Yeobright’s mind flew back to earth at the sight; he arose, shook himself, and listened” (230). Hardy uses the dubious status of popular astronomy to gesture to the weakness of Clym’s fantasies in resisting the larger forces of the novel. In typical realist fashion, a character’s desires or expectations are frustrated to draw attention to the social or psychological imperatives that order the novel’s world. Yet, buried in this tactic, there lies a contradiction that, while the character’s imagination is sacrificed to a world outside it, the reader is expected to shut out the outside world and indulge in the imaginative world of the novel. Clym shakes himself into a hyper-alert state, but the reader is to be seduced away from their lives into a work of fiction. As a novelist, Hardy is invested in creating the illusion that falls apart for Clym. Popular astronomy becomes a site for
investigating how imaginative worlds are created, sustained, and – in Clym’s case – interrupted.

Astronomy appears prominently in many of Hardy’s works, and by reading the novelist alongside popular science we can better sense Hardy’s strategies for presenting his imaginary worlds as compelling realist novels. Victorian popular science writers wrote extensively and self-consciously about how to produce the illusion of “voyaging bodily” by using figuration to link familiar impression to the distant places in space.

Similarly, I argue that Hardy tries to sustain his imaginative worlds through a deeply allusive texture that weaves his novels into the familiar culture of his late-Victorian readers. For both novelist and popular science writer, imaginary worlds held belief when they established continuity between experience and imagination. This chapter traces how these late-Victorian writers created other worlds out of which the reader could not be “shook” – as Clym suddenly is.

Linking science to fiction, imagination, and desire in Hardy’s novels may seem surprising. Literary critics have tended to argue that Hardy uses science to indicate detachment and objectivity – rather than escapist absorption. J. Hillis Miller has found that science in Hardy’s novels is typified by “detached clarity” (17) called “distance” which he opposes to the subjective perspective of characters. Similarly, Gillian Beer suggests that evolutionary theory presented Hardy the problem of positioning subjective points of view against the long, inhuman narratives of science12. George Levine reads in both Hardy’s novels and the autobiographies of prominent Victorian scientists a narrative

12 Beer discusses Hardy and “the problem of finding a scale for the human” (233) in *Darwin’s Plots* (Cambridge: Cambridge UP, 2009)
of “dying to know,” which involves the death of emotion and desire to promote objectivity. This trend has continued in studies of Hardy and astronomy where astronomy is taken as a form of impersonal truth against which the subjective lives of characters is set. Pamela Gossin claims that advances in astronomy forced Hardy “to take up the task of fashioning a meaningful life … in a deterministic natural world surrounded by a mechanistic universe” (60). Meanwhile, Anne Dewitt considers astronomy opposed to moral character – finding that “astronomy leads Hardy to depict science’s failure to serve as a source of morality” (98). For literary critics, science forces characters and readers in Hardy’s novels to confront larger, impersonal realities.

While these readings have shed light on how the ethos of scientific objectivity influenced Hardy, they do not take into account the more immersive aspects of Hardy’s engagement with popular science. When Clym uses his knowledge of astronomy to imagine the surface of the moon, he is not confronting the objective conditions of a world that exists beyond the mind. Rather, he “longed to be in some world” different from the actual one. Literary critics have yet to appreciate this imaginative aspect to Hardy’s reading of science. Not just in Return of the Native, but also Far From the Madding Crowd, Two on a Tower, and Tess of the d’Urbervilles, astronomy serves as a vehicle for discussing how imaginative worlds are created and sustained in the minds of readers and characters. In order to understand how Hardy used popular astronomy, though, first we need to examine the role popularizers had in recasting the science as imaginative travel.

Writing Popular Astronomy

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The texts on which Hardy drew were experiments in a kind of scientific travel literature that allowed readers to inhabit places that were merely speculative for astronomers. The most prolific popularizer of astronomy in the late nineteenth century, Richard Proctor, wrote at length about how to recast astronomy in this way. Michael Crowe has estimated that Proctor composed over five hundred essays for general readers in journals of general interest like The Cornhill, Fortnightly Review, Fraser’s Magazine, Belgravia, and Contemporary Review – as well popular science journals like Scientific American or Popular Science Review. He repackaged many of these essays into well-selling books. In 1881, Proctor established his own journal Knowledge, as a more accessible version of Nature – the main organ of professional science during the late nineteenth century. For him, scientific concepts had to be made real before the student could be said to actually understand them. He explains in The Essays on Astronomy:

the student cannot be rightly said to ‘have astronomy’ at all (to use Shakespeare’s apt expression) until he is capable of picturing to himself, however inadequately, the truths of the science. A man may have at his fingers’ ends the distances, volumes, densities, and so on of all the planets … but unless, he has in his mind’s eye a picture of the solar system, with all its wonderful variety, and all its yet more amazing vitality, he has not yet passed even the threshold of the science.

(37)

Visualization in “his mind’s eye” becomes the only test by which scientific understanding could be gauged, and astronomy had to be presented in a “striking and graphic manner” (37) to create this kind of understanding.
Hardy owned and annotated Proctor’s *Essays on Astronomy* and shows an awareness of other of Proctor’s popular works in his notebooks and novels. Pamela Gossin speculates that “One probable source of some of the astronomical points of fact Hardy records in his notebooks is Proctor’s *Other World than Ours*” (107). Anna Henchmen has further added Proctor’s *Poetry of Astronomy* to the list of probable influences. The exact boundaries of Hardy’s reading are not entirely clear, but the wealth of astronomical references in his novels and literary notebooks suggests Proctor was the main source of Hardy’s astronomy. *Essays* and *Other Worlds than Ours* were Proctor’s two most commercially successful books, and they influenced more than Hardy. They reached the same audience who would have read Hardy’s novel – setting up the conditions in which Victorian readers would have read Hardy’s astronomical scenes.

For Proctor, popularization did not mean simplification for lay readers, but rather an attempt to render science in a palpable way – to make readers feel they were directly experiencing nature. This was not an unusual position for popular science writers to take. Proctor’s works followed a pattern set by the commercial success of earlier popularizers in the nineteenth century. Astronomy grew into a popular topic at the beginning of the century after the construction of large, deep-space telescopes allowed astronomers to draw images of distant galaxies, star clusters, and nebulas that drew the public eye.14 Between the 40-foot telescope built by William Herschel in 1789 and Lord Rosse’s 53-

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foot telescope built in 1845, Britain witnessed a boom in observatory construction with larger and larger lenses. The increased light-gathering ability of these telescopes led to vivid depictions of deep-space objects which transformed the night sky into a cabinet of curiosities with seemingly endless new discoveries possible. Even if lay audiences could not follow the technical discussions of astronomers about the shape of orbits or the birth of stars, they could marvel at the illustrations of the Orion Nebula or the Andromeda Galaxy. Popular astronomy was a visual pleasure for this new audience, and popularizers catered to their demand.

When Thomas De Quincey wrote his review of John Nichol’s *System of the Heavens as Revealed by Lord Rosse’s Telescopes* for *Tait’s Edinburgh Magazine*, he devoted most of his attention to recalling illustrations – particularly the “dreadful cartoon” (23) of the Orion Nebula. De Quincey instructs his readers on just how to recreate the impressions he felt while staring at the illustrations – even going as far as telling readers they must turn the book upside down: “If he neglects that simple direction … my description will be unintelligible” (79). John Nichol wrote to De Quincey to complain about his impressionistic reading of *Systems of the Heavens*, and eventually forced De Quincey to admit that he wrote “as one belonging to the laity, and not to the clerus in the science of astronomy.” (117) But the dispute points to the gap that was opening between astronomers and their new audience. Nichol hoped his *System of the Heavens* would promote a particular theory of stellar birth – what is known as the nebular hypothesis – but readers were more drawn to the fantastic depictions of distant astronomical phenomena. Popularizers took the findings of astronomers as jumping off
points for imaginative journeys out into space. Often, as with De Quincey, they ran into resistance from scientists who felt that popularization was overreaching.

Even De Quincey’s critic, John Nichol, marketed his works carefully to walk the line between serious and amusing science. In his *Architecture of the Heavens* (itself a commercial success – selling over 3000 copies in its first two editions), Nichol explained that he wrote “not without the shew of science, but without its form – having in that something of the form of Romance” (qtd. in Secord 58). Romance, with its connection to the fanciful and emotionally resonant, gave Nichol and many science popularizers a form to marry their works. By doing so, they sidelined their work from participation in professional science, but also shielded it from criticism. Astronomers looking to build their reputation in the scientific community could not gain much by casting their work as romance. As Michael McKeon has shown, professional science began to distance itself from romance during the seventeenth century as empiricism began to take hold. According to McKeon, scientists cast their opponents’ work as romance to tar the validity of their method or findings. Yet, while romance lost favor in the scientific community, it reemerged in popular science as an apology for the liberties that popularizers took with astronomy. This enabled writers like Nichol to deflect criticism, while indulging readers like the young George Eliot who recalls reading Nichol’s *Architecture of the Heavens* as virtual tourism: “I have been reveling in Nichol’s ‘Architecture of the Heavens and Phenomena of the Solar System,’ and have been in imagination winging my flight from system to system” (69).

Nichol’s popularizing strategy made him one of the most commercially successful science writers during the first half of the nineteenth century. The only astronomy writer
who would top him would be John Herschel, the son of William Herschel. Like Nichol, John Herschel straddled the line between professional and popular science, but became a celebrity through his vivid prose, which brought readers in contact with the furthest reaches of the universe. Herschel explained that he wanted to create “a strangely wide and novel field for speculative excursions, and one which it is not easy to avoid luxuriating in” (394). This was science as travel. It created a feeling that the reader was there at distant worlds or traveling between galaxies.

In this way, Victorian popular astronomy followed what the rhetorician of science Greg Myers has called the “narrative of nature.” In this mode, the science writer “minimizes expertise and emphasizes the unmediated encounter with nature” (189). Myers finds that popular science often relies on this sense of an “unmediated encounter with nature” to drive interest. Professional science distinguishes itself in its focus on the disciplinary structure of knowledge. Scientists writing for professional journals establish how their research is unique, but fits into the larger body of knowledge assembled by those in a particular field. Myers refers to this latter style as the “narrative of science.” While the narrative of nature joins together the findings of many scientists to create a more complete experience, the narrative of science establishes the validity and relevance of a particular piece of research.

Both Herschel and Nichol would influence Proctor’s popular astronomy. These writers established a genre for Proctor to continue in the 1860’s when he began writing for a lay audience. In the Essays on Astronomy, Proctor complimented John Herschel’s prose as the latter is “never content with merely stating such and such circumstances about celestial bodies, but will not leave his subject until he has impressed on the mind of
his reader his own feeling of the reality of those circumstances” (34). Proctor knew that successful astronomy writing relied on more than just the reiteration of scientific information for the uninitiated. It needed to give readers a “feeling of the reality.”

Proctor believed that this drew popular science closer to literature. He explains that “the literary qualities required for the effective popular treatment of scientific subjects are the same which are required for success in the literature of history, biography, fiction – nay, even for success in poesy and the drama” (Wages 7). Proctor casts a wide net in his definition of the literary, but like Nichol, who called his works romances, Proctor wanted to situate his popular science within literature as much as science. The literary quality of popular science granted astronomy a larger audience, but it also raised creative issues about how best to absorb readers in this form of virtual travel. Just as Hardy’s Return of the Native takes the moon as a site for imaginative escape, rather than scientific education, popular astronomy encouraged readers to see the cosmos as a series of journeys that were artfully constructed.

Perhaps Proctor’s most ambitious project was his Other Worlds than Ours (1870), which tried to depict the surface and possible life on each planet in the solar system. Given the scarcity of information about neighboring planets, this would seem an impossible task. Telescopes could make out little detail on the planets, and the drawings of each planet contained few markings. But despite the overwhelming methodological obstacles, Other Worlds than Ours set out to describe everything from the landmasses on Venus to the ecosystems on Mars. Proctor proceeded using a series of analogies that used the Earth as a model for imagining other planets. The variety of climates and forms of life found on Earth became a way to understand the differences that might exist
between terrestrial and extraterrestrial environments. This eventually allows for fantastic scenes of planetary exploration. Proctor explains of Mars:

All the kinds of scenery which make our earth so beautiful have their representatives in the ruddy planet. The river courses to the ocean, by cataract and lake, here urging its way impetuously over rocks and boulders, there gliding with stately flow along its more level reaches. The rivulet speeds to the river, the brook to the rivulet, and from the mountain recesses burst forth the refreshing springs which are to feed the Martial brooklets. (110)

Like Clym transporting himself to the moon, Proctor takes readers to the surface of Mars where he imagines with striking detail Martian geography. Proctor’s familiarity with an alien world is surprising to say the least. With what would seem like a paralyzing lack of research, *Other Worlds than Ours* traces Martian waterways – and eventually describes the vegetation and alien population. By making Mars “the miniature of our Earth” (85), the familiar surface of our planet can serve as an extraterrestrial model.

Proctor frequently resorted to analogy to complete his scientific sketches. Speaking of the universe beyond our galaxy, Proctor asks:

What evidence then have we that there exists a universe beyond? – unless a sort of argument from analogy that the galaxy, with all its contents, may be but one of these miniatures of that vast universe, and so on ad infinitum; and that in that universe there may exist multitudes of other systems on a scale as vast as our galaxy. (*Essays* 23)
While the science behind these figurative leaps may be disastrous, the appeal is clear. It materialized locations that were inaccessible through the works of other astronomers. Texts such as *Other Worlds than Ours* were not science primers that carefully explained the latest theories. Rather, they served as aids to the readers’ imagination as they speculated about topics beyond the reach of rigorous research.

For Proctor, analogies had to be carefully controlled to make them believable. In a piece for *Fraser’s Magazine*, Proctor explained that the success of earlier popularizers was tied to their “natural” style that allowed them to slip from summary of scientific findings into figuration. A void in space could be considered a desert, or a field of the sun could become a despot of a solar system only when the language of the writer is a “natural effusion” that comes “unbidden to his pen.” (27). A sense of effort would call attention to the writer’s art and alert readers to the substitution that their analogies are performing. Space is not a desert – just as an opera singer’s voice is not that of an extinct bird. Proctor’s handling of metaphor, with its reliance on imagination and its organic flowing “unbidden from the pen,” seems to resonate with earlier Romantic conceptions. Indeed, Proctor’s “natural effusions” may be taken for Keats’s suggestion that poetry come “naturally as the leaves to a tree” (Keats 289). In this sense, the organic production of poetry expresses the inner truth of the imagination. The imagination is its own truth which the poem attempts to unfold. But, for Proctor, metaphor and imagination serve merely as tools to reach out beyond the self. They extend the sensibility of the reader beyond their immediate surroundings or what is currently known. The connections that metaphor and imagination draw tend to be largely factitious. They are connections more closely resembling Coleridge’s category of fancy – a mental faculty that combines sense
impressions into new configurations. Proctor uses the language here of Romantic poets, but without the hope that there is any truth behind the expression. Proctor was aware that the leaps of imagination that his work relied on were tenuous constructions of language that could dissolve if subjected to too much analysis.

Reviews of Proctor’s work expose the extent that Victorian readers were aware of its speculative character. The Athenaeum largely dismissed the planetary explorations of Other Worlds than Ours – finding that “Such speculations, we are of opinion, can be at present of little practical importance” (744). Nature expressed similar doubt: “We can neither follow nor admit the validity or consistency of Mr. Proctor’s arguments” (161). While the credibility of Proctor’s science was questioned, though, its value was found in its imaginative power. Reviews often broke out into discussions of the proper use of imagination. For example, fellow science popularizer Agnes Clerke wrote an extended review of Proctor’s work in The Edinburgh Review that veered into a philosophical argument about speculations beyond known science. For Clerke, speculation was inevitable since the mind craves the feeling of reality, yet speculation was also fruitless since it could not be verified. This conflict drives her to conclude that “We can set no bounds to creative power, neither can we insist upon its indefinite exercise for the mere purpose of peopling with worlds that void of space from the contemplation of which we instinctively recoil” (551). The “bounds to creative power” was a theme that ran through reception of Proctor’s writing. While lay readers wanted a more intimate familiarity with scientific theories, many were troubled by popular astronomy’s tendency to leave behind the rigorous proof demanded by the scientific community.
This tension between Proctor and his critics exposes both the appeal of popular science and its questionable relationship to professional science. While effortlessly traveling through the universe had its attractions, the depiction itself was often scientifically questionable. When “peopling with worlds that void of space,” Proctor had to rely on the force of his language to substantiate largely fictitious places. Much like a novelist asking readers to picture fictional characters interacting, Proctor relied on what Elaine Scarry has called “authorial instructions in getting us to imagine vividly” (104). Scarry and other literary critics have frequently commented on fiction’s ability to grip one’s imagination and immerse one in an extended narrative. Realist novels, with their lengthy page counts, sympathetic characters, and attention to external detail, have drawn particular attention for “getting us to imagine vividly.” Rachel Ablow has argued that the Realist novel is defined by “readerly absorption” (1), and Alison Byerly has recently identified a series of techniques in the Realist novel to “immerse the reader in a coherent and convincing illusion” (28). Popular astronomy, like a Realist novel, attempted to convince readers of an illusion, but, as Proctor and his reception show, the illusion was never entirely convincing. The imagination in the postromantic and popularizing mode in which Proctor wrote could only function as a tool to extend the sensibility. The imagination did not have any validity in itself. By using analogies, Proctor hoped that readers would take their belief in the immediate and familiar and use it to picture distant worlds. But these constructions remained weak and crumbled under scrutiny.

Exploring the Stars and Reading Novels: Hardy Takes Up Proctor

When novelists like Hardy took up popular astronomy, they were often taking up its speculative appeal – more than any particular theory. This is especially true of Hardy
who had more than a passing familiarity with Proctor’s work. For Hardy and Proctor, the expanses of space raised questions about how to represent theoretical or imaginative material in a tangible way to readers. Space was a site for both popular astronomy writers and Hardy to work out how the familiar could be figuratively linked with the unfamiliar to lend substance to imaginary worlds.

In Hardy’s novels, astronomical scenes place in the role of narrator as they create their own worlds within the fictional world of the novel. Clym imagines a world where personal ambition is not the only measure of progress, but other character dream up other possibilities. The success of these imagined worlds lies in their relation to the characters’ memories and the larger cultural context. Hardy’s most successful astronomers figuratively weave their experiences into their imaginary worlds, and thus psychologically sustain them. In this way, Hardy is less interested in exposing his characters’ fantasies as escapes from reality than he is in showing the psychological dynamics at work in imagination. In Tess, the heroine imagines better circumstances for her family while stargazing. Explaining to a younger sibling the difference between worlds, she lapses into a discussion of her family’s fortunes:

“Did you say the stars were worlds, Tess?”

“Yes.”

“All like ours?”

“I don’t know; but I think so. They sometimes seem to be like the apples on our stubbard-tree. Most of them splendid and sound – a few blighted.”

“Which do we live on – a splendid one or a blighted one?”

“A blighted one.”

“Tis very unlucky that we didn’t pitch on a sound one, when there were so many more of ‘em!”
“Yes”

“Is it like that really, Tess?” said Abraham, turning to her much impressed, on reconsideration of this rare information. “How would it have been if we had pitched on a sound one?”

“Well father wouldn’t have coughed and creeped about as he does, and wouldn’t have got too tipsy to go this journey; and mother wouldn’t have been always washing and never getting finished.”

“And you would have been a rich lady ready-made, and not have had to be made rich by marrying a gentleman.” (35-6)

Tess slides from the scientifically sound claim that there are other worlds into a rather dubious discussion of what those worlds would look like. Tess admits she does not know whether other worlds resemble ours, but she contends that they “seem” as though some are better than others. This turns into speculation about “How would it have been” in other circumstances – a competing counterfactual world to the one of the novel.

Tess’s astronomical conjecture, though, follows a pattern set by Return of the Native, and Hardy shows how fragile these other realities can be. Shortly after the above conversation, Tess slips into a reverie and causes an accident that further ruins the family – forcing her deeper into the “blighted” world she wants to escape. The novel repeatedly collapses the realities that characters try to create in reaction away from the world of the novel. Tess tries to act as her own novelist – generating her own narratives – but the bleak outlook of her life inevitably returns. Similarly, for Clym, astronomical speculation yields to immediate realities. As Clym stares into the moon, an eclipse begins which signals his meeting with Eustacia who will continue to press Clym into a more ambitious life. In Return of the Native and Tess, the imaginary worlds of popular astronomy are tenuous constructions overcome in time. Clym and Tess try to create astronomical realities that are not tied to their familiar lives, and this renders their
creations fragile. For these characters, the attraction of the stars and moon are their exoticism – their difference from terrestrial concerns. But this leads to the immediate collapse of their fantasies. Without support from familiar experience, their imaginary worlds are suddenly interrupted. Proctor shows how the illusion of presence is supported through analogies that link the familiar to the merely speculative. Following Proctor, Hardy uses the astronomical to talk about how imagination is sustained through its connection – however factitious – to the sensible.

In *Far From the Madding Crowd*, though, Hardy offers an example of how astronomical speculation can be successfully sustained. Here, Gabriel Oak achieves this more vivid conception of the stars by projecting his own sensibility into his visualization of the night sky. Oak employs his own somatic sense to visualize the pulse of the stars above his head, and this connection lends him a fuller appreciation of what he imagines. During a “nocturnal reconnoitre” (10) at the beginning of the novel, Oak stares into the stars to note:

> The sky was clear – remarkably clear – and the twinkling of all the stars seemed to be but throbs of one body, timed by a common pulse. The North Star was directly in the wind’s eye, and since evening the Bear had swung round it outwardly to the east, till it was now at a right angle with the meridian. A difference of color in the stars – oftener read of than seen in England – was really perceptible here. (9)

The “oftener read of than seen” probably refers to Proctor’s essay on “Colored Suns” in which he observes that:
In tropical countries the colours of the stars form a very obvious and a very beautiful phenomenon. The whole heaven seems set with variously coloured gems. In our latitudes, none but the brightest stars exhibit distinctly marked colours to the naked eye. (qtd. in Gossin 139)

Hardy uses the exquisite color to gesture to the uniqueness of Oak’s viewpoint. Unlike the usual colorless specks that the casual observer sees, Oak appreciates the night sky as a “work of art superlatively beautiful” (13). Literary critics have tended to read this passage from *Far from the Madding Crowd* as an example of Oak’s connection to nature through his pastoral vocation as a shepherd. For example, Anne Dewitt contends that Oak, as a “shepherd-naturalist” (98), takes a different view of the night sky than Hardy’s scientist characters. Pamela Gossin calls Oak’s particularly aesthetic response “part of a long tradition of rural knowledge that Gabriel has kept alive” (140). But, less noticed has been the way Oak’s understanding of the stars is embodied in somatic language. The stars are felt as “throbs of one body, timed by a common pulse.” Hardy encourages the reader to think of the stars as an extension of Oak’s sensibility through the metaphorical slippage wherein stellar shimmering becomes bodily pulsing.

When Oak stops to stargaze from a hill, Hardy continues to realize the stars through Oak’s sensations. Hardy’s narrator wonders how the mind can understand the grand scope of the heavens’ rotation around the earth, and juxtaposes Oak’s sense of movement to the larger celestial turning:

To persons standing alone on a hill during a clear midnight such as this, the roll of the world eastward is almost a palpable movement. The sensation may be caused
by the panoramic glide of the stars past earthly objects, which is perceptible in a few minutes of stillness, or by the better outlook upon space that a hill affords, or by the wind, or by the solitude; but whatever be its origin, the impression of riding along is vivid and abiding. The poetry of motion is a phrase much in use, and to enjoy the epic form of that gratification it is necessary to stand on a hill at a small hour of the night…. After such a nocturnal reconnoitre it is hard to get back to earth, and to believe that the consciousness of such majestic speeding is derived from a tiny human frame. (9-10)

Again, Hardy connects astronomical awareness to bodily sense. As Oak stands still, the view above him begins to take on the feeling of motion. The illusion of “riding along” is a projection of familiar impressions out into the cosmos. After this realization, the narrator asks how “such majestic speeding is derived from a tiny human frame.” The link between the observer’s seemingly “tiny human frame” and cosmic velocity is only achieved linguistically in this passage. There is no true comparison between the vast scale of the universe with a sense of “riding along,” but Oak and the reader can follow these analogies to project their familiar sensations and imagine larger astronomical realities.

In *Far from the Madding Crowd*, this ability to project one’s sensibility to imagine other realities becomes more than just the basis of astronomical speculation – it also underlies characters’ abilities to understand and empathize with each other. Oak senses the pulse of the star above him, but he also notes “a throb of tragic intensity” (59) in Fanny Robin’s wrist as she attempts to find the lover who has jilted her. With just a touch, Oak discerns the outline of Fanny’s story and the reader is brought into concern
for her. In “The Science of Fiction,” Hardy argued that the novelist’s gift lay in the “intuitive power” to “see in half and quarter views the whole picture, to catch from a few bars the whole tune” (103). Hardy seems to lend this skill to Oak in his quick perception of Fanny’s trouble. Throughout the novel, characters pulse, throb, and beat, and Oak’s attunement to this physiological register allows him to pick up on the inner life of others. Under Oak’s questioning, Hardy explains of Bathsheba that “No Christmas robin detained by a windowpane ever pulsed as Bathsheba now” (223). While characters can only speculate about the thoughts and emotions of others, the pulse becomes a clue on which to build deeper understandings. Like Proctor using the earth as a model for Mars or the solar system as a miniature of the galaxy, Oak uses familiar sensation to tell a larger story about others’ consciousness.

Anna Henchman has already pointed out how many of Hardy’s astronomical scenes set up the potential of characters to understand each other in the novels, but critics have yet to explore how characters make these leaps in imagination. By reading Hardy in the context of popular science, which was embedded in discussions about the limits of imagination, we can begin to see the ways both science writers and novelists like Hardy sought to overcome these limitations. For Hardy, and Proctor, the danger of astronomy lay in its tendency to lapse into the merely theoretical. They worked to more fully realize astronomy through analogies that linked the familiar with the speculative.

But this work was always tenuous. Proctor believed that analogies had to be carefully controlled to prevent readers from picking up on the rhetorical sleight of hand. Meanwhile, Hardy’s characters struggle to sustain their astronomical tours if they are not attached to and supported by familiar impressions. In *Far from the Madding Crowd*,
Hardy contrasts Oak’s intuitive understanding of others’ consciousness with William Boldwood’s social blindness. Hardy expresses this comparison with paired astronomical analogies. While Oak projects his sensibility into space to feel the rotation of the night sky, Boldwood struggles to think beyond the immediate appearance of astronomical objects. Hardy compares Boldwood’s inexperience with women to his poor astronomical understanding:

To Boldwood women had been remote phenomena rather than necessary complements – comets of such uncertain aspect, movement, and permanence, that whether their orbits were as geometrical, unchangeable, and as subject to the laws as his own, or as absolutely erratic as they superficially appeared, he had not deemed it his duty to consider. (136)

Boldwood fails to realize the orbit of comets – just as he mistakes the intentions of women – because he cannot connect these speculations to anything in his life. He lacks the foundational analogies that Oak uses to bridge the gap between the sensible and the imagined. Whereas Oak uses the throbs and pulses of bodies to intuit larger realities behind the stars and other characters, Boldwood can only understand the most superficial meanings behind celestial bodies or women’s intentions. Boldwood’s imagination, like Tess’s or Clym’s astronomical rambles, has a thinness to it that makes it difficult to maintain hypothetical thought.

For example, when Bathsheba sends him a letter on a whim, Boldwood obsesses over the writer of the letter but struggles to picture what she would have looked like
writing it. His image of Bathsheba lacks any detail and forms of thin basis for speculation. Staring at the paper, Boldwood conceives that:

Somebody’s – some woman’s – hand had travelled softly over the paper bearing his name: he unrevealed eyes had watched every curve as she formed it: he brain had seen him in imagination the while. Why should she have imagined him? Her mouth – were the lips red or pale, plump or creased? – had curved itself to a certain expression as the pen went on – the corners had moved with all their natural tremulousness: what had been the expression?’

The vision of the woman writing as a supplement to the words written, had no individuality. She was a misty shape. (116)

Boldwood can only realize Bathsheba as a “some woman” who “had no individuality.” The image that he forms of her finally resolves itself into “a misty shape.” Like Proctor working from a low resolution image of Mars to construct a detailed survey of the Martian surface, Boldwood begins with little information and a hazy outline. But Hardy’s character does not progress beyond this understanding. Proctor used analogies to connect what was intimated known with what was merely theoretical, but Boldwood only theorizes. His visualization lacks specificity and thins out into a “misty shape.” For Hardy, popular astronomy exposed how sustained imagination relies on metaphors that link familiar impressions with thin speculation.

So far I have traced the psychological forces and rhetorical devices that enable sustained virtual travel, but, for Hardy, imaginary worlds had to be seen as continuous with the surrounding culture. Oak’s astronomical vision is more vivid than Boldwood’s
because of more than just the figurative connection between the stars and his sensibility. Oak is also a figure of cultural continuity. Oak is one of the “stationary cottagers, who carried on the local traditions and humours” (4) that Hardy refers to in the 1912 preface. The novel reminds readers that Oak and his form of work remain true to generations of pastoral culture before them. In a frequently quoted section, Hardy describes Oak at work in a barn that has remained devoted to the same task for centuries:

The mind dwelt upon its past history, with a satisfied sense of functional continuity throughout – a feeling almost of gratitude, and quite of pride, at the permanence of the idea which had heaped it up. The fact that four centuries had neither proved it to be founded on a mistake, inspired hatred of it purpose, nor given rise to any reaction that had battered it down, invested this simple grey effort of old minds with a repose, if not a grandeur, which a too curious reflection was apt to disturb in its ecclesiastical and military compeers. For once medievalism and modernism had a common standpoint. (125)

Like Oak’s astronomical wandering, the barn is an “idea” that is sustained through its continuing connection to the local culture. As part of the unbroken tradition of sheep shearsers working in the barn, Oak’s labor performs the larger cultural task of joining medievalism and modernism in “a common standpoint.” Hardy gestures to the grandeur of castles and cathedrals – traditional sites for romance novels – but shows how poor the “idea” behind them stands up in comparison to the barn. The barn, with its emphasis on prosaic reality and familiar experience, links it to the realism that Hardy’s novels represent. The passage suggests that realism is supported by greater imagination than romance – a somewhat surprising claim given literary criticism’s tendency to read
realism as rooted in observation rather than imagination. For Hardy, though, realism is not less imaginative than romance: Realism’s imagination is simply rooted in more accumulated experience.

Hardy’s *Two on a Tower* – which places characters’ astronomical knowledge at the center of the plot – raises the stakes of these discussions, and the metaphorical connections drawn between familiar impressions and imagined realities become more complicated and harder to control. *Two on a Tower* was often read by Victorian reviewers in the light of popular science. Havelock Ellis even compared the novel unfavorably to Proctor – remarking that “The astronomical enthusiasm is wanting in spontaneity. We prefer Mr. Proctor for popular astronomy.” Others were kinder, but there was a clear sense that Hardy had entered into the discourse of popular astronomy when composing the novel.

More recent criticism has also found Hardy dabbling in astronomy. But they often mistake the level at which science and literature intersected for Hardy. While Victorian reviewers understood that Hardy followed in the wake of popularizers who made the subject entertaining, literary criticism in the last thirty years has tried to draw connections between disciplinary science and Hardy’s novel. Anna Henchman argues that Hardy was influenced by obscure discussions surrounding optics. For Henchmen, Hardy “consistently applies the optical distortions found in astronomy to the relations between other people” (135). Anne Dewitt finds that Hardy’s attitude toward to astronomy comes from the behavior of professional journals and societies. Pamela Gossin goes so far as to suggest that Hardy was anticipating developments in astrophysics: “astrophysics is the environment of the novel” (176). These critics surmise
that the tragedy of *Two of a Tower* results from problems within the discipline of astronomy. Yet understanding how Victorian literature and popular science interacted can reveal different perspectives on the novel. Hardy reflects, not on issues in astronomy, but more on the problem of sustaining conviction in the literary presentation of fictional worlds. For Hardy, the popularizer, novelist, and characters of his novels struggled with the need for this conviction. *Two on a Tower* represents Hardy’s most sustained engagement with both astronomy and the limits of fictional worlds.

*Two on a Tower* focuses on a wealthy widow, Vivette Constantine, who begins a relationship with a much younger astronomer, Swithin St. Cleeve, who has built an observatory on a tower in her property. For most of the novel it is unclear whether Vivette’s first husband is alive or dead – rendering the novel’s main romance problematic. This provides most of the dramatic tension throughout the novel, as the new couple have to pursue their relationship in private due to Vivette being still technically married. The lovers use astronomy as a plausible cover for their quasi-adulterous affair, as Vivette asks Swithin for astronomy lessons and the two meet under that pretense. From there, astronomy grows into the medium through which the novel describes the central romance. As characters learn to imagine distant worlds or outer space, the quasi-adulterous affair becomes more plausible in their minds. When the reality of astronomy grows more tangible, new actions in the fictional world become possible. Yet, for Hardy and Proctor theoretical ideas are materialized by linking them to familiar impressions. *Two on a Tower* explores what happens when a new reality is imperfectly joined to analogous memories. *Two on the Tower* uses astronomy, then, not only to advance a
melodramatic plot, but also to talk about the limits of imagination in creating fictional worlds.

Like Proctor, Swithin is a popularizer of astronomy. He creates an inhabitable depiction of the universe through which Vivette travels. During their first astronomical survey, Hardy explains:

they traveled together from the earth to Uranus and the mysterious outskirts of the solar system; the nearest fixed star in the northern sky; from ’61 Cygni’ to remoter stars; thence to the remotest visible, till the ghastly chasm which they had bridged by a fragile line of sight was realized by Lady Constantine. (38)

As Vivette’s scientific “elucidator” (39), Swithin takes her through the universe as a series of palpable places. Hardy points out that Swithin carefully chooses his language to create this effect: “By figures of speech and apt comparison he took her mind into leading-strings, compelling her to follow him into wildnesses of which she had never in her life even realized the existence” (40). When Swithin attempts to publish his work in a professional journal, the narrator notes that “It was written in perhaps too glowing a rhetoric for the true scientific tone of mind” (85). As a whole, the astronomy of Two on a Tower steers clear of the professional and disciplinary side of astronomy. When Swithin attends a scientific voyage to the South Pole, the narrator skips over the episode with the bald comment: “To speak of their doings on this pilgrimage, of ingress and egress, of tangent and parallax, of external and internal contact, would avail nothing. Is it not all written in the chronicles of the Astronomical Society?” (343). Hardy chooses instead to focus on astronomy’s popular appeal as a form of virtual travel.
For Vivette, the other worlds of popular astronomy provide an entertaining escape from her first husband. After her husband goes missing, Vivette is left in limbo between being married and unmarried. She has no husband with her, but cannot pursue another until the fate of her first husband is discerned. As the novel opens, we see her in a state of “killing ennui” (3) as she tends the property left to her by her husband. She happens upon astronomy as an interesting diversion from this monotony. When she finds scraps of Swithin’s notes in the tower where he is pursuing his study, the novelty of finding someone new on her property leads her to the young astronomer – the paper “arrested her attention by its freshness” (5). Vivette chases astronomy’s newness. The narrator remarks of one of her astronomical journeys that “They plunged down to that … invisible stellar multitude in the back rows of the celestial theatre; remote layers of constellations whose shapes were new and singular” (78). This experience provokes Vivette to comment on the telescope’s odd power to conjure up such different places: “I have a feeling for this instrument not unlike the awe I should feel in the presence of a great magician in whom I really believed. Its powers are so enormous, and weird, and fantastical” (79). Astronomy reveals new places, which, in Vivette’s mind, come to represent different realities and possibilities of escape. Vivette’s attraction for Swithin is based on these other places that he can create. Swithin, himself, is an otherworldly figure who cannot regard things from a personal or human perspective. He helps Vivette to imagine ways out of her stagnation as an uncertain widow.

The astronomical voyages of Vivette and Swithin wax realistic or wane into weak fantasies throughout the novel, and Hardy shows the processes that work these changes. In some moments Swithin is able to convince Vivette that the stars represent new
realities, but both characters are prone to doubt. After their first astronomy lesson, Vivette returns home only to lose track of everything she learned. The weather turns overcast, and astronomy slips from mental travel to merely theory: “It seemed as if the whole science of astronomy had never been real, and that the heavenly bodies, with their motions, were as theoretical as the moves and pieces at a bygone game of chess” (84). Removed from the popularizing discourse of Swithin, astronomy lapses back into the abstract. Vivette seems to lose that “creative power” that reviewers of Proctor’s work found in popular astronomy.

Similarly, Swithin feels astronomy dematerialize when he leaves England for a scientific expedition to the South Pole. For Swithin, the northern hemisphere’s familiarity lends it a reality that the starry sky above the South Pole lacks. Swithin begins to reflect on the way his memories provided him a way of contemplating space in the northern hemisphere – while the southern hemisphere begins to appear more like an unimaginable void:

Infinite deeps in the north stellar region had a homely familiarity about them when compared with infinite deeps in the region of the south pole. This was an even more unknown tract of the unknown; space here, being less the historic haunt of human thought than overhead at home, seemed pervaded with a more lonely loneliness. (350)

Without the “homely familiarity” that previous thought had given the northern sky, the alien feeling of outer space becomes unbearable. Even though Swithin peers into the same space that he had seen in the northern hemisphere, the absence of “human thought”
renders it more distant. When Swithin cannot find the familiar constellations, Hardy explains that “the polar patterns, stereotyped in history and legend, without which it had almost seemed that a polar sky could not exist, had never been seen therein” (347).

Hardy links the gradual accumulation of human thought found in the constellations to the creation of mimetic effect. The sky seems as though it “could not exist” without the projection of human experience. Just as Proctor used analogies drawn from the local to talk about the most distant and unimaginable places, Hardy shows how the feeling of reality is tied to familiar patterns of human thought. Places are rendered inhabitable to the extent that they can be made to conform with previous experience.

_**Two on a Tower**_ is centrally concerned with the connection between previous experience and the ability to imagine new possibilities. The romance of the novel hinges on whether Vivette and Swithin can imagine a life together when Vivette is still legally and psychologically tied to her former husband. His memory threatens to overshadow the affair. Swithin and Vivette meet on a tower that is, itself, a complicated image of memory and forgetting. The tower is erected as a monument to her husband’s grandfather, and stands to recount the legacy that her husband represents. But, after a century of poor upkeep, it falls into disrepair: “Here stood this aspiring piece of masonry, erected as the most conspicuous and ineffaceable reminder of a man that could be thought of; and yet the whole aspect of the memorial betokened forgetfulness” (5). Around the tower, trees count the passage of time by rocking like “inverted pendulums” while their branches “click” together. Insects carve the tower’s walls with intricate patterns: “here and there shade-loving insects had engraved on the mortar patterns of no human style or meaning, but curious and suggestive” (4) – perhaps alluding to the common nineteenth-
century conception of memory as a series of etchings on the mind or brain. The tower gestures to the tension between Vivette’s memory and the novel possibilities that Swithin opens up.

Throughout the novel, the memory of the former husband reappears as a sudden shock. During one of the lovers’ meetings, Swithin puts on the clothes of the former husband – only to later traumatize Vivette as though she had seen an apparition. She tries to write it off as a “trick of the imagination” (187), but these flashes of remembrance threaten to break up the affair. The uncertainty that surrounds the husband’s death further suspends him in the minds of both Vivette and the reader. While probably dead, he continually threatens to return. Even after his death is confirmed, his presence looms large over the text. In one of the novel’s many melodramatic twists, just as she is about to marry Swithin she receives an illustrated newspaper describing her husband’s death by suicide. Even though the newspaper has no real information about the death, the paper produces an illustration of the scene just after the suicide:

The print was one which drew largely on its imagination for its engravings, and it already contained an illustration of the death of Sir Blount Constantine. In this work of art he was represented as standing with his pistol to his mouth, his brains being in the act of flying up to the roof of his chamber. (282)

While the illustration is just sensational fare for its usual audience, Vivette’s experience lends the image additional power. She feels compelled to return to the picture:

The crude realism of the picture, possibly harmless enough in its effect upon others, naturally overpowered and sickened her. By a curious fascination she
would look at it again and again, till every line of the engraver’s performance seemed really a transcript from what had happened. (282)

Vivette’s imagination lends the image credibility where it should only have lurid attraction. From there, it begins to haunt her daily life. As she prepares to marry Swithin, the image of her husband’s body returns like a gothic overlay: “It was as though her first husband had died that moment, and she were keeping an appointment with another in the presence of his corpse” (283). Vivette’s reality becomes a composite of the new possibilities that Swithin raises and her memories of her former husband. In *Two on a Tower*, the kind of creative imagination that astronomy represents is put in tension with memory. Astronomy has the power to take one outside of their immediate surroundings and plunge them into alternative realities, but the ability to materialize those realities comes from memories and experiences that are linked to the world one is trying to escape.

In *Two on a Tower*, then, Hardy focuses on the limits that memories impose on imagination. Memories do not help the characters develop new possibilities. Rather, imagining new experiences in *Two on a Tower* means reliving old ones. Instead of using memories as a vehicle for vivid imagining, the novel makes memory itself vivid. In Proctor’s notes on writing popular science, he counseled writers to make their metaphors unnoticed as much as possible, so that their rhetorical effect would go unnoticed. The reader would feel the illusion of being on Mars or travelling between galaxies without knowing how weakly supported this feeling is. But, in *Two on a Tower*, such figuration is largely absent, and memory and imagination drift in opposite directions. Lady Constantine has to choose between her memory of her husband and her imagined life
with Swithin. Her memory does not make new possibilities seem more real, but rather holds her in the past. In this way, Two on a Tower exposes how weak the imagination is when set against the vividness of past experience.

Hardy seems to agree with Elaine Scarry when she argues that “the imagination is enfeebled and impoverished” (4) when compared with sensed objects, and that verbal art requires connecting imagination to the vividness of the senses. Hardy’s astronomical passages give us insight into how both characters and writers can mobilize past impressions to create more realistic worlds. Clym’s fantasy of an unambitious world or Oak’s view into others’ lives expose the cognitive and rhetorical processes that underlie sustained immersion in an imaginary world. They play out the processes at work when readers become absorbed in a novel. Novelists had to link experience to their fictional worlds in the right way to sustain this absorption. For Hardy, realism succeeded in these conditions because it resonated with the experiences of the reader and the culture at large. Realism created worlds just as imaginary as romance, but it grounded them in conditions familiar to its audience. In “The Science of Fiction,” an essay on the relationship between science and realism, Hardy explained that realism works because it changes to meet the beliefs of the surrounding society. This is important – not because newer beliefs more accurately represent reality – but because newer beliefs compel belief. His essay casts realism as an “illusion” which has to be brought into line with current thinking: “Nothing but the illusion of truth can permanently please, and when the old illusions begin to be penetrated, a more natural magic has to be supplied” (855). Realism exists at one of these transitions between types of illusion. Hardy contends that conditions in the late nineteenth century have called for a closer attention to observation and empiricism,
but Hardy makes this move grudgingly: the “creative fancy has accordingly to give more and more place to realism, that is, to an artificiality distilled from the fruits of closest observation” (855). Realism is not closer to the actual world than any other form of fiction – it is simply another form of artifice grafted onto fiction to sustain readers’ belief in the fictional world.

But Hardy distinguishes his realism from what he calls “copyism” (856), which he considers an overly objective rendering of external reality. Like the “crude realism” of the suicide illustration in *Two on a Tower*, copyism adheres too closely to observation without resonating with the experiences of its audience. It is only in Lady Constantine’s mind that the illustration becomes “a transcript from what had happened” because of her personal involvement. Hardy reminds readers that the image itself is largely inert and “possibly harmless enough in its effect upon others.” But, through its investment with personal or cultural memory, realism becomes absorbing and lifelike.

Hardy’s distinctive prose style bears traces of the author’s desire to connect his fictional worlds with the familiar world of his readers. The novels are laced with borrowings from and allusion to other texts, works of art, or fashionable ideas. Hardy read deeply in late nineteenth-century reviews which provided him with glosses of vast stretches of intellectual and art history. He poured quotation and commentary on heterogeneous topics into his notebooks, which served as sources for allusion and borrowing in the novels. Literary critics have tended to read these references as attempts at erudition and “no more than irritating and embarrassing name-dropping” (qtd. in Byerly, *Realism* 159). Nineteenth-century reviews found the allusive texture of Hardy’s prose confusing. A reviewer for *Return of the Native* complained that “we almost always
find ideas and words more or less belonging to the stratum of contemporary culture, blending with the ideas and words of rough and superstitious ignorance; and the mingling of the two bewilders and confuses the reader” (56). Another attacked *Far From the Madding Crowd* for its “clumsy and inelegant metaphors” (Cox 95). Reviewers felt that the hand of the writer was seen too plainly in these moments, and absorption in the text was broken. In line with Proctor’s advice that metaphors come naturally and “unbidden to the pen,” critics thought Hardy’s connections were too strained.

At the same time, this perceived overreaching speaks to Hardy’s desire to root his fictional worlds in the shared cultural experience of his readers. Just as a sensational illustration can grow more real to Lady Constantine through its resonance with memories, a novel begins to seem more grounded when linked to the larger cultural context. For Hardy, realism meant continuity between the reader’s world and that of the novel. It was not merely an observance of external appearances, but an investment of actual experience into an imagined one. Proctor and popular science writers were only interested in the illusion of realism when it succeeds and sells well, but Hardy’s novels explore the psychic and cultural dynamics at play in this illusion. When Clym Yeobright or Gabriel Oak stare into the sky and imagine other worlds, Hardy describes the processes that go into sustaining prolonged fictional worlds.

Popular science appealed to Hardy because it highlighted the creative issues at stake in realism. Proctor worried that science popularizers would not have the rhetorical skill to make the universe – as it was being discovered by astronomers – seem real to lay readers. In his view, popularization depended on the ability to translate thinly conceived abstractions into inhabitable places that could be seen “in the mind’s eye.” When Hardy
read Proctor, he was not just acquainting himself with the latest theories about the cosmos – he also assumed the mimetic concerns that Proctor and other science popularizers had been exploring. Literary criticism has often noted how the Victorian novel took up a particular scientific theory or discipline, but, as Hardy’s reading of Proctor shows, Victorian science was not just a storehouse of ideas or narratives to be later aestheticized by literary authors. Gillian Beer has provided an excellent understanding of how Hardy’s novels adapted to evolutionary theory, and Pamela Gossin has shown how the cosmological discussions of professional astronomers shaped Hardy’s Wessex universe. Yet, literary critics have overlooked the role popularization had in shaping science before it reached Hardy. Science writers were already concerned with creating their own engaging imaginative worlds. When Hardy wrote his astronomical passages, he was not an intruder in a disciplinary discussion. Rather, he was another writer tackling the same creative anxieties that had occupied others.
“Specialism popularized”: The Move Away from Popularization in George Gissing’s Late Fiction

In George Gissing’s late novel Born in Exile (1892), the hero, Godwin Peak, is an amateur geologist and freelance science writer trying to break into professional science. Gissing inflects his intellectual ambitions through the language of popular geology. At the beginning of the novel, Peak faces a series of personal setbacks which prompt a self-questioning and a desire for escape. He questions himself: “Was he in any respect extraordinary? Were his powers noteworthy?” Almost in direct response, the mood of self-doubt gives way to one of vast geological speculation:

From a point on the high-road he observed a small quarry, so excavated as to present an interesting section; though weary, he could not but turn aside to examine these strata. He knew enough of the geology of the county to recognize the rocks and reflect with understanding upon their position; a fragment in his hand, he sat down to rest for a moment. Then a strange fit of brooding came over him. Escaping from the influences of personality, his imagination wrought back through the eras of geological time, held him in a vision of the infinitely remote, shriveled into insignificance all but the one fact of inconceivable duration…. [H]e passed so wholly under the dominion of that awe which attends a sudden triumph of the pure intellect. (61)

Like Clym Yeobright hoping to escape onto the lunar surface in Return of the Native, scientific vision yields brief respite to the hero’s oppressive life. Everything outside his geological wonder is “shriveled into insignificance” in what he calls a “sudden triumph
of the pure intellect.” But Peak’s imaginary voyage is enabled by his specialized knowledge, as he “knew enough of geology.” Hardy’s characters feel transported through space and time without any reference to astronomy as a discipline, yet, in Gissing’s novels, these experiences become limited to the educated, and mark them as privileged figures. Peak’s vision is triggered by self-conscious reflection on his special intellectual status.

In this chapter, I argue that the distance traveled between Hardy and Gissing represents changes in science and fiction that were occurring at the end of the nineteenth century. Victorian novelists and popular science writers shared sites and audiences during much of the period, but these decayed into different fragments that required new strategies to successfully address. Earlier Victorian realists had large and heterogeneous audiences guaranteed by popular magazines, lending libraries, and the cost of print. In this literary market, novelists shared with popular science literary strategies that engaged readers while challenging their expectations and understanding. As market conditions changed at the end of the century, these literary strategies began to disappear. Realists targeted smaller audiences with a more specialized art. Just as many popular science writers aspired to the prestige of professional science, novelists like Gissing longed for suitable protection from the market that would allow them to produce their specialized craft. Gissing’s late fiction offers a unique window into these changes, as he devoted considerable attention to the fate of writers – both scientific and literary – in novels such as *New Grub Street* (1891), *Born in Exile* (1892), *The Odd Women* (1893), *In the Year of Jubilee* (1894), and *Henry Ryecroft* (1903).
This chapter focuses on the most overtly scientific of these novels, *Born in Exile*, and shows how inadequate the literary strategies of past writers had become in facing this new situation. In the novel, Peak hopes that geology will relieve him of his financial insecurity, class position, and emotional strain. Gissing drew on popular geology that explicitly promises these escapes, but the fantasy falls apart for Peak. His “triumph of the pure intellect” is momentary, and cannot be sustained without the kind of support that professional scientists enjoyed in specialized societies, laboratories, or universities. *Born in Exile* implies that the specialized work of scientists and novelists cannot succeed without protection. This specialization also means abandoning attempts to communicate with the lay public. Peak’s life ends in ruin when he compromises his scientific integrity to blend in with an aristocratic family. Earlier novelists and science popularizers believed that they could accommodate audiences with certain “literary qualities” – as the astronomer Richard Proctor put it. But Peak’s efforts at accommodation put him in hypocritical positions that the novel dissects in detail. The pathos of the novel is that Peak does not have space to pursue his studies without making compromises to laymen. I argue that *Born in Exile* and Gissing’s other late fiction reflect a larger historical change away from accommodation to specialization in the novel.

The “common context” of Late Victorian Literature and Science

In *Darwin’s Metaphor*, Robert Young describes the collapse of what he calls the “common context” of science and literature during the Victorian period. Young locates

15 More recently, historians have complicated Young’s “common context” by showing how this “rich interdisciplinary culture” was never completely stable. It required the skill of writers in this context to address the different concerns of multiple audiences. James Secord has argued that the common context “turned out to be a nostalgic invocation of a predisciplinary past in which everyone spoke the same language” (Victorian Sensation
a strong interdisciplinary culture at the beginning of the century that gradually decays as
the print culture that supported this connection slowly breaks apart. At the start of this
narrative:

There was a common intellectual context (one could put that anachronistically as
"a rich interdisciplinary culture") in the early decades of the nineteenth century in
Britain, and this was reflected in the periodical literature, monographs, lives and
letters, and in a wide range of other writings. (127)

This was typified by texts like Buckland’s Bridgewater Treatise. But Young finds that
by the 1870s and 80s the magazine and book trade that sustained this “rich
interdisciplinary culture” began to be replaced by more specialized journals in science
and cheaper magazines for fiction:

The common intellectual context came to pieces in the 1870s and 1880s, and this
fragmentation was reflected in the development of specialist societies and
periodicals, increasing professionalization, and the growth of general periodicals
of a markedly lower intellectual standard. (136)

Young points to declining circulations of popular early and middle Victorian periodicals
– along with the introduction of specialist science journals in the 1870’s and 80’s – as
evidence of science and literature beginning to drift away from each other\textsuperscript{16}. The middle-brow magazine that combined literature and science struggled to stay afloat when

\textsuperscript{16} Ann Dewitt has recently expanded on Young’s analysis – showing how literature and science engaged in
“boundary work” (Moral Authority 20) where each discipline began to demark separate spheres of activity in the late
nineteenth century.
increased competition saturated the market. With their decline came periodicals that targeted more specific audiences and catered to narrower tastes.

Other changes such as the expansion of syndication rights, the introduction of literary agents as go-betweens for novelists and publishers, and the decline of three-decker novels all contributed to a revolution in late Victorian fiction\(^\text{17}\). The prolific silver fork novelist Ouida summarizes these changes in an article to the *Times* in 1891: “Within even the last ten years the manner of issuing novels has entirely changed in England” (3). Lengthy realist novelists suffered the most in this shift. Syndication favored short fiction since newspapers wanted brief pieces that could be positioned between other articles. Long novels did not suit the small copy available in many daily or weekly papers. When Mudie’s and W.H. Smith’s lending libraries stopped purchasing three-decker novels in 1894, it removed another support from lengthy realist fiction. These forces undercut the commercial viability that had supported the previous novelists.

Gissing was particularly aware of the desperate state of the realist novel. He wrote extensively about past realists and their connection to the literary market. In his book-length study of Dickens, Gissing charted the increasing commercial pressures on realist novels from Walter Scott to his own fiction in the 1890s. With each generation of novelists, Gissing found new demands that made his craft increasingly heroic to attempt. Realist novelists faced financial insecurity and debilitating psychological strain. The two

\(^\text{17}\) Nigel Cross gives a more complete list of changes in *The Common Writer: Life in Nineteenth-Century Grub Street* (Cambridge: Cambridge UP, 1985): “the introduction of syndication, the expansion of the popular press, the founding of the Society of Authors, the rise of the literary agent, the relaxing of mid-Victorian pruderies in fiction, the triumph of the adventure story and of the gossip column” (205). See Richard Salmon’s *The Formation of the Victorian Literary Profession* (Cambridge: Cambridge, 2013) for a more recent account of Victorian attitudes to literary authorship.
problems are woven into each other for Gissing, as he recounts what Dickens must have gone through during serial publication: “however thoroughly assured an author may be that he is doing his best, a falling-off in the sale of his work must needs cause him grave mental disturbance…. He is to write, in short, with an eye steadily fixed upon his publisher’s sale-room” (69). Authors such as Scott and Dickens fascinated Gissing because they represented successful compromises between realist ambition and commercial reality.

But Gissing could only find these successful compromises in nostalgia. His fiction about the contemporary situation portrays more desperate circumstances. In *New Grub Street*, a middling novelist Edward Reardon reacts in horror when a publisher asks for a one volume work, rather than the usual three-decker:

> For anyone in my position,’ said Reardon, ‘how is it possible to abandon the three volumes? It is a question of payment. An author of some repute may live on a yearly three-volume novel—I mean the man who is obliged to sell his book out and out, and who gets from one to two hundred pounds for it. But he would have to produce four one-volume novels to obtain the same income. (165)

His publishers had abandoned the extended form – calling it a “procrustean system” (294). But Reardon finds himself wedded to long forms and unable to produce shorter, more strongly plotted fiction. He had established his reputation as a psychological realist who eschewed sensational plots for thoughtful description. When conditions changed to make his fiction unmarketable, he finds himself unable to make the switch to more
remunerative work. Reardon attempts “a glaringly artificial story with a sensational title” (294), but the experiments ends in depression and failure.

Gissing makes it clear that Reardon’s failure is not one of ignorance or will, but one of temperament. Reardon is aware that he needs to change his literary style to fit the market and he makes several attempts to do so, but Gissing shows that his personality is inextricably linked with unfashionable literature. His passivity in the face of change is built into his characters. To understand Reardon, Gissing asks the reader:

try to imagine a personality wholly unfitted for the rough tumble of the world's labour-market…. Nothing is easier than to condemn a type of character which is unequal to the coarse demands of life as it suits the average man…. You scorn their passivity; but it was their nature and their merit to be passive. (348)

In New Grub Street, Gissing presents authors and readers as locked into particular types. Reardon does not decide to write psychological realism – in fact, he sets out multiple times to write the exact opposite. But his “personality” recoils from unsuccessful attempts to compromise his work, and he returns to impractical forms of fiction.

Much of Gissing’s accomplishment in New Grub Street is to describe the different micro-sociologies of authorship and readers that were emerging toward the end of the nineteenth century, and to show how impossible it was to move between different positions. One hack writes to “the upper middle-class of intellect” (12), while another might appeal to “the young men and women who can just read, but are incapable of sustained attention” (510). This writing complements the limitations of the reader – rather than asking one to transcend them. Reardon’s work fails because it ignores the
situation of the reader, as it demands more focus, education, and time than can be reasonably expected. The novelist’s position comes to resemble that of the professional scientist who requires his audience to have special training to meaningfully participate. For both, popularization is a dubious endeavor. In the previous decades, novelists and popular science writers encouraged readers to imagine other worlds – either of characters or of the natural world. But the disintegration of any “common context” into smaller units begins to undermine this kind of imaginative work.

Reardon’s own approach to reading further emphasizes how specialized literature was becoming in the late nineteenth century. He reads almost exclusively Greek classics with an academic attention to meter, figure, and pronunciation. Reardon is not put off by technical language while he discusses preferred translations and the effects of anacrusis: “He involved himself in the term of pedantry, and with such delight that his eyes gleamed. Having delivered a technical lecture, he began to read in illustration” (148). Gissing combines Reardon’s proclivity for psychological realism with a love for narrow technical discussion. While earlier realist novelists aligned their work with popular science – with its open, non-technical literary strategies – Gissing makes realism appear part of an exclusive and specialized culture.

Popularization, in *New Grub Street*, represents hypocrisy more than an earnest attempt to connect readers to disciplinary knowledge. Amy Reardon leaves her husband, and, in her reaction away from her husband’s ambitious career as a novelist, she takes up the more lucrative angle of science popularization. Her need for quick payoff, though, causes her to fast-track her science education:
She read a good deal of that kind of literature which may be defined as specialism popularised; writing which addresses itself to educated, but not strictly studious, persons…. Thus, for instance, though she could not undertake the volumes of Herbert Spencer, she was intelligently acquainted with the tenor of their contents; and though she had never opened one of Darwin’s books, her knowledge of his main theories and illustrations was respectable. (362)

While her writing can sell, it does so at the expense of actual scientific rigor. Gissing’s critique of Amy’s knowledge parallels earlier attacks by professional scientists on popularizations. Just as Amy passes along the “tenor” of scientists through partial acquaintance with their work, Huxley complained that the author of the popular *Vestiges of the Natural History of Creation* had simply “waded through the lumber room of second-hand scientific furniture” (17). Such reviews would become common in the pages of scientific journals. In a review for *Nature*, the physicist O.J. Lodge called the science popularizer Grant Allen “an amateur who has devoted a few weeks or months to the subject, and acquired a rude smattering of some of its terms” (291). Whereas previous realist novelists aligned their work with popularization, Gissing distances his realist writer from popular science. Reardon connects more closely with the exclusivity and specialization of professional science, as it emerged in laboratories, societies, and universities.

Fredric Jameson has argued that Gissing’s novels reflect the increasing specialization of society, and a break in social vision from earlier novelists like Dickens who could imagine the state as an interlocking social totality. Speaking of Gissing, he concludes: “Naturalist narrative will substitute, for the older totalizing frameworks, a new
classification of narrative material according to specialization, or the division of labor” 
(*Political Unconscious* 190). Jameson has in mind the Taylorization of factory hands when he makes this comment, but the insight can be helpfully extended to describe the specialization of scientific and literary workers and the fragmentation of their audiences. Writers like Gissing increasingly felt themselves compartmentalized, and unable to connect with broad readerships. This drive toward greater specialization and its complementary alienation can help us understand much of the tension in Gissing’s late fiction.

Literary critics have observed that Gissing’s characters are simultaneously drawn to social, sexual and financial success, but unable to make the necessary compromises to achieve what they want within the plot. John Sloan explains that “The condition of ‘oddness,’ like that of exile in *New Grub Street* and *Born in Exile*, involves desire or integration and refusal of the term of incorporation, forming a conflictual nexus” (119). These separate drives for inclusion and specialization rend Gissing’s characters. As Michel Ballard suggests, Gissing “does not view man as a flat figure with clear-cut motives but as a complex knot of conflicting influences each striving for supremacy” (333). At once, heroes like Reardon or Peak long to develop their specialties in literature and science, but also want social acceptance and support. Gissing’s late novels plot how impossible these forces are to reconcile. Earlier novelists in this dissertation believed that realism could accommodate broad audiences – often by borrowing literary strategies from popular science. Gissing’s late novels suggest that such accommodations could not be reached in the 1890’s. In the next section, I turn to *Born in Exile*, a novel that explicitly calls upon the literary strategies of popular science.
Professional Geology in *Born in Exile*

Critics have described *Born in Exile* as an anti-*Bildungsroman*. The story follows Godwin Peak from aspiring naturalist in school to freelance science writer, but Peak’s development never leads to a stable place in society. Simon James explains that:

*Born in Exile* satirizes the expectations generated by the *Bildungsroman*.... Unlike the usual narrative pattern of a social and sexual apprenticeship, followed by useful accommodation into the social structure, the plot of *Born in Exile* is centered on an individual that society is incapable of accommodating. (107)

Peak cultivates status as a scientist, and publishes a controversial but respected article titled “The New Sophistry” that castigates writers who try to combine scientific findings with biblical doctrine. But his work as a scientist pays little and socially isolates him. He longs for the community, class, and financial support of one of his old school peers, Buckland Warricombe. The Warricomes also have access to scientific equipment and specialist periodicals. Gradually, Peak insinuates himself into the Warricome household, but only by concealing his anti-religious views and his authorship of “The New Sophistry.” He falls in love with Sidwell Warricome, Buckland’s sister, and the board is set for a typical Gissing conflict: social, financial, and sexual success hinge on Peak abandoning his principles as a scientist. In a reversal of the bildungsroman, as Peak develops as an individual he becomes more alienated from society.

From Peak’s perspective, though, readers sense a longing for the psychological and market protections of professionalism. While popularizers had to appeal to mass audiences in an increasingly squeezed market, the life of the professional scientist could
appear idyllic. Critics have often noted a utopian strain buried in Gissing’s naturalism. John Sloan comments on what he calls “a Utopianism that points beyond the inadequacies of both the past and the present to a world that has yet to come into being” (151). Simon James explains that “the pastoral and the utopian have a strong imaginative appeal for Gissing” (18). Critics have often concluded that this escape is found in money or culture, but *Born in Exile* locates utopia in the laboratories and disciplinary journals of the professional scientist. Gissing’s late novel demonstrates that the “world that has yet to come into being” is the one that set novelist and scientist as separate professions. The main character of *Born in Exile* comes to resent the compromises involved in communicating with a broad public. His ambitions point to the impossibility of writing to this public as either a novelist or popularizer.

Peak’s ambitions as a scientist are steeped in the Victorian hope that popular geology could open up new worlds through imagination and careful observation. *Born in Exile’s* attitude toward geology bears traces of earlier popularizations of the field which stressed the imaginative work that it took to comprehend the geological past and picture the earth in remote stages of history. In the months just before Gissing composed the novel, he read extensively in the early Victorian science popularizers Charles Lyell and Hugh Miller. Lyell and Miller’s works brought developments in geological theory to a non-specialist public by vividly portraying different geological eras and accompanying theoretical discussion with imaginative speculation. Readers were encouraged to mentally picture the past as a series of scenes – often explicitly framed with dramatic curtain openings and events placed on a stage. Miller’s *The Cruise of the Betsey* (1858), begins with a scene similar to Gissing’s in which idle musing turns into profound
geological journeying. Walking along a coast, Miller notes a formation of lime running into strata of old red sandstone – the realization sending his mind into the past when the rocks formed and began to interact. Miller populates that “incalculably remote period” with prehistoric fish, primitive insects, and plants. More than describing the geological forces that contribute to current rock formations, the passage constructs a reality for the reader’s imagination to inhabit and consider. Historians and literary critics have frequently observed this kind of imaginative travel in popular geology, and consider it to be a constitutive element of the genre. Adelene Buckland argues that “The retrospective ‘procession’ or ‘pagaent’ of a portion of the geological past, a fictional imagining of how the anatomical or palaeontological or geological ‘facts’ … might appear if the geological past was suddenly reconstructed, was a standard mode of geological writing” (204). The text does more than elucidate current geological theory – it recreates a past world for the reader to explore. Ralph O’Connor has referred to this kind of exploration in Miller and Lyell’s works as a form of “virtual tourism” (263).

Where the past reality becomes hard to hold in one’s mind, Miller lapses into metaphysical discussion of the mind’s limits:

A bit of fractured slate, embedded among a mass of rounded pebbles, proves voluble with ideas of a kind almost too large for the mind of man to grasp. The eternity that hath passed is an ocean without a further shore, and a finite conception may in vain attempt to span over it. But from the beach, strewed with wrecks, on which we stand to contemplate it, we see far out towards the cloudy horizon many a dim islet and many a pinnacled rock, the sepulchers of successive eras. (qtd. in O’Connor 5)
Such open-mouthed wonder at the infinities opened by science may seem strained, but for Miller there were high stakes involved in understanding geology. In his massively successful *The Old Red Sandstone*, Miller – once a laborer in a quarry before his success as a popularizer – sets out to working class readers the value of geological study over what he calls “misnamed pleasures” such as drinking or “Chartist meetings” (1). Instead, by exercising the mind on nature, Miller contends that readers will cultivate a moral and intellectual sense that “every charter in the world could not confer upon you, and which all the tyranny or injustice of the world could not withstand” (2). Miller presented the “virtual tourism” of Victorian geology, not as light entertainment, but as cultivation that would direct readers to grander social goals. Throughout the texts, readers are explicitly reminded of the work they are doing. Miller is quick to point out that “the wonders of Geology exercise every faculty of the mind – reason, memory, imagination” (93).

Sir Charles Lyell introduced similar strategies into his popular geology. His work used imaginative reconstructions of past landscapes and philosophical musing about the limitations of the mind to, not only draw readers into a difficult and technical subject, but also to elevate the mind of the reader. In *The Principles of Geology*, Lyell sets out his method:

Thus, although we are mere sojourners on the surface of the planet, chained to a mere point in space, enduring but for a moment of time, the human mind is not only enabled to number worlds beyond the unassisted ken of mortal eye, but to trace the events of indefinite ages before the creation of our race. (197)
Lyell imagines the reader’s mind unchained from the limitations of time and space and allowed to pass into the distant past and the center of the earth. *The Principles of Geology* has been considered a landmark text for its advancing of the theory of uniformitarianism, but for many Victorians the allure of the text was its immersion of the reader in new terrain. Like Miller’s intellectual exercise, Lyell’s *Principles* could have a moral effect as well. Readers observed a change in intellectual tenor after setting the book aside. A reviewer for *The Spectator* argued that:

> There are other investigations which more nearly affect our social happiness than the philosophy of geology, but perhaps there is none which in an indirect manner produce a more wholesome and beneficial effect upon the mind…. After the perusal of Mr. Lyell’s volume, we confess to emotions of humility, to aspirations of the mind, to an elevation of thought, altogether foreign from the ordinary temper of worldly and busy men. (qtd. in Secord 244-5)

Readers returned from the “virtual tourism” of Miller and Lyell’s geology as better people. The scientific journey exercised readers’ imaginations and reoriented them towards higher goals. It is in this sense that James Secord has recently suggested that Victorians read popular science like Lyell’s and Miller’s as conduct books as much as scientific discourses¹⁸. Imagined travel could quiet “misnamed pleasures” and cultivate larger sympathies.

Gissing’s hero in *Born in Exile* hopes for similar cultivation from his brief geological encounter. Like Miller’s dissolute and politically radical hypothetical

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¹⁸ *Visions of Science: Books and readers at the dawn of the Victorian age* (Oxford: 2014)
reader,” Gissing presents Peak as an overly class-conscious agitator who drowns his sense of inferiority in “misnamed pleasures.” As the son of a working class family, Peak feels stung by the privilege that other students have that allows them a social and academic ease he lacks. When Bruno Chilvers, a wealthy but intellectually shallow student, bests Peak in an essay contest at the beginning of the novel, it triggers this feeling and sets him down a path to “ruinous dissoluteness” (60). For Miller, mental cultivation was the only way out of Peak’s resentment. Miller explains – almost directly to Gissing’s hero – that “You are jealous of the upper classes … and there is only one way in which your jealously of them can be well directed. Do not let them get ahead of you in intelligence” (Old Red Sandstone 2). Peak finds in the cross-section of quarry the kind of intellectual victory that early Victorian science writers like Miller and Lyell left for him. Just as Peak is beginning to question his own intelligence, an elevating geological journey separates him from the social problems that plague him and directs him to larger questions.

Yet Peak’s victory is short-lived. Gissing explains that “The amiable frame of mind was not likely to last beyond the first day” (62). Peak finds himself encumbered by demands on his time which prevent him from slipping into the larger geological frame of mind. Between his studies at university and working as a chemist’s assistant, Peak finds his time and energy monopolized by other pursuits. Trying to escape “the influences of personality” in the geological infinite becomes impossible. Peak begins to believe that he needs to secure leisure and wealth in order to more completely follow science. He soon finds a model for the kind of privileged lifestyle he would need in the family of one of his university peers, Buckland Warricome. The Warricomes have, not only the time and
financial security to pursue intellectual interests, but they also have the resources to buy the books and tools necessary to work in a scientific field at the end of the nineteenth century. Their library is filled with geological maps, specimens, and the specialist publications that Peak can only read about through general introductions at university:

Those publications of the Palaeontological Society, one volume of which (a part of Davidson’s superb work on *Brachiopda*) even now lay open within sight – his hand trembled with a desire to touch them! And those maps of the Geological Surveys, British and foreign, how he would have enjoyed a day’s poring over them! (212)

Meanwhile, Peak is only able to work in a desultory fashion at the problems that can be approached with just a simple microscope. With this in mind, he begins to fixate on earning the favor of the Warricombes and marrying into the family.

But this plan involves acting a part and suppressing his larger ambitions until he is in a position to succeed. Where Hugh Miller had represented geology as a path of social mobility, Peak’s geology holds him back. To insinuate himself into the Warriccombe family, he has to pretend to hold more conservative ideas about science, evolution, and religion. Victorian popular science frequently presented a more conservative and religious appearance. While professional scientists took on secular or even openly atheistic attitudes during the nineteenth century, much of popular science was still inflected with religion. Bernard Lightman has shown that many popularizers “shared the goal of providing a religious framework for science in opposition to the secularizing agenda of scientific naturalists” (43). Hugh Miller and Charles Lyell’s popular geology
invoked a divine creator and the spiritual significance of nature at many points. When Peak writes his criticism of religious science writers, he is siding with professional scientists like Huxley or Darwin who challenged the Anglican establishment for cultural authority.

Peak’s intellectual development, then, leads him further away from the success he desires. His radical scientific ideas put him at odds with the family he needs to court. Much of *Born in Exile* follows the mental strain that his hypocrisy put on him. Peak has to learn to carefully self-monitor his expressions and thought: “one must learn to act a part, to control the facial mechanism, to observe and anticipate, even whilst the intellect is spending its sincere energy on subjects unavowed” (84). Like Reardon trying to compose a potboiler, Peak’s camouflaging requires significant energy. Eventually, his authorship of “The New Sophistry” is uncovered by Buckland, and Peak is disgraced.

Gissing makes it clear that Peak’s scientific ambitions are out of reach from the beginning of the novel – in much the same way that Reardon’s novels are doomed to fail. From the beginning these characters are marked by temperament. The Warricombes quickly pick up on this, and discuss his awkward position:

“Such a very unprepossessing young man I never met! He seems to have no breeding whatever”

“Overweighted with brains,” replied her husband; adding to himself, “and by no mean so with money, I fear.” (33)

Even though Peak is exposed near the end of the novel, the Warricombes have already detected falsity at the very beginning. One of Peak’s friends cautions, “You have been
trying to adapt yourself to a world by which you are by nature unfitted” (290). The language of adaption recalls evolutionary theory, with which naturalism has often been aligned. But Gissing’s novels do not allow for adaption. Peak’s attempt to evolve to meet new demands is doomed to failure before it starts. The interest of the novel does not lie in suspense about whether Peak will be discovered, but rather in dissecting the mental torture through which Gissing’s hero passes. As Ballard notes, Gissing’s characters are “a complex knot of conflicting influences.” The novel focuses, then, on the internal conflict presented by the drive for intellectual development at the expense of community and security.

After Peak separates from the Warricombes, Gissing quickly kills off his hero. In *New Grub Street*, Reardon dies in visions of Ithaca, but in *Born in Exile* early-Victorian popular science comes to take that role. Just as Reardon slowly passes away to thoughts of Greece, Peak dies in isolation contemplating rocks: “Sitting down before some interesting strata, I lost myself in something like nirvana, grew so subject to the idea of vastness in geological time that all human desires and purposes shriveled to ridiculous unimportance” (450). In the 1890’s, Peak and Reardon are nostalgic characters that look back to a time when literature and science did not require alienating specialization. They long for the “common context” of an earlier period in which the realist novel and popular science were approachable and even marketable.

In Peak’s final moments, he recedes into the kinds of virtual tourism that popular geology writers had made a vehicle for broadening the appeal of disciplinary science. But Peak’s travels through space and time only isolate him from the society that does not appreciate his intellectual views. In this dissertation, I have shown how realist novelists
relied on the literary strategies of popular science to boost the appeal of the novels – to make readers more receptive to new, challenging content. Dickens could turn to the wonder of natural history displays found in the pages of Hugh Miller’s popular geology to ease readers into the complicated and sometimes dreary plots of his later fiction. For Gissing, professional science socially isolates his characters, and popularization signals a loss of integrity. Literary critics have acknowledged the impossible situation in which Gissing places his characters, but less regarded is how these situations reflect the perils of specialization at the end of the nineteenth century. The “rich interdisciplinary culture” of the Victorian period began to disintegrate during Gissing’s career, and his later novels expose how the connections between popular science and the realist novel fell away.

After Gissing: Scientific Romance and New Intersections for Science and Literature

This dissertation has followed an important relationship between popular science and literature that had emerged and diminished during the Victorian years, but there are many other ways science and literature interacted over the period and continued to interact going forward. One can sense a new connection forming between science and literature in the work of Gissing’s close friend H.G. Wells. While Gissing saw science and literature as the province of separate specialists, Wells believed that both could be combined into fiction with popular appeal. Wells was acquainted with science from within, as he attended Huxley’s Normal School at South Kensington where he took courses on geology, physics, and biology from Huxley himself. But Wells tended to take literary inspiration from more popularized forms of science. When he asked the question, what was “the greatest influence upon your mental growth, what book, what teacher, what experiences?” (Wood Natural History xv), he did not pick Huxley. Instead, he
recalled the first time opening J.G. Wood’s popular *Natural History:* “it does seem that the day I opened that once popular favourite, Wood’s *Natural History,* was in its way exceptional” (xv). This text introduced life as a progression with sensational illustrations that stirred the imagination. For the young Wells this was the first time nature had been ordered by a clear narrative, and this would become one of his central ideas for how science could engage the lay public.

In 1894, Wells wrote an article in *Nature* explaining how science should best be popularized, and narrative played a key part. Wells argued that only a well-crafted story could engage readers from start to finish before gesturing to specific works of short fiction as models for intriguing plot:

> The interest should begin at its opening words, and should rise steadily to its conclusion. The fundamental principles of construction that underlie such stories as Poe’s ‘Murders in the Rue Morgue,’ or Conan Doyle’s ‘Sherlock Holmes’ series, are precisely those that should guide a scientific writer. (301)

Readers should slowly put together the true meaning of the story through a process he called “inductive reading.” Wells found that too many popularizations were mere catalogues that lacked any organization, let alone plot. Finally, he also argued that the content of the popularization should always be “philosophical” rather than “technical” – meaning that methodological discussion should be avoided in favor of ideas with social implications. These strictures became the basis for much of his later short fiction like *The Time Machine* (1895), *The Island of Doctor Moreau* (1896), and *The War of the Worlds* (1898). Wells called these works “scientific romances,” and they became
foundational in the history of science fiction, which is still characterized by strong plotting and a “philosophical” take on science.

Wells eventually abandoned the scientific romance in order to write more traditionally realist novels, but the beginnings of science fiction in the late nineteenth century point to other possible histories of science and literature. The interaction between popular science and realist fiction I chart in this dissertation is just one connection between science and literature that existed during the Victorian period. I argue that Gissing’s pessimism about reaching broader audiences reflects the decline of this particular connection, but this was not the only way science has entered literature. This dissertation has investigated the long overlooked role science popularizers played in forming a “common context” for literature and science. But, as Wells and many other writers can show, science and literature bear many different points of interaction.
Conclusion

Academia has frequently complained that disciplinarity has fenced scholars into esoteric subfields, and limited communication between different fields. The gap between science and literature has been viewed as a particularly deep divide. In the 1950’s, C.P. Snow famously decried what he saw as the fragmentation of the sciences and humanities into “two cultures.” For Snow, the tragedy of this arrangement was that meaningful opportunities for interdisciplinary work were foreclosed by an inability to communicate across the cultural divide:

The clashing point of two subjects, two disciplines, two cultures – of two galaxies, so far as that goes – ought to produce creative chances.... The chances are there now. But they are there, as it were, in a vacuum, because those in the two cultures can’t talk to each other. (16)

In recent years, Snow’s “creative chances” have taken many forms in literary studies. For example, critics have begun using statistical models in big data analyses of literary history and specific texts, while other researchers have attempted to overlay literary works with schemas from evolutionary theory or neuroscience in the field of cognitive approaches to literature. These approaches wear their interdisciplinary methods on their sleeve – often as part of an explicit claim of healing past divides between the humanities and sciences.

Victorianists have also capitalized on this interest in crossing disciplinary lines by presenting the interaction of nineteenth-century British literature and science as a model of pre-disciplinary cooperation. Victorianists have often thought of literature and science
as existing within a single culture that did not have to worry about miscommunication. The relationship between scientists and novelists was, in Beer’s terms, one of “interchange rather than origins and transformation rather than translation” (86). Victorian culture, from this perspective, could stand as a model for exactly the kind of interdisciplinary work that interests more recent scholars. Victorianists have been quick to show that the kinds of cross-disciplinary projects that garner attention today are actually pale shadows of earlier Victorian efforts. In *The Physiology of the Novel*, Nicholas Dames explains that current cognitive approaches to literature are “mitigated by institutional barriers and conflicts of procedure and emphasis between humanistic and scientific disciplines” (3). But Dames argues that Victorian writers had already anticipated this interdisciplinary work, and achieved greater success before researchers became locked in their fields. Cognitive approaches to literature had “already been practiced in Britain, a century earlier” in Dames’ estimate. Vanessa Ryan has made the point more forcefully in the pages of *Critical Inquiry* – noting that “Few scientists today turn to literature in quite the way Victorian scientists did” (411). Interdisciplinary approaches are, in Ryan’s view, “beginning to restore a productive interaction between science and literature” that existed for Victorians, but has since become difficult.

Yet, as I have shown in this dissertation, Victorian studies has misjudged where most cross-disciplinary work was actually happening. Victorianists have focused on places where scientists read and incorporated literature into their specialized work, or passage in literary texts that show where scientific ideas, language, or methods slipped into fiction. But this overlooks the most active area of interdisciplinarity in the period: popular science. It was in the experiences of lay readers coming across popularizations
that science and literature were most frequently combined. Many Victorian sciences were already specialized and opaque to the public by the beginning of the period, and one can sense their separation from the culture by their vitriolic response to popularizations. When Huxley castigated a popularizer such as Lewes for making claims without having “the discipline and knowledge which results from being a worker” in science, he exposed how professionalized the sciences had already become. As Huxley argued, creating new knowledge in Victorian science meant following the training and methods of professional science. Victorianists are correct to point out the “rich interdisciplinary culture” that existed in the nineteenth century, but it was not the work of professional scientists that typified this connection.

Both popular science writers and novelists used accommodating strategies that transformed narrow, complicated, culturally challenging, or any difficult content into accessible and emotionally engaging experiences for readers. I have focused this dissertation on some of the more common strategies novelists and popularizers relied on to accommodate audiences – such as deploying mystery, wonder, surprise, or absorption. But little research in literary criticism has yet addressed popularization or its ways of communicating. Instead, Victorianists continue to imagine direct conversations between high realist novelists and disciplinary scientists. Some critics have begun to push back against this “one culture” model of Victorian science and literature. Gowan Dawson and Anne Dewitt point out that science and literature could often clash, as much as cooperate, with each other. Yet, despite these attempts to complicate the one culture picture, literary criticism has been slow to acknowledge the important role popularizers played in moving
work outside of disciplinary borders. Even more importantly, no work has yet analyzed
the strategies that popularizers employed to make science communicable.

This dissertation hopes to clarify how and why the Victorians became so
interdisciplinary, but it should also draw attention to the important role that
popularization continues to play in moving knowledge beyond specialists. Today,
popularization carries negative connotations of vulgarization or *dumbing down* that can
make it seem like it is beneath the attention of scholars. But much of what specialists
know of other fields comes through popularizations, and not direct contact with those
fields. Ludwig Fleck, a Polish microbiologist and philosopher of science, gave this point
considerable attention in his *Genesis and Development of a Scientific Fact* (1935) – a
work that eventually influenced Thomas Kuhn’s *The Structure of Scientific Revolutions*.

For Fleck, specialists exist in circles devoted to sharing narrow slices of esoteric
knowledge, but this knowledge exists on top of broader understanding derived from
exoteric knowledge. Popularization is the process of moving esoteric knowledge, and
making it part of the greater body of exoteric knowledge. Even specialists, then,
constantly derive knowledge from popular science. Fleck explains:

> Popular science furnishes the major portion of every person’s knowledge. Even
> the most specialized expert owes to it many concepts, many comparisons, and
> even his general viewpoint…. When an economist speaks of the *organism* of the
> economy, or a philosopher of *substance*, or a biologist of the *syncytium*, they use
> each within his own discipline, concepts derived from their fund of popular

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19 Kuhn would write the foreword for the English translation in 1979 (*The Genesis and Development of a Scientific Fact* [U of Chicago: 1979]). Fleck’s analysis of popular science deserves fuller attention than I can give it here.
knowledge. They build up their specialized sciences around these concepts.

Popular science makes these concepts portable, and when they find homes in different disciplines they can alter the development of entire fields. Popularization builds this “fund of popular knowledge” that even specialists use to construct their esoteric studies.

Popular science continues to influence the interdisciplinary endeavors of even recent literary criticism. Cognitive approaches to literature frequently draw from neuroscience published in trade presses and popular science journalism. For example, Lisa Zunshine’s *Why We Read Fiction?* (2007) relies on the psychologist Simon Baron-Cohen’s work on social cognition summarized in *Mindblindness* – which has been distributed for commercial release by the trade imprint of MIT Press. Baron-Cohen’s work has been covered by popular science journalism from *Scientific American* to *The New York Times*. Psychology and neuroscience remain fields that rely heavily on articles in disciplinary journals, but most of Zunshine’s work uses books and other popularizations to represent the latest science. Popular science can serve as a bridge between disciplines in this way because it allows for quick and lucid understandings of dynamic fields like neuroscience. Mastering all the competing theories of social cognition and understanding the methods of neuroscience enough to evaluate available evidence is simply too time-consuming for outside scholars. Popularization makes such interdisciplinarity possible.

Interdisciplinary endeavors like cognitive approaches to literature also tend to receive considerably more attention from the popular press than they do from the
disciplines from which they draw. Jonathan Kramnick finds that the application of evolutionary theory to literary texts has drawn the eyes of a broad readership, “yet for all this attention outside the academy, the movement has not provoked much of a response from within” (316). While many literary critics may be hesitant to accept evolutionary theory as a key for literary interpretation, the popular reception has been little short of breathless praise. When the New York Times covered the approach, they determined it was the “next big thing” to bring back enthusiasm and wonder to moribund English departments increasingly slipping into irrelevance. In this view, evolutionary theory has the power to “rescue literature departments from the malaise that has embraced them over the last decade and a half” (Cohen “The Next Big Thing”). From outside of academia, it is easy to see how general readers might get the impression that evolutionary theory is the next big thing. Books such Brian Boyd’s On the Origin of Stories: Evolution, Cognition, and Fiction and Jonathan Gottschall’s The Storytelling Animal: How Stories Make Us Human enjoy wide releases from commercial presses, and they present popularized versions of evolutionary theory as ways of understanding the complicated narratives of literary fiction. From the top of shelves at Barnes & Noble, they give the sense that scientists and literary critics can – and currently are – working together. The popular press does not just allow specialized content to move between disciplines. It can also offer a more receptive audience for interdisciplinary approaches.

Finally, just as popularization allows the ideas or methods of disciplines to reach wider audiences, specialists are increasingly told to rely on the strategies of popular science writing to make their own prose more understandable to researchers outside their field. Academic writing guides like Helen Sword’s Stylish Academic Writing or Stephen
Pinker’s *The Sense of Style* ask writers to escape “the ironclad rules of their disciplinary discourses” (Sword 19). Good academic writers are told to eliminate jargon, emotionally engage their readers, highlight the vivid and concrete over the theoretical or abstract, and focus on broad payoffs rather than methodology. Victorian popularizers knew the importance of these lessons when trying to sell their science works to commercial publishers. But researchers today relearn these lessons in hope of being understood outside their narrow subfields.

Sword and Pinker contrast technical language from academic journals with what they consider stylish writing from popularizations. The prose of popular science writers often appears as a model for emulation. Both Sword and Pinker give favorable coverage of *Unweaving the Rainbow* -- Richard Dawkins’ attempt to convey the wonder and poetry of science. Much like the science journalism in Dickens’ *Household Words* and *All the Year Round*, Dawkins’ text tries to counter the impression that science leads to disenchantment. For Sword and Pinker, Dawkins’ prose succeeds because of its approachability and its emotional appeal. Just as Victorian popularizers used wonder or mystery to keep readers’ involved, Sword and Pinker assert that Dawkins’ language “provokes curiosity” (Pinker 93) and holds attention. George Henry Lewes wrote extensively in his popular natural history on the importance of curiosity in drawing readers through a text. Sword and Pinker use Dawkins’ work to show how that same approach can help academic writing reach a wider audience. The literary strategies of popular science writers reemerge as ways of mitigating the effects of increasing disciplinarity.
If science and literature have receded into two cultures as Snow argued, then popularization has tried to reconnect the two halves. The popular press has provided ideas, audiences, and even the prose for interdisciplinary work. But popularization is not simply a medium through which content flows. Rather, popularization creates its own culture next to the two cultures of science and literature. As I have shown, popular science writers have their own unique objectives that are separate from the scientific disciplines from which their content is drawn. To write popular science is not simply to dumb-down, but to accommodate new audiences that bring different goals to science than those of specialists. If current interdisciplinary work continues to rely on popularization, it needs to understand the unique dynamics involved in accommodating these new audiences. Popularization involves more than simplification. To reach wider audiences, popularizers transform science into an engaging experience that works orthogonal to the intentions of the professional scientists. Interdisciplinary work is not only subtraction of technical content, then – it is also the addition of the literary experiences that this dissertation has examined. I hope this dissertation opens further investigation into the role that popularization continues to play in interdisciplinary work. I have highlighted one particular historical moment in which popular science encouraged cross-disciplinary conversation, but more work needs to be done to give a more complete picture. As popularization plays such a key role in current and future interdisciplinary projects, English scholarship should begin to address the uniquely literary strategies that underlie successful popularization. And, even beyond that, scholars will need to ask whether popularization is an effective medium of communication between disciplines. These questions are beyond the scope of my project, but I believe that the issues raised in this
dissertation point beyond the Victorian period to the current intersection of the humanities and sciences.
Bibliography


Ballard, Michael. "Born in Exile as an Organic Study in Behavior and Motivation."


---. *Realism, Representation, and the Arts in Nineteenth-century Literature*. Cambridge:


------. *Sea-side Studies at Ilfracombe, Tenby, the Scilly Isles, and Jersey*. Edinburgh: Blackwood, 1858. Print.


Ryan, Vanessa L. "Living in Duplicate: Victorian Science and Literature Today."


------. "PORTRAITS OF SCIENCE: Quick and Magical Shaper of Science."


