Gendering Scientific Discourse from 1790-1830: Erasmus Darwin, Thomas Beddoes, Maria Edgeworth, and Jane Marcet

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by

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ABSTRACT
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MARIA EDGEWORTH,
AND JANE MARCET

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This dissertation project operates on the belief that the democratic, everyday pursuits of science were at least as significant scientifically, and perhaps even more important culturally, as the elite, highly speculative work done by the gentlemen scientists of the Romantic Age (1790-1830). It focuses upon the literary works, careers, and discourse of Erasmus Darwin, Thomas Beddoes, Maria Edgeworth, and Jane Marcet, tracing the role that gender played in assigning recognition and authority in the scientific community.

Operating in a public sphere that favored the scientific discoveries of male gentlemen scientists, boundary crossing had to occur decisively, but quietly through a method of subversion and containment. Women had to enter the scientific conversation through traditionally unscientific genres and anonymous or apologetic prefaces, which usually conveyed intent to share science with other women. I explore the problem they all faced, in trying to recount science to a broader audience; I document how and why they responded to each other and toward the changing public sphere's positioning of science. For these reasons, the Romantic Age's collaboratives of gentlemen scientists significantly influenced how their popularizing contemporaries, specifically women, responded to science and how, as a result, elitism further diversified the pursuit of science.

Each author's presentation of expertise demonstrates the role of popular writings on the sciences in redefining scientific authority. These authors are representative of the two-sided struggle to make science more elite and more popular; and regardless of their allegiance in this struggle, each attempted to make science more accessible. This dissertation explores the tenuous relationship between the professions of authorship and science, highlighting the communication of both scientific discoveries and applications through writing as another facet of scientific practice. Elite gentlemen scientists' perceptions of others as authors reflect their own self-fashioning of the professional identity of scientific writer, and popularizers of science synthesized scientific information as they learned it themselves, thereby forging a new worldview.

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This dissertation is dedicated in memory of Phyllis Hanrahan Gibson.

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INTRODUCTION

This dissertation project operates on the belief that the democratic, everyday pursuits of science were at least as significant scientifically, and perhaps even more important culturally, as the elite, highly speculative work done by the gentlemen-scientists of the Romantic Age (1790-1830). It focuses upon the literary works, careers, and discourse of Erasmus Darwin, Thomas Beddoes, Maria Edgeworth, and Jane Marcet, tracing the role that gender played in assigning recognition and authority in the scientific community.

Operating in a public sphere that favored the scientific discoveries of male gentlemen-scientists, boundary crossing had to occur decisively, but quietly. Women had to enter the scientific conversation through traditionally unscientific genres and anonymous or apologetic prefaces, which usually conveyed intent to share science with other women. I explore the problem both men and women faced, in trying to recount science to a broader audience; I document how and why they responded to each other and toward the changing public sphere's positioning of science. For these reasons, the Romantic Age's collaboratives of gentlemen-scientists significantly influenced and were influenced by how their popularizing contemporaries, specifically women, responded to science and how, as a result, elitism further diversified the pursuit of science.

In these four case studies, each author's presentation of expertise demonstrates the role of popular writings on the sciences in redefining scientific authority. These authors are representative of the two-sided struggle to make science more elite and more popular; and regardless of their allegiance in this struggle, each attempted to make science more accessible. This dissertation explores the tenuous relationship between the professions of authorship and science, highlighting the communication of both scientific discoveries and applications through writing as another facet of scientific practice. Elite gentlemen-scientists' perceptions of others as authors reflect their own self-fashioning of the professional identity of scientific writer, and popularizers of science synthesized scientific information as they learned it themselves, thereby forging a new worldview and space for scientific discussion.

As Romanticist scholars of the history of science, we usually consider the years 1830-1880 as the space in British history in which the impact of the sciences produced the most profound modifications in our conceptions of the world. Yet more and more attention is being devoted to the very rich and complex situation that characterizes the Romantic Age. The time period from 1790-1830 was consumed with scientists who strongly aspired to a global, yet profound vision of knowledge. This aspiration was fueled by the understanding that scientific knowledge should not only be learned, but shared with others. This educative purpose of science drove the great thinkers of the Romantic Age to consider how to communicate best with others, who were both part of the collaboratives of elite gentlemen-scientists and the democratic work of women to include others in the conversation on science. This aspiration with purpose was supported by the firm belief that observing nature gives access to understand ourselves, too.

The fundamental feature of what is scholarly defined as the eighteenth-century conception of science is the thesis that the microcosm reflects the macrocosm, and vice-versa, thereby fueling a push to connect the various known aspects of the world to each other. This activity is represented in the work of natural philosophers, who were precursors to what we recognize as modern scientists. The above thesis derives from the concepts of the eighteenth century German theory of *Naturphilosophie*, which was very speculative and lofty in nature. This is the view of those individuals who, though convinced that science must be knowledge of nature as a whole, did not wish to assign value to mere facts and observations, unless they could represent a grander cosmic theory about the nature of the universe. These individuals were usually male, involved in one or more modern disciplines of science, and sought to keep the work of determining the value of facts and observations in the hands of an elite, male subset of the population.

The primary goal of this project is to extend scholarly knowledge about the Romantic Age's distinctive divide between the practical and theoretical pursuits of knowledge and the widespread application of scientific rationality for individual and collective character growth that was present in poetry, novels, and textbooks of the time period. After the work of gathering scientific knowledge and making of theoretical considerations by the natural philosophers of the Enlightenment, there was a surplus of knowledge circulated in written literary works, under the banner of natural philosophy. Natural philosophy, of course, was the nearest thing to science that the late eighteenth and early nineteenth century had. I am tracing back a lineage that is known to modern scientists as theoretical and applied science, but I am looking at applied science for its practical applications and therefore will use that term instead. I define practical science as the work done by individuals to indicate a relevant application in a particularly innovative approach to apply scientific knowledge and rationality toward improving the material world; whereas theoretical science usually appears with the intent to investigate the causes of certain observable effects and may or may not be validated by appropriate experimental results. The distinction can also be thought of as practical science is intuitive applications of knowledge that make common sense to scientific minds through eureka-like, brilliant, inventive methods, and theoretical science is discursive because it takes human computation and mental power to figure out the framework of scientific knowledge, where the latter is usually a more efficient and accurate means to systemically approach the discovery of new knowledge. The main thread of this project follows a twofold goal. I aim to show how applied science and its expression in literature worked to open up knowledge to be more inclusive, especially of women. But even so, I also aim to prove that the gentleman-scientist, while in part participating in this work of inclusion through theoretical science, also pushed against it by attempting to keep science more exclusive. Therefore, I will look at the figure of the gentleman-scientist's role in the stratification of theoretical science. Understanding these contexts makes it possible to read Romantic texts, especially those that deal with the interaction between the elite gentleman-scientist and the everyday, rational, intelligent individual, in refreshingly new ways.

I use four lenses to focus my study. The first is *The Temple of Nature*, the last completed work of Erasmus Darwin, who was one of the period's most eccentric gentlemen-scientists that struggled to keep science in the hands of the elite and gain more scientific knowledge simultaneously. Moreover, Desmond King-Hele said of Darwin's "unequalled achievement" that Darwin's wide swath of interests in geology, meteorology, medicine, botany, and many more disciplines led him to characteristically realize the great value that such knowledge would bring. My second focusing lens is the connective collaboration within the Lunar Society of Birmingham. Erasmus Darwin, as well as ten to fifteen other members, joined in the project of scientific professionalization that ensued in the late eighteenth century as modern science began to invent itself and as the profession of practical scientists, or engineers, was trying to find an economically viable and secure footing in a changing world. The third lens considers the discussion of scientific knowledge and production of rationality through a woman's perspective, which I considered through Maria Edgeworth as the author of *Belinda* and the titular character, who both have very close associations with the realm of elitist and everyday science. This close connection of lived experience between author and main character ultimately allows me to discuss the public role and private lived experience of people of scientific rationality in the culture of the Romantic Age. The fourth analyzes the work of Jane Marcet's *Conversations on Chemistry* and her act of democratizing science in order for scientific knowledge and the practice of rationality to become accessible to individuals of all literate classes and genders.

This is not a biography of Erasmus Darwin, a close reading of the collaborative work of the Lunar Society of Birmingham, or a comparison of Edgeworth's and Marcet's rationalization of science and participation in the discernment of scientific knowledge as portrayed in their written works, though I do adhere to the biographical, textual, comparative, and geographic matters that informed each of these individual aspects because I believe that historical moment, place, and individual characteristics inform well any reading of Romantic authors.[1] It is, instead, an attempt to reveal and explore the

[1] Six months after the Fall of the Bastille, Erasmus Darwin wrote to his Lunar Society friend, the great Scottish engineer, James Watt, to celebrate and frame his opinion on the matter: "Do you not congratulate your grand-children on the dawn of universal liberty? I feel myself becoming all French both in chemistry and politics" (Darwin, Letters, 19 Jan. 1790, 200). The significance of this event was not lost on those living in the time period as French chemist Antoine Lavoisier wrote to Benjamin Franklin to deliver a concise, witty account of his chemical revolution's connection with politics: "After you have heard all that has happened in chemistry, I must now tell you about our political revolution. We think that all is now settled, and there is no chance of returning to the ancient order" (qtd. Cohen 283). And in 1793, Joseph Priestley of the Lunar Society of Birmingham declared in a letter to the Jacobin leaders of the French

ubiquitous play of elitist theoretical science and the everyday practical science that was exposed by these authors to exist in British culture during the Romantic Age, in order to show the sociological interworking of the career of science and the practice of rationality on the written works of these particular individuals. By providing a more precise picture of the integration of science into literary works produced during this time period, I hope to offer new reading methods to other scholars in this field. I particularly direct my studies to any scholar interested in this period, but especially to those interested in the public sphere, scientific professionalism, nineteenth-century science in other genres, and the form of educating others on science.

Because this dissertation crosses several disciplinary boundaries, the scholarly theories and practices which I have drawn from are not only wide-ranging, but also diverse in their perspectives.[2] I loosely identify my work with the new historicist response, through the constructivist notions of the history of science which maintain that scientific knowledge is, at least in part, culture-based and contingent on the society it participated in. The work of Jürgen Habermas and Romanticists — such as Jonathan

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Revolution that "with respect to philosophy, and especially chemistry . . . the age of mystery and deception is now over, and rational and useful science has taken place of solemn pretensions, absurd systems, and idle tricks" (Priestley, Works, Vol. 21, 88). This bold declaration of the victory of science was made by Priestley, but belonged to the majority of his generation.

[2] The decades of the 1960s and 1970s saw a pivot in the discussions of revolutions in science, particularly in light of Thomas S. Kuhn's *The Structure of Scientific Revolution* (Chicago: U of Chicago P, 1962). For a response to Kuhn's analysis, see the work of Imre Lakatos and Alan Musgrave (eds.) *Criticism and the Growth of Knowledge* (Cambridge: U of Cambridge P, 1970), comprised of reactions to Kuhn's thesis of social dynamics of scientific change, which was the same criticism dealt to Erasmus and Charles Darwin — that their theories were right, but their criticism of humankind's involvement in evolution was not. This created a split due to Kuhn's controversial use of what he calls "normal science" and the technical terms he uses to raise doubts about the proprietary nature of using the concept revolution in relation to scientific change. The secondary literature, as a result, on the philosophy, history, and literature of science has become saturated with books and articles using the word "revolution" or demarcating certain "ages" as the pivot point in scientific knowledge, which is an interesting yet worthless quest as those who participate in science are always modifying and honing its scope. Thus, the quest of my study is to determine who was involved in the recording and dissemination of scientific knowledge and how that was accomplished across many written genres over the course of the Romantic Age.

Klancher, James Chandler, Anne Mellor, Mitzi Myers, Kevin Goodman, M. H. Abrams, Martin Priestman, Jessica Riskin, Alan Richardson, Jerome McGann, Jonathan Klancher, Emily Hodgson Anderson, Deborah Weiss, Greg Myers, and Nicole M. Wright. — on the socialization of the scientific professions and democratization of scientific knowledge as well as scholars in the area of history of science — such as Robert Merton, Bruno Latour, Thomas Kuhn, and Jan Golinski —have been indispensable to my project. I am especially grateful for Martin Priestman's *Romantic Circles*'s version of *The Temple of Nature* and Saba Bahar's research into the unique qualities of Genevan education.

I am cognizant of the peril of basing generalizations about education, knowledge, and individuals on the importance of a localized, historical moment upon the evidence from the lives of a few notable individuals that represent the time period. Michel de Certeau is correct to caution that "each individual is a locus in which an incoherent (and often contradictory) plurality of . . . relational determinations interact" (de Certeau xi). Erasmus Darwin's life and career as a scientist and a poet are proof of this. Yet if there was ever an individual who provided a locus for the gentleman-scientist for its study, then it was this man and the work he inspired and encouraged through the Lunar Society of Birmingham as well as the Derby Philosophical Society. My goal, nevertheless, has been to attempt forming a structural thought process within which to better understand how science was both increasingly more elite and more accessible during the Romantic Age through the works of Erasmus Darwin, a select few of the members of the Lunar Society, Maria Edgeworth, and Jane Marcet.

I have also realized it is necessary to make somewhat arbitrary and idiosyncratic selections of my materials and interpretative strategies, but I have endeavored to focus upon points of contact and similarity between real-world occupations of theoretical and practical sciences and consider them as competing educational strategies that worked themselves out through a back-and-forth conversation between gentlemen-scientists and new players, mainly women, who worked to democratize science subversively. Thus, feminist theory has been influential in a general way to my project. The collective work of feminist thinkers on patriarchy and the construction of difference has informed my consideration of the politics involved, especially in my consideration of why and how Romantic authors needed to invent their differences and play off them in their work to educate others on scientific knowledge. In particular, Hélène Cixous has influenced my thinking and method with her challenge in "The Laugh of the Medusa," where she states that women must "stand up against separation" (Cixous 882). In that essay, Cixous also exhorts women "to write through their bodies . . . [and to] invent the impregnable language that will wreck partition, classes, and rhetorics, regulations and codes" (Cixous 886). While I do not believe I have the capacity to invent in this dissertation a new scholarly language to discuss these issues better than the scholars who have come before me, I have tried to recognize where my engagement from the text stands in relation to the work of others and read the works of these individuals clearly and with intent to give them new binaries through the elitist and populist work of theoretical and practical sciences, respectively. For, ultimately, my investigation comes from a deep passion for the well-guided and/or misguided attempts that individuals make to find purpose and pleasure in a world that was shifting under their feet with every new scientific discovery. I find this story crafted between the gentlemen-scientists and those who knew enough to educate others fascinating because it shows the bifurcated ideology that drives every written work, exemplifying the rationality that urges thought and understanding forward.

In the past, science had been a spectacle for those who did not understand it. Now, science was becoming a space reserved for the gentleman-scientist who had wisdom enough to moderate the world around him. The gentleman-scientist was a conduit for observing, recognizing, and pointing out specific aspects of science that were of use. I am endowing the term "gentleman-scientist" with a rich history stemming from the early modern term of the natural philosopher. Adam Smith's *Wealth of Nations* suggests that a natural philosopher or a

> meer man of speculation [is] one of these people whose trade it is, not to do any thing but to observe every thing, and who are upon that account capable of combining together the powers of the most opposite and distant objects. To apply in the most advantageous manner those powers, which are already known and which have already been applyed to a particular purpose, does not exceed the capacity of an ingenious artist. But to think of the application of new powers, which are altogether unknown, and which have never before been applied to any similar purpose, belongs to those only who have a greater range of thought and more extensive views of things than naturally fall to the share of a meer artist. (Smith 337-38)[3]

Inventive, innovative activity involves more creative insight in order to improve upon the inventions of illustrious men. Smith comments that "[i]t was a real philosopher only who could invent the fire engine [Matthew Boulton and James Watt's steam engine], and first form the idea of producing so great an effect, by a power in nature which had never before been thought of . . . . It must have been a philosopher who, in the same manner

[3] In his "History of Astronomy," Smith defines philosophy as ". . . the science of the connecting principles of nature . . . as in those sounds, which to the greater part of men seem perfectly agreeable to measure and harmony, the nicer ear of a musician will discover a want, both of the most exact time, and of the most exact time, and of the most perfect coincidence: so the more practised thought of a philosopher, who has spent his whole life in the study of the connecting principles of nature, will often feel an interval betwixt two objects, which, to more careless observers, seem very strictly conjoined" (Smith 19-20). An early draft of Smith's text was used here as reference in order to sketch out Smith's early concerns of science because it provided a much more simple explanation than the published draft that was cited above.

first invented, those now common and therefore disregarded, machines, wind and water mills" (Smith 338). The direct address to the importance of creativity in these statements by Smith inspired Coleridge and Wordsworth's insistence that creative acts deliver truth to others. Ultimately, the capacity of these scientists to invent is conceptually meaningful only in relation to the complexity of the existing technology and the degree of creative imagination required in order for "breakthroughs" to occur. As technology became increasingly complex, however, and as solutions to problems began to require knowledge and experience of a variety of subject areas and disciplines, the inventors had to be exposed to more and more ideas, which is something reminiscent of Coleridge's notes in the *Biographia Literaria*. And where Smith outlined what principles came to characterize the Lunar Society and its members — their creative applications of science to the known world — it became apparent that these men were becoming the new moderators of truth, taking action to shape their world.

This type of man became best epitomized by Joseph Priestley in the Lunar Society of Birmingham. Before Joseph Priestley moved to Birmingham in the 1780s, he lectured at one of the more prominent dissenting academies, Warrington Academy. There Priestley made a name for himself, published several education textbooks, and performed his experiments on "dephlogisticated air" — experiments which led to Antoine Lavoisier's discovery of oxygen (Priestley 342, 345).[4] Priestley's time at Warrington

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[4] Joseph Priestley. "The History and Present State of Electricity, with Original Experiments, 1767," *Works* XXV. For greater details on Priestley's work, see "Preface and Dedication to Heads of Lectures on a Course of Experimental Philosophy, 1794," *Works* XXV, 385-89; "A Syllabus of a Course of Lectures on the Study of History," *Miscellaneous Observations Relating to Education*, London, Joseph Johnson, 1778, 230-34.

spurred his penchant for radicalizing scientific education, encouraging him to take his ideas to the masses.

Even before moving to Birmingham, Priestley attended the monthly meetings of the Lunar Society at Matthew Boulton's Soho House. In these meetings, Boulton and James Watt discussed the invention and industrialization of their steam engine; Erasmus Darwin, William Small, and Thomas Beddoes contemplated the application of certain botanical extracts in the refinement of their medical practices; Josiah Wedgwood asked for help to improve his pottery and porcelain production, perhaps gaining insight from James Keir who was a chemist and geologist; while Richard Lovell Edgeworth designed new inventions for unloading cargo ships and began to think how to educate the world from the knowledge contained within their small society. This society, which never grew to be more than fourteen members at its height in the 1780s, began in the late 1750s with just Boulton and Darwin who were connected through familial associations as Darwin was Boulton's mother's family doctor and this association quickly grew with the introduction of the charismatic, well-connected, Scottish doctor, William Small.

In the early stages of the Lunar Society, the group of scientists worked as a sounding board for innovation by providing opportunity for conversations on the improvement of the Watt Steam Engine and the Josiah Wedgwood and Sons' pottery company. With assistance from this group, Wedgwood created a thermometer to measure the heat in his blast furnaces so that he could create fine porcelain more reliably and consistently. These artefacts, and the written documents and drawings of them, are the only remnants of a thriving scientific culture that sought to bring into the world a new way to understand it. Understanding the world has long been contemplated by the greatest minds, these entrepreneurs of scientific application set out to harness the power of understanding the world, which through scientific collaboration became physically and practically actualized as never before.

However, the conceptualization of the term "scientist" is anachronistic to the Romantic Age, because the first printed use of the term was not until 1834 by William Whewell. In the March 1834 *Quarterly Review*, Whewell states that:

> Science . . . loses all traces of unity. A curious illustration of this result may be observed in the want of any name by which we can designate the students of the knowledge of the material world collectively. We are informed that this difficulty was felt very oppressively by the members of the British Association for the Advancement of Science, at their meetings . . . in the last three summers . . . *Philosophers* was felt to be too wide and too loft a term . . . *savans* was rather assuming . . . some ingenious gentleman proposed that, by analogy with *artist*, they might form *scientist*, and added that there could be no scruple in making free with this termination. (59)

Before Whewell, there was a conglomeration of all fields of science into the terms savants or cultivators or natural philosophers, but it was not until Whewell, the Cambridge University historian and philosopher of science and scientist of geology and mineralogy in his own right, coined the term that retrospectively deemed individuals, like Leonardo Da Vinci and Michael Faraday, seekers of the truth and therefore scientists.[5] However, I assert that, looking back for a distinction between the scientific work of various individuals, the true lineage stems from the scientist tradition, as "scientist" was no longer a term reserved for men of the leisurely gentleman class. Now the term, and

[5] The years from 1790-1830 are fraught with cultural change, competition, and incentive to produce, leading to the need to make money off the scientific discoveries and cultural changes that occurred during this time period. Christopher Macleod asserts that authors of the Romantic Age believed that "*through creativity we can directly access the truth*" (403).

responsibilities associated with it, of a scientist provided opportunity and wealth through ingenuity and hard work to anyone who was willing to dedicate his or her life to science.

This lineage of scientists is complex because gentlemen-scientists experimented with many types of science, blending and mixing Whewell's separated disciplines of chemistry with physics, biology, anatomy, and botany; altogether, this made it impossible to distinguish a chemist from a physicist, blurring the line between where chemistry ended and biology began. However, this was a critical point in the establishment of practical scientists, that is, engineers, as lived out through the individual members of the Lunar Society of Birmingham. Armed with the desire to make the world more perfect than the situations they were born into, but with acute recognition that they could never make the world around them completely perfect, these practical scientists sought out correcting the errors of the natural world, admitting that they would always be wrong, but striving always to be less wrong than before. This cultural memory carried with it an idea that others had done what they were doing before, and they were merely uncovering old knowledge or reapplying it in new ways; thus, there was no need to reinvent the wheel, but rather to improve what they had in front of them through the application of knowledge, linear thought, and the need to make the world less complicated.

This led to new discoveries that made possible the windmills in Holland that claimed land from water, steam engines converted water to energy, more efficient blast furnaces, and the perfect combination of circumstances for scientific knowledge to increase in leaps and bounds, rather than incrementally over a long period of time as had hallmarked the previous five hundred years' association with science.[6] And given the

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[6] For additional context of science's growth and development, see John Gribbin's *The Scientists: A History of Science Told Through the Lives of its Greatest Inventors*. New York: Random House, 2002.

state of scientific knowledge at the end of the eighteenth century, these practical scientists deserve credit for trying to come up with scientific explanations and gathering the needed information to build foundations and, ultimately, lay the groundwork necessary for the individual and the family's place in the burgeoning Industrial Revolution. However, it is curious that, through analysis of Maria Edgeworth's perspective of the father-figure as scientist and the family as participants in a rational endeavour to understand the world, she makes the project belong to the hero of the novel, perhaps suggesting that even a "man of genius" can be led astray by faulty ideology.

By the 1790s, though, the work of gentlemen-scientists to classify and recognize their observations into refined knowledge of science was beginning to require more individuals to contextualize the new discoveries. In short, there was more work than the speculative, leisurely, elite gentlemen-scientists could keep up with in their scientific societies. Science had more to offer than the markedly speculative "philosophy of nature" could encompass. However, in terms of the political economy of the idea of science at this time, the "philosophy of nature" still represented a powerful factor of aggregation in the process of renewal of scientific research in Britain during this time; yet it is also during this time, however, that many of the speculative aspects of science were removed from consideration by the scientific community and a strict adherence to the observation of facts became more appreciated by the greater scientific community. This growth of scientific knowledge, by means of technological advances that made it more accessible for Humphry Davy to procure alkali and alkaline metals from the Earth and for William Herschel to name seven moons of Saturn and four more of Uranus, required more participants in the conversations on scientific knowledge. This new discipline of science demanded more insight from a broader, more democratic group of scientists. However, during the first few years of the Romantic Age, certain individuals continue to feel the need to provide a common end to the various lines of scientific research. This is the realm of the gentleman-scientist.

The Romantic pursuit of science gave insight into the world's spaces, people, and ideas. One way these ideas came together was through the economic feasibility to transform scientific practices into financial gains. Looking backwards from the Romantic Age, we find that science in the Enlightenment was focused on gaining knowledge broadly in pursuit of natural philosophy and also for particular application. In pursuit of knowledge toward particular applications, many task-oriented scientists began to distinguish themselves. Metallurgists were interested in science's insight on how to make better metals; pharmacists and doctors were intrigued by what science offered for the growth of medical knowledge; geologists were interested in the effects of mineralogy on humans, animals, and the natural world around them. Then, as the Industrial Revolution gained momentum, the need for new practical applications encouraged the division of the sciences from their pursuits of knowledge so that scientific knowledge could be redistributed in the form of practical applications in order to engineer new inventions and make technical leaps and bounds. In this need, there was space for the gentleman to capitalize on his scientific understanding of the world. Because the gentleman-scientist was, by curiosity, drawn to these experiments, the practical application of scientific exploration gave a justified reason to indulge curiosity and experiment with purpose. These are what I will call the practical scientists because they cared for the pursuit of knowledge if it had tangible usefulness to offer the growing understanding of the intersection of science and humanity.

The Romantic conception of science had in fact pointed to the need of a global, systemic, and solidly picture of knowledge of nature as knowledge of what reflects humankind; at the same time, the Romantic conception of science had recognized the importance of the non-preconceived observation of phenomena, which can only be made by uninitiated members of the greater community. These uninitiated members are valuable to the scientific community because they bring new perspective to the domain of sciences. These individuals brought in new questions, giving the gentlemen-scientists, who had for so long perceived of the world in a certain way, new fresh perspectives of the world around them. And for the introduction of women to the conversation of science, these women, who were intellectual anomalies of their time, replied to questions with more insight and new perspective that formulated new ways of looking at the world, which ultimately required men to respond to women's scientific work.[7] Because of its

[7] The best example of this is Caroline Herschel. Current, popular interpretations of scientific discovery, such as Richard Holmes's *The Age of Wonder,* explain that science is reserved for the great wonderers of the world that had time to ponder deeply the nature of the universe, which are visible and thus in the realm of men, not women. In fact, Holmes tells the story of siblings William and Caroline Herschel and their quest to document the moon and stars, but notes that while Caroline made discoveries of two comets, Dr. Nevil Maskelyne, a fellow of the Royal Society and astronomer royal, both recognized her as the "first woman in the history of the world" to make such a discovery and feared that her find would propel her into outer space alongside the comets and away from the terrestrially-bound scientific community that he represented (qtd. in Holmes, "The Royal Society's Lost Women Scientists"). In December 1788, Maskelyne noted, "I hope you, dear Miss Caroline, for the benefit of terrestrial astronomy, will not think of taking such a flight, at least till your friends are ready to accompany you" (qtd. in Holmes, "The Royal Society's Lost Women Scientists"). This harsh commentary, delivered somewhat jokingly, conveyed the sharp truth that male scientists were the only ones who could confirm what she had seen, and thereby validate her claim. Even her own brother William Herschel annotated her paper, "An Account of a New Comet, in a letter from Miss Caroline Herschel to Mr Charles Blagden MD, Secretary to the Royal Society," that announced the discovery of her first comet in August 1786 with the comment that "[s]ince my sister's observations were made by moonlight, twilight, hazy weather, and very near the horizon, it would not be surprising if a mistake had been made" (qtd. in Holmes, "The Royal Society's Lost Women Scientists"). Even Caroline's own brother and fellow astronomer cast doubt over her power to observe and recognize what she saw. The Royal Society only perpetuated William's sentiment throughout its tenure as England's most prestigious scientific organization.

ability to make women invisible, science became close-minded and closed to outsiders because gentlemen-scientists saw language as power, and the act of creating a scientific discourse only required these men to plunder meaning from language in order to provide space for science to answer all of humankind's questions. The Romantics wanted answers to the questions that spurred on the advent of scientific exploration in the nineteenth century, but their motivations were diverse.

The diverse reasons for such an interest in science are therefore numerous and evidently apparent to Romanticists. These reasons certainly cannot be reduced to sheer learning or to mere interest in the opinions on science that developed in the years of greatest creativity for all Romantic thinkers. This was a vision based both on the awareness of the alienating power of scientific knowledge and on the firm belief that only systematic observation, through the scientific method and free from all prejudices, could increase the spread and awareness of knowledge. The awareness of the importance of knowledge for the sake of power and of the great responsibility of scientists was affirmed by the Royal Society and other scientific societies. This awareness did not merely bring the work of gentlemen-scientists to the forefront, but rather it led to the foundation of societies and organizations aimed at promoting and spreading science, which was no longer presented as the exclusive prerogative of a narrow, elite community. Many, or even most scientists active in the Romantic Age, had a profound respect for nature, meaning that being consistent in observation and research plus in the development and definition of theoretical definition of new disciplines. These scientists engaged in a work that illustrates the Romantic Age to be the starting point of many scientific developments that occurred throughout the nineteenth, twentieth, and twenty-first centuries.

Science in the Romantic Age thrived due to the sheer pleasure and sparked curiosity that came from being in social and working relationships with other thoughtful individuals. Because of the small population size of Britain at the time and the even smaller intelligentsia, it can be assumed that, if the intellectual participants did not know every other educated individual personally, then this elite group at least knew of each other. This type of synergy can be created by a combination of factors and thought patterns. The Lunar Society of Birmingham was one of the extraordinary examples because of their practical application and insistence on garnering both scientific knowledge and economic benefit from their relationships with each other and the community. As demonstrated by all intellectuals in the Romantic Age, both literary and scientific, these moments of extraordinary creativity were often fleeting. For almost as quickly as the energy began to flow for the Romantics, such as recorded in Coleridge's "Kubla Khan," concurrent developments spurred on by outside concerns began to shake the confidence and impede the progress that kept these innovative collectives together. Thus, as the spark of the Romantic Age was burning out, other projects, like the professionalization of science, were taking shape because they had been influenced by the Romantic ethos that reached for power in all things.

Jon Klancher asks: "Why, from the late 1790s to the late 1820s, did the 'arts' in all senses of the term recede decisively further from what was now counting as knowledge in the scheme 'arts and sciences'?" (148). In positing this question, Klancher builds upon Daniel Defoe's *An Essay Upon Projects* (1697) where Defoe suggests "the modern outlines of how sociability and connectivity could be channeled more optimistically into new institutions for the public good" (153). By bringing Defoe and earlier Enlightenment thought into conversation, Klancher shows that this earlier passion for social improvement through diffusing knowledge publicly flourished well into Klancher's "Age of Institutions." This Age of Institutions also came with the commercial viability of public lectures that attracted both sexes and all economic classes, fanning out to seek new constituencies. However, with more people invited to the conversation, more questions of specialization became central tenets of the second scientific revolution; as by the 1820s, Klancher notes that it "would become increasingly difficult to engage both men of science and fashionable audiences . . . with the same materials and expertises, within the same spaces" (Klancher 220). Specialization made shared conversation impossible.

The 1820s saw what Klancher calls an "institutional fissure" that resulted in the creation of the National Gallery of Pictures and the British Association of the Advancement of Science that was "contingent, conjectural, and unpredictable" because it does not neatly fit with current disciplinary or interdisciplinary narratives (Klancher 229). This lack of conversations between the arts and sciences is clearly representative of a disconnected practice of an explanatory methodology that seeks to ratify itself through its own perception of its field of study. Conversations, with all individuals included and about the subject matter at hand, is what defined the Romantic Age as unique and clarified the expansive access to knowledge that was valued by a community that at first resisted, then gave in to the looming presence of specialization that sought to make books like Jane Marcet's *Conversations on Chemistry* obsolete because the early Romantics believed a future synthesis of poet and scientist was possible. In Wordsworth's "Preface to *Lyrical Ballads*," he hypothesized a future interrelation of literature and science and their impacts on the individual and society. When Wordsworth addresses the question of where the scientist belongs, he begins by framing the matter as such:

> If the labours of men of science should ever create any material revolution, direct or indirect, in our condition, and in the impression which we habitually receive, the Poet will sleep then no more than at present; he will be ready to follow the steps of the Man of Science, not only in those general indirect effects, but he will be at his side, carrying sensation into the midst of the objects of the science itself. The remotest discoveries of the Chemist, the Botanist, or Mineralogist, will be as proper objects of the Poet's art as any upon which it can be employed. (Wordsworth 271-72)

For those living in the Romantic Age (1790-1830), scientific knowledge was problematic. Scientific knowledge was not connected to Truth in the same way that philosophy or any other of the gentlemanly arts were. Truth about the world gained through scientific means could not be valued because it was disconnected from any access to truth, which for the Romanticists came from passionate creative acts of something permanent, everlasting, and inspired by the imagination, as noted by Coleridge and Wordsworth in the creative work of *Lyrical Ballads* and further by Coleridge in his own *Biographia Literaria*,[8] and from true interaction with the Christian God through the mediator of Nature, as postulated by Blake and suggested by both William and Dorothy Wordsworth.

From this distinction of Coleridge's and Wordsworth's purposes in the *Lyrical Ballads*, it becomes clear that, in order to garner readers, the author needed to attract an audience by getting the reader's attention through access to real life, which is why, as

[8] In a journal entry on the topic of making the *Lyrical Ballads* more relatable to the reader, Coleridge mentioned that "artificiality and impermanence of poetic fashion with aristocratic taste" can sometimes dissuade the common reader so that the creative work stands in as more real and true (*BL* IV, XIV). See Shulz, "Coleridge, Wordsworth, and the 1800 Preface to *Lyrical Ballads*." *Studies in English Literature, 1500-1900*. 5.4. (Autumn, 1965): 619-639. For more on the work of Coleridge and the connections between science and poetry, see Coburn, K. "Coleridge: A Bridge Between Science and Poetry" in *Coleridge's Variety: Bicentenary Studies* and Levere, T. H. *Poetry Realized in Nature: Samuel Taylor Coleridge and Early Nineteenth-Century Science*.

Shulz notes, Wordsworth wrote to the lowest "denominator of taste" so as not to leave anyone out for an inability to understand his work. However, Coleridge's purpose was to communicate at the level of his audience, writing to those he wished to address, which is why Coleridge's poetry ranges from very directed toward the ordinary man to seeking the ear of philosophers and other thinking men of his day. By operating multivalently, Coleridge shared his "spontaneous overflow of powerful feelings" through the "good sense" that mediated his poetic genius (Coleridge, *BL* XIV).

Looking forward toward another Romantic who was able to conceptualize the historical moment's value, I have determined Shelley provides the highest return on my intellectual work. Shelley reflected on the moment's fragmenting forces in his conclusion of his 1821 *Defence of Poetry*:

> In spite of the low-thoughted envy which would undervalue contemporary merit, our own will be a memorable age in intellectual achievements, and we live among such philosophers and poets as surpass beyond any who have appeared since the last national struggle for civil and religious liberty . . .. At such periods there is an accumulation of the power of communication and receiving intense and impassioned conceptions respecting man and nature. The persons in whom this power resides . . . measures the circumference and sound the depth of human nature with a comprehensive and all-penetrating spirit, and they are themselves perhaps the most sincerely astonished at its manifestation, for it is less their spirit than the spirit of the age. (Shelley 850)

Shelley's critique of utilitarian and reductive science in his *Defense of Poetry* only calls for a future where science and poetry can be discussed together, ending with the visual proclamation that "Poets are the hierophants of an unapprehended inspiration, the mirrors of the gigantic shadows which futurity casts upon the present" (Shelley 850). Shelley's work contextualizes the tentative boundaries of theoretical, elite science with the practical, accessible science that could give scientific legitimacy to the pursuit of material understanding of the world. The work of literature is to provide a point of view that is divorced from reality and then give the imagination the means to comprehend the world and the human experience in more detail than ever before. This type of future-oriented discussion showed that the Romantics were aware of the significance of their contributions to the distinctive work of science.

CHAPTER ONE:
ERASMUS DARWIN'S *THE TEMPLE OF NATURE*
AND THE GENTLEMAN-SCIENTIST

Erasmus Darwin's poetry is in fact a precursor to the Romantic tradition, instead of his poetry working against the notion of Romantic poetry, as Michael Page notes in "The Darwin before Darwin: Erasmus Darwin, Visionary Science, and Romantic Poetry."[9] By working to expand the definition of the Romantic tradition, I argue that there is room for Darwin's "sciencey-poetics" in the Romantic tradition. Darwin's active participation in the diverse activities of the Lunar Society provided practical industrialists like Boulton, Watt, Wedgwood, and Galton access to Darwin's speculations, diverse observations, and energizing conclusions that allowed the propulsion of visionary ideology into applied science. The Lunar Society sparked change and development that in turn further fueled ideas and innovation; yet, without each of its members, the group would not have had such significant impact. Erasmus Darwin was a visionary who saw broader connections across the cosmological, biological, geological, social, and historical evolutionary processes. These connections fueled his poetry and expanded his mind, making him both a lunatic and a visionary, in every sense of each term.

Looking at Darwin's empiricist foundations, Darwin's pursuit of scientific knowledge both informed and was informed by his poetics. Like older philosophers, wherein the term "philosopher" simply means "lover of wisdom," Darwin was able to see through the educational categories that had been established by the Enlightenment and

[9] Page gives an illuminating discussion of Darwin's cosmology and complex scientific understanding of the world by breaking down each poetical passage into its particular expression in the biosphere and correlates it to the overall universal expression in the big picture of the cosmos (Page 154-61).

understand that wisdom can be obtained through many forms of knowledge and all that knowledge can lead to a greater universal understanding of the world. Yet, in spite of his project's vast scope, Darwin's poetic works were heavily parodied in the 1790s, as Darwin's *The Botanic Garden* became codified as a center of revolutionary ideology in Britain.

As I. A. Richards notes, there are two purposes for the language of poetry: emotive and scientific. While Richards here refers to the science of language itself, the structure that language is scientifically bound to gives poetry the ability to figure out discursively the nature of the world. Poets use the structure of poetry "to instruct and delight," as Horace remarks in the *Ars Poetica*, which was a format loved and adhered to by the Romantics. The Romantics, especially, used poetry's dual characteristics to delve into the mysterious scientific discoveries of the universe. Erasmus Darwin, a poet and scientist, fell in love with this genre, as his greatest works are scientific poems.

Trained as a medical doctor at Cambridge, Darwin began his career in Nottingham, a provincial town where he had no patients. Thus, he turned to "the wildest speculations . . . on the resemblance between the action of the human soul and that of electricity" (qtd. in C. Darwin and Krause 17). While this is an early remnant of Darwin's thought process, it shows that, by his own nature, he was inclined to see connections across nature that most others did not see. His own personal connectivity allowed him to design and test his hypotheses, always following the scientific method, which filled six volumes of shorthand notes before the age of 30 (C. Darwin and Krause 17-19). Darwin's work first surfaced in literary criticism and scholarship in the latter half of the twentieth century with Desmond King-Hele's continued interest and dedication to publish

Darwin.[10] Darwin's literary voice is now well known through its vivid descriptions of evolution, science, technology, society, and cultural progress during the English Industrial Revolution.

This chapter argues that Erasmus Darwin's quest to bring scientific knowledge to the general public was filtered by his own desire to keep science in the hands of the elite, learned individuals of the Romantic Age, mainly male gentlemen-scientists. Darwin wrote in such a fashion as to seemingly popularize science for a democratic, inclusive audience, but so much of what he used to ground his argument came through un-yet-forgotten languages, knowledge that was lost to the ages, and perspectives that he did not want others to share. Darwin wanted others to understand, the way he did, the evolutionary creation process of the universe, but he was too revolutionary for his time, which is likely why he chose to focus on an audience of highly learned individuals in order to have the best chance of convincing them to reconsider the creation of the earth from a perspective other than that offered by Christianity.

Darwin's writing attempted to bridge that gap between revolutionary ideology and what people would generally be willing to believe, assuming, as Darwin did, that they had enjoyed some degree of scientific education. Darwin's metaphors and personifications throughout *The Temple of Nature* speak to his own personal background and scientific training. Darwin created a new way of looking at the world in the poem simply by seeking to be a poet and a physician. His love of science taught him to write

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[10] See *The Essential Writings of Erasmus Darwin*, ed. Desmond King-Hele (London: MacGibbon and Kee, 1968); King-Hele's earlier biography, *Erasmus Darwin* (London; Macmillan P, 1963); King-Hele, *Doctor of Revolution: The Life and Genius of Erasmus Darwin* (London: Faber and Faber, 1977); *The Letters of Erasmus Darwin*, ed. King-Hele (Cambridge; Cambridge UP, 1981); King-Hele, *Erasmus Darwin and the Romantic Poets* (London: Macmillan P, 1986); and King-Hele, *Erasmus Darwin: A Life of Unequalled Achievement* (London: Giles de la Mare, 1999).

about the world in new ways. While *Temple* is inherently didactic, what makes it unique is Darwin's ability to explain the world around him to those knowledgeable enough to understand the terms he casually dropped in the poem. He was able to deliver an "exquisite poem . . . in which the graces themselves seem to decorate the temple of science with their choicest wreaths and sweetest blossoms," as was remarked by his Lunar Society associate the geologist James Keir (Keir 112-13).[11] And yet, Darwin's earlier poems focused on botany, due to his Botanical Society of Lichfield and its three members' efforts to translate Linnaeus's *Species Plantarum* and *Genera Plantarum* (Darwin, *Letters* 109-11).[12] This insular world was Darwin's and Darwin's alone, within the Lunar Society; he viewed himself as the sole arbitrator of knowledge of botany and classification systems in England. Darwin's world was very much on the brink of a knowledge expansion, one which Darwin was dead set on ushering in personally by making it seem that so many others had already taken up the standard of science. His goal was to share an exclusive knowledge with others outside of the proscribed ring of scientists in order to bring new ideas and new ways of thinking into the profession of scientist. Darwin sought to include others because he wanted to know more, make more connections, and figure out how the world really worked. Darwin was an unusual

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[11] King-Hele in *Doctor of Revolution*, pp. 197-98, summarizes the favorable reception of the *Loves of the Plants* and *The Botanic Garden* as well. And for Darwin's response to this reception, see *Letters of Erasmus Darwin*, 193 and 196-97.

[12] Browne notes in "Botany for Gentlemen: Erasmus Darwin and 'The Loves of the Plants'" that there is little direct evidence beyond a few letters that Erasmus Darwin had any other members beside Darwin. Yet, in each of the Botanical Society of Lichfield's published translations *A System of Vegetables, According to Their Classes, Orders, Genera, Species, with Their Characters and Differences* . . . *translated from the 13th Edition of the System vegetabilium* . . . *and from the Supplementum plantarum of the Present Professor Linnaeus,* 2 vols. (Lichfield, 1783); and *The Families of Plants, with Their Natural Characters* . . . *Translated from* . . . *the Genera plantarum of* . . . *Linnaeus* (Lichfield, 1787), Darwin always referred to the activity of the translations as a joint venture of the Lichfield Botanical Society and the title pages of both books name only the society as author. Browne notes that "[f]ew contemporaries would have attributed them to Darwin alone" (599, 20n).

"gentleman-scientist" because he was more passionate about making connections across the sciences than he was about keeping other people out, although he still wanted to receive the acknowledgments that came with the elite status of scientist.

However, the world that Darwin sought to supply with more knowledge excluded even knowledgeable individuals from participating in the conversations. Janet Browne notes in her history of science article, "Botany for Gentlemen and 'The Loves of the Plants,'" that within his poem *The Loves of the Plants* the "women that Darwin created were therefore entirely appropriate for the pastoral setting he envisaged. With one exception, there are no intellectual women in Darwin's verses, no educated poetesses like Anna Seward; no artists like Angelica Kaufmann . . .; no one like Maria Edgeworth, well known personally to Darwin as a girl; no Mary Wollstonecraft or Madame de Staël" (Browne 616). These women were on the frontlines of science in Darwin's day; thus, they are likely the very women that Darwin may have been considering when he wrote *The Temple of Nature*. Calling out these women in particular, Browne brings to the reader's attention the lack of women, with one major exception, that of the narrator herself who is presented as the goddess of botany, the didactic lecturer who speaks the entire poem. Not only is she an expert botanist, but she "displays a deep and varied knowledge of contemporary science and the world about her" (Browne 617). However, the goddess is knowledgeable and wise, which opens up her character as Darwin's endorsement that at least some women belong in the conversation on science.

The goddess of botany opens by addressing the "Nymphs of Primeval Fire! your vestal train / Hung with gold-tresses o'er the vast inane —" (Darwin, *Loves,* I, ll. 97-98); yet, the line is so complex for the average reader that Darwin shows that it requires a footnote for elucidation: "The fluid matter of heat is perhaps the most extensive element in nature; all other bodies are immersed in it, and are preserved in their present state of solidity or fluidity by the attraction of their particles to the matter of heat" (Darwin, *Loves*, I, 98n). This explanation is not only spoken by the goddess, but delivered with confidence, thereby elevating the understanding of some women above the average reader of the poem. And the note itself speaks to the idea that the "great world itself had likewise its infancy and its gradual progress to maturity" (Darwin, *Loves*, I, ll. 98n). This maturity, Darwin added in *The Temple of Nature*, rendered nature self-sufficient and divine intervention unnecessary for the generation of life (Darwin, *Temple*, I, ll. 233-46, 247-50, 295-302). Because Darwin strove to be as accurate, current, and inclusive as possible, his schema made him first incorporate biological evolution into his own understanding of evolutionary geology, then finally to link it to cosmological development, as understood by the Lunar Society to be the evolutionary worldview moving forward. However, this level of inclusivity at this time period required the reader "to enlist Imagination under the banner of Science; and to lead her votaries from the looser analogies which dress out the imagery of poetry, to the stricter ones which form the ratiocination of philosophy" (Darwin, "Advertisement," *The Botanic Garden*). This quotation points to the melding of science and the imagination, which the major works and principles of Erasmus Darwin's life embody. Thus, it was a natural extension of Darwin's life work to delve into the roles of women.

Gender analysis of *The Loves of the Plants* shows that it represents a patriarchal document that endorses the delineation of male and female sex roles, as well as concepts of masculinity and femininity. The robust sexual images in *Loves* appear at a time when some options for women were gaining traction in mainstream British culture, but this time was simultaneously one where many other roles were narrowing and becoming more restrictive. Darwin's images in *Loves*, for all his other progressive views, can only be read as deeply polarized between the chaste virgin and the seductive woman, suggesting there existed no real woman in between. If anything, reading *Loves* and *Temple* in conjunction shows that Darwin was becoming more aware of the need to include women in discussions of science and to include real depictions of women in his works, especially those that were written in the 1790s that reflected, at least, the shifting gender ideologies that individuals like Mary Wollstonecraft brought to light. However, in *Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England 1760-1860*, Ann B. Shteir explains that, in the early eighteenth century, the study of botany was reserved alone for polite culture. Because before Darwin's more explicit *Loves of the Plants*, there was no fear of impropriety from conversations around the subject of botany; and therefore, these types of discussions could be held around women, without ruffling polite culture's ideologies for women. Shteir sees botany changing gradually, according to the conventional views of women's nature and roles. This meant that women could collect plants, identify and illustrate them, but could not participate in public institutions that sought to record and assign meaning to those plants. Shteir's work uncovered the women who surrounded Darwin, but who were not given the appreciation they deserved for their illustrations of plants, especially those that were used to provide aesthetic beauty to clothing, cushions, and paper mosaics, and because of the medium in which they were represented, these illustrations were neither respected nor given consideration by contemporary scholars. By filling in the work of women in botany, Shteir opens eyes by showing the published history of these women who popularized the science of botany in more polite ways than Darwin's erotic *Loves of the Plants*. Shteir, however, shows in her conclusion that women who attempted to bridge the gap between public and private botanical study were not successful. This success could only come through the opening of the pursuit of science through male voices, like Darwin. Therefore, it is critical to keep in mind that, while Darwin's inclusiveness toward women was not much outside the strictures of social code, Darwin did appreciate the inclusion of more worthy women of science, especially those who were well educated. This inclusiveness stemmed from Darwin's inclusion of particular women like Anna Seward and Maria Edgeworth in the conversations of science.[13] Darwin's inclusiveness extended to women through both his Lunar Society as other kinds of institutions promoted scientific culture, attracting broad support from men and women in the 1790s and 1810s (Shteir 22-27), when this inclusivity came under strain from the radical sympathies of some of the more prominent scientific activists who wished to keep the pursuit of science elitist.

Browne seems to believe that this choice of narrator and couching of the entire poem in the voice of the female goddess of botany shows Darwin's "genuine regard for educated women" (Browne 617-18). Closer analysis of *The Loves of the Plants* and *The Temple of Nature* in conjunction shows that Darwin did recognize that women had been wrongly excluded women from experiments and conversations about science; a viewpoint he meant to uphold with his new text because, within its pages as he rewrote a

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[13] For other illuminating considerations of Darwin's inclusivity toward women, see James Harrison, "Erasmus Darwin's View of Evolution," *Journal of the History of Ideas*, 1971, 247-64; Maureen McNeil, *Under the Banner of Science*, (Manchester: Manchester UP, 1987), 88; and Ann B. Shteir, *Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England: 1760-1860* (Baltimore: Johns Hopkins UP, 1996), 22-27.

history of the development of science, Darwin seems to have left out women consciously, while acknowledging their place in society as worshippers of nature as he outlines in Canto I: Production of Life, especially in the role of the goddess of Botany. This is a conclusion supported by Browne's work. While *Temple of Nature* is not as insistently didactic as *Loves of the Plants* in its exclusion of educated women in its conversations, *Temple* did not seek to exclude women so intently.

This complex absence and presence of educated women in Darwin's *Temple*, however, cannot undermine Darwin's progressive or anti-progressive views, in regard to women in science. Darwin helped his two daughters plan and execute a girls' boarding school; however, Darwin's views were ultimately problematic because, to Darwin, women's education was only beneficial to men and therefore worthwhile for that purpose alone. Darwin had recommended the adoption of simplified form of vocabulary and the creation of a new system of shorthand for educational purposes in his *Plan for the Conduct of Female Education*; for during the 1790s, the Darwin, as well as the other leaders of the Dissenting academies and the Derby savant community, chose to send their children of both genders to the Spenser school, where they received an education that included the study of natural philosophy. The men of the Derby Philosophical Society were also influenced by the philosophy of Johann Heinrich Pestalozzi, who emphasized the Enlightenment view that education must conform to the natural processes of mental evolution, to the sequence in which the faculties spontaneously develop, which is something that intrigues Darwin throughout *The Temple of Nature*. [14] For ultimately,

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[14] See Stephen Tomlinson's "From Rosseau to Evolutionism: Herbert Spenser on the Science of Education" *History of Education* 25 (1996): 235-54. Matthew Spenser owned a set of philosophical instruments that included Erasmus Darwin's microscope. On Pestalozzi and his influence, see Johann Heinrich Pestalozzi's

education held the key to social progress. Thus, Darwin urged the maintenance and improvement of society, which required the education of others on the topic of science and instruction in its essential progress of rationality. Ultimately, Darwin was entirely in accord with the other male authors of his time. Darwin sought to expand the world in which women conversed, but wanted to keep women circumscribed within roles males meant for them to inhabit. The issue Darwin faced was how to approach, teach, and educate others on the new knowledge that science offered.

Thus, I believe it is possible to locate Darwin's poetic work within the advent of new knowledge, which is why *Temple of Nature* is conveyed through female interaction with the goddesses and muses of the Temple. There he is opening a space for female engagement with science, but ultimately he still worked to contain it within the subtext of the poem. In *The History of Sexuality*, this is what Michel Foucault illustrates, in a broad theoretical swath, the transition from the "bright day" of seventeenth-century sexuality to the "monotonous nights" of the Victorian bourgeoisie (Foucault 3). Thus, for Foucault, the things left unsaid or lingering in the poem can indicate the reader's way into a deeper understanding of the author's views expressed in the text, and such an approach is clearly helpful in assessing Darwin's position on women's roles in society. Foucault's attempt at providing an illustration of how one period of history gave clarity to the understanding of another era can also help explain some of the lingering aspects of Darwin's poem, showing that Darwin was both a progressive individual who wanted to shepherd in a new, more inclusive world grounded in science, but also wanted to remain true to the social norms that he believed to be true, regardless of the knowledge offered by science.

How Gertrude Teaches Her Children and Guy W. Trompf's "Radical Conservatism in Herbert Spencer's Educational Thought" in the *British Journal of Educational Studies* 17, (1969): 267-80.

Darwin's world was one of returning to old ways of encountering the world, while plunging into the knowledgeable depths of the new. Darwin was born into a world that clung to polite culture and a world moderated by men. However, during Darwin's lifetime (1731-1802), there was a "retrieval of romance modes, renewed interest or imaginative investment in national and cultural pasts, the turn from polite culture to the 'very language of men' – at times conjoined with a full-scale retreat from the anonymity of print culture and its potentially hostile public – and the reanimation of oral cultures and orality, even when, or perhaps especially when, the bards were inauthentic and technologically mediated" (Goodman 195). Darwin kept within polite culture, straying slightly with the *Loves of the Plants* and their sexual reproduction in 1789; and, for the most part, Darwin sought not to offend in print or speech with his ideas of evolution. The pressing realities of curiosities that lined the cabinets of gentlemen-scientists were slowly increasing the importance of the study of fossils and understanding how humankind arrived at the present day. Darwin's purpose in *Temple* was to systematize nature and human life, pursuing the operations of each as objects and activities for further scrutiny. Although, in disagreement with Goodman's nostalgic reading of *Temple*, science and poetry functioned seamlessly for Darwin. This new world that unified poetry and science provided fodder for poetry as scientific knowledge was busting at the seams because the vast stores of scientific information needed someone to make sense of it; for, ultimately, its purpose was not clear to the average reader.

Thus, into this world Darwin plunged. Older and wiser than when he composed *The Botanic Garden* or *Zoonomia*, Darwin's project in *Temple of Nature* (1803) is a bit more complex and willing to propose the radical truth of evolution. When the first two poems were published, the underlying materialism of the goddess of botany and other scientific disciplines too heavily assaulted political tyranny and religious worship. Yet, by the later 1790s, the same attitudes that had been considered scientific and industrial were now "dangerously libertine, irreligious and hence (in an increasingly common conflation) pro-French" (Priestman, "Introduction"). Coleridge criticized Darwin's *Botanic Garden* by stating that Darwin "thinks in a *new* train on every subject," obviously criticizing Darwin's overly connective mind (Coleridge, *Collected Letters*, I. 177, 216, 205-06).

Published a year after Darwin's death, *Temple of Nature* is truly a brave, bold synthesis of all his other works. The *Temple of Nature* makes a never-fulfilled promise to explain the nature of science and art to a learned, scientifically elite audience. In the preface to *Temple*, there is a continuing arc from mythology where Darwin explains the nature of myths in terms of scientifically observed natural processes, but not in human models or cultural achievements because the Temple of Nature itself is constructed as a physical place, which explains the mixture of the present and the unrealized future, and therefore functions to question the performative, literary space that serves to moderate between science and human nature.

In four lengthy Cantos, Darwin crafted his scene. Indicated by extensive annotations and connective notes, the poem provided for Darwin's reader an exploration of many senses and feelings throughout the physical Temple of Nature. Starting with Canto I, Darwin's version of the cosmological event that started the universe, now called the "Big Bang," and evidence of evolution is laid out for the reader, while Canto II explains that sexual reproduction is the vehicle by which evolution occurs; moving forward, Canto III explains how the human mind is separate and distinct from other minds, giving it the potential to be the foundation of society. Finally, the fourth and final Canto is a pledge to the importance of evolutionary happiness, i.e. not happiness or misfortune in one's own life and instead a focus on the evolutionary success that brought us to this age.[15]

CLOSE READING OF *THE TEMPLE OF NATURE*

Darwin used *Temple of Nature* not only to outline a fairly complex theory of evolution but also to advance his connective ideology that everything on Earth shared a common lineage. Darwin's circle of ingenious friends helped him to make the connections across geology, biology, botany, and many other fields of science. His poetry thrived on his love of science, and *The Temple of Nature* was his most expansive and full work. While he was criticized by the anti-Jacobins for publishing *The Loves of the Plants* and *Zoonomia*, he seemed not to concern himself with those threats as he composed his last work; instead, he was focused on a larger goal: bringing structure to nature and calling others to the noble work of science.

This structure may seem odd in that it seems to have no explanation or foundation, but reading *Temple* in conjunction with Darwin's unfinished historical poem, *The Progress of Society*, sheds light on *Temple of Nature*. In fact, Darwin elaborates on the metaphor built in *Temple of Nature* by rewriting completely the Garden of Eden story, taking it one step further than Milton by showing that Nature is all that humanity has to rely on after the Fall of Adam and Eve. Darwin breaks down the time since the Fall into five "successive ages" of Hunting, Pasturage, Agriculture, Commerce, and

[15] See Erasmus Darwin *The Progress of Society*.

Philosophy, which seem to be present intermittently in each of the four cantos of Temple. In "Progress," with Eden lost to time and progress, Nature has become the new site for explaining creation and the evolution of life. This unique observation allows insight into the mind of Darwin and the conversations that he must have had with the poets and individuals he knew through the Lunar Society. "Progress" actually includes a good deal of *Temple*'s poetry, but looks more for a societal reason for what Temple determines to be a scientific concern.

While the four cantos seem to be laid out neatly in an overarching structure, they fail to create any cohesion or real purpose. In Priestman's introduction to his edition of *Temple of Nature*, he notes that the Preface does not alert the reader to the poem's real themes and suggests that actual people may have inspired the Classical myths and "may have played a part in discouraging readers not already put off by the political assaults on his reputation" (Priestman, "Introduction"). Not only did Darwin's grand masterpiece offer more confusion than clarity, Darwin was not specific enough in his descriptions; or, what is more disconcerting to the modern reader, he truly believed that it was possible to create new life artificially, giving Mary Shelley and Lord Byron the possibility that life could occur naturally through other means.[16] Whether this is what Darwin meant, it was what was published after his death, preventing him from interacting with his work as the audiences consumed it, thereby leaving a legacy of evolution's effect on society for his grandson Charles Darwin and other evolutionists.

And the extensive notes that Darwin provided only explain his cognitive understanding of life, creation, and science in more complex and connective ways that

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[16] See the Lawrence-Abernathy debates in Sharon Ruston's *Shelley and Vitality* (Basingstoke: Palgrave Macmillan, 2005), 1-105.

poetry alone would provide. Darwin wanted to be his reader's guide through the vast stores of human knowledge and scientific gains that were accumulating throughout his lifetime. Thus, in order to explain more fully the connections he planned to make and the argument he wanted to form for evolution, Darwin knew he needed to start at the beginning, with the big bang that would start life on Earth.

In Canto I, Darwin describes that, before the rising from "elemental strife" in a Big Bang like moment, Nature went through "[f]our past eventful Ages" before Time arrived on the scene (Darwin, *Temple*, Canto I, ll. 3, 9). The first canto marks Time as the "new-born . . . to light" (Darwin, *Temple*, Canto I, ll. 10). Time brought order and structure to nature. Darwin seems to posit that this "whirling world" once existed in an unconnected state, where there existed separate entities that needed time to connect them together (Darwin, *Temple,* Canto I, ll.20). Darwin states the instructions simply as Nature's need to "[p]ress drop to drop, to atom atom bind, / [l]ink sex to sex, or rivet mind to mind" (Darwin, *Temple,* Canto I, ll.25-26). Without knowledge of Darwin's initial plan, mentioned in earlier drafts as *The Progress of Society,* the reader is unaware that, in *Temple*, Darwin's intent was to trace what it meant to be human through five ages of Time: Hunting, Pasturage, Agriculture, Commerce, and Philosophy. In this initial version, Darwin focused on humanizing the past and separating human achievement, but *Temple* was different. Instead in *Temple*, Darwin sought interconnectivity and support for the unification of aspects of the world around us. Darwin wanted science to be understood by others, thus he presented the immutable world as connectable by human involvement.

To give additional context, the following will provide some plot summary and condensation of Darwin's various facts and poignant moments of *The Temple of Nature*. Darwin thanks the Sun for its "silver zone" that allows the planets to survive within its warmth, which is where he turns his telescopic lens on Earth and its society as his "lines soft-rolling eyes engage" (Darwin, *Temple*, Canto I, ll. 22, 29). With "snow-white fingers [to] turn the volant page," Darwin sets the scene for a very inviting description of the Garden of Eden (Darwin, *Temple*, Canto I, ll. 30). His poetic work is repaid by the scene laid before him in Eden, where just as there were four ages before time, in this pre-mapped world, Eden offers four rivers "lav'd with wandering tides" where "unclad the Graces stray'd / And guiltless Cupids haunted every glade" (Darwin, *Temple*, Canto I, ll.37, 39-40). The word choices here signal the reader's attention to the perfect tendencies that allow the Earth to blossom under the Sun, yet not specifically under a Christian God's guidance, but where even Darwin's poetry encourages the reader to engage with the willing pages of a text that lies open for interpretation, perhaps even a bit too open. Here, Darwin's Eden is illuminated as a golden space without boundaries, as there were no forbidden topics or taboos before the Fall of Man. The openness of Eden is lit by "sun-bright lawns" and that world is only rendered asunder by that which accompanied the Fall.

Yet the description of the resultant world is much closer to that described by Byron or Shelley's promethean and natural descriptions of the world that appear in *Childe Harold* or *Prometheus Unbound*.

> Now rocks on rocks, in savage grandeur roll'd,
> Steep above steep, the blasted plains infold;
> The incumbent crags eternal tempest shrouds,
> And livid light'nings cleave the lambent clouds;

> Round the firm base loud-howling whirlwinds blow,
> And sands in burning eddies dance below. (Darwin, *Temple*, Canto I, ll.47-52)

This sublime, utterly Romantic description of the world marks Darwin's observations of the changed, post-Edenic world. The beautifully primal can be applied to the world itself, providing insight into the very fabric of nature. Through Darwin's poetic eye, the reader sees Nature in its true element. The resultant geographical map shows the powerful potential that the world inherently has to change over time. Nature is shaped by the winds that blow through sands and the tempests that carve the crags.

While these are not new ideas, in fact they echo back to Hesiod's *Works and Days* and Horace's *Ars Poetica*, Darwin presents them with an authority that assumes all his readers have encountered these ancient texts and are familiar with how such nature poems capture Nature's changing aspects. Literature is meant to enhance nature and in order to do so the author must be free from nature's conventions in order to make something perhaps better than nature had intended. Through words, an author can convey a sense of the true nature of the world; however, as literature has progressed through time, it is obvious that there is not only one way to portray nature. Every author can improve the standards of literature through redefinition. In Hesiod's *Works and Days*, woman was made by Hephaestus when he was instructed by the father of men and gods to "make haste" by putting in woman "the voice and strength of human kind, and fashion a sweet, lovely maiden-shape, like to the immortal goddesses in face" (60). Now "make haste" can be interpreted as the woman needed to be quickly because the world was incomplete without her or perhaps that the woman was hastily put together thus making her a necessity to the survival of the world. The myth also discusses the ease of the lives of men before woman came into being. The men were not good creatures before women; they were not even close to god-like, but they had freedom.

> For ere [taking the gift from Zeus] the tribes of men lived on earth remote and free from ills and hard toil and heavy sickness which bring the Fates upon men; for in misery men grow old quickly. But the woman took off the great lid of the jar with her hands and scattered all these and her thought caused sorrow and mischief to men. (90)

This passage seems to show that men believed they enjoyed a sort of freedom before women came into their lives, perhaps echoing some of the same desires that the gentlemen-scientists had in attempting to keep science elite. Men were free from the evils of the earth and likely grew old very slowly, without the constraints that woman released, either metaphorically or literally, into the world. Mythically, both stories of the Greeks and of most moderns trace humans' lack of freedom as stemming from the introduction of woman into culture.

Darwin's contribution to this conversation was through the inclusion of all humankind into the umbrella of nature and reconsidering the place of the individual, both man and woman, in the pursuit of scientific advancement. Darwin even imagines what humankind would have been like in this early age, remarking that "sacred symbols crowd the pictur'd walls; / With pencil rude forgotten days design, / And arts, or empires, live in every line" (Darwin, *Temple*, Canto I, ll.76-78). Darwin recognizes in these individuals the ability to leave their mark, quite literally, on this age, which allowed them to leave remnants of themselves and their thinking for future generations. Here Darwin, perhaps, was thinking of the hieroglyphics in Egypt, particularly for their visual expression of thought that did not have to be mediated through word choice and verbal expression. Just as *Loves of the Plants* draws heavily on the knowledge compiled by those who came before him, Darwin had great interest in putting what he imagined the natural world to possess into words.

Darwin's respect for those who came before him also reflects those closer to his own time. Echoing the prologue of *Paradise Lost*, Darwin draws on imagery of dark and light to make connections across nature in Canto I; however, instead of a focus on light and dark, Nature is born under the auspices of "IMMORTAL LOVE!" and in context of the importance of time, for it is noted that Nature was born before the "morn of Time" when "Chaos hung sublime" (Darwin, *Temple*, Canto I, ll.15-16). The *Temple of Nature* was meant to stand out because it is quite possible that, as Martin Priestman notes, Darwin signaled the qualities of time to the characterization of Proteus, whose form was perpetually changing, could discover the truth of the past events of the world, and simultaneously held the ability to predict the future (Priestman, *The Poetry of Erasmus Darwin*, 103). Proteus becomes the guide through the "piazza'd courts," "long arcades," and "bowers of PLEASURE," signaling that Time is the mediator between the garnering of knowledge that occurs in the Temple and the operations of Nature (Darwin, *Temple*, Canto I, ll.89).

Discussion here calls for a mediation between scientific knowledge and the activity of nature. For theoretical groundwork, I am using the distinction between what Bruno Latour calls "science in the making" and "ready made science" to show a split in the rationality of science (Latour 4). Focusing on how science is made, although perhaps starting a bit too soon for an Enlightened audience to recognize its epistemology, Darwin traces the lineage of science to before any scientific concepts were formalized and taught from authorized textbooks rather than through observations. Darwin figures the shift in scientific epistemology through his history of the world, a history which was moderated through what he had read. By returning to an earlier protean state, Darwin gave his audience a chance to reconsider scientific concepts in their nascent state, rather than as fully-formed ideas that the reader has to accept as true.

While *Temple* was written near the end of Darwin's life and published posthumously, the majority of his life was spent trying to break free from a worldview that separated and praised observations only for what they were, not what they could offer the innovative scientist. This practice is termed by James E. McClelland, III to be the organization of science, and he notes that science, itself, by McClelland's modern standards is "an organized intellectual enterprise pursued by a community of practitioners for its existence, pursuit, and advance" (McClelland xvii). He points out that this definition exhibits and contains a scientific practice that straddled two roles: "the rejection of university-based scholastic science, and the instauration of scientific societies [and] on the other hand when the general learned society was eclipsed by other, more modern ways of organizing, producing, and disseminating science, notably in university contexts, into disciplinary specialties, and along professional lines" (McClelland xix).[17] This simplified straddle echoes Bruno Latour's Janus concept, where he suggested that science is always comprised of two faces: ready-made science and science in the making. Here, I will signify ready-made science with additional meaning by calling it "practical," and I will signify science in the making by calling it "innovative." This delineates the non-modern scientist, and some modern scientists, into two communicative entities, where one declares the philosophical position of realism and declares nature to be the

[17] Ultimately, this happened because universities became too siloed and could not provide access to new methods of discovery without heightened scrutiny.

cause of knowledge and the other speaks to how scientists act in the pursuit of knowledge. Both help to provide understanding, at this junction, of why Darwin turned away from the philosophical pursuit of science and attempted to create a well-documented poem about the relationship of science and nature, thereby leaving his legacy in the form of his worldview.

Darwin stood uniquely positioned to capture the multi-dimensional expansion of science in the eighteenth century. McClelland explains that "[i]n the eighteenth century the scientific enterprise grew considerably larger and became better integrated in society. . . . Yet, eighteenth-century scientific societies need to be seen against the background of the larger "socialization" of science in that period, and . . . the scientific societies were not so much derivative of developments in an autonomous science as responsible for them" (McClelland xxii-xxiii). Darwin's worldview and leadership of many scientific societies, mainly the Derby Philosophical Society and the Lunar Society of Birmingham, showed that he endorsed the social nature of science, expressing belief through his actions that science was greatly benefitted by social conversation and networking ideas with others. However, while Darwin used *The Botanic Garden* and *Temple of Nature* to discuss these points, Darwin also wanted science to remain elite and his own. The genius of Erasmus Darwin was that he found a way to do it through the obscure references and footnotes that littered the *Temple*. By beginning at the very beginning of things, with Titus Lucretius Carus, Darwin narrowed down his potential readership to the Latin learned of the eighteenth century.

Darwin wanted to start at the very beginning, drawing upon mythical, Christian, and other ancient sources to set the stage of a world before "ready-made science" by following in the path of Lucretius's Latin poem *De Rerum Natura* (*On the Nature of Things*).[18] Lucretius's first-century work mused upon the nature and causes of things throughout all aspects of the known world. However, a sharp differentiation exists between the works of eighteenth-century Darwin and first-century BCE. Darwin saw these connections empirically, rather than through speculation, which is evident in his poem as the descriptions are so intuitive and simple. For Darwin, it was easy and clear to see how the origin of life began, but in *Temple*, the speaker needs to hear the goddess Urania's answer in order to determine the viability of his own idea.

However, it is not until Urania answers that the scientific account of the origin of life truly begins. As a deist, Darwin believed that the universe had a first cause, which could be called God by believers, but that everything that followed is explicable by the natural laws God created. In an early letter to Dr. Thomas Okes of Exeter sent November 23, 1754, Darwin argued

> That there exists a superior ENS ENTIUM, which formed these wonderful creatures, is a mathematical demonstration. That HE influences things by a particular providence, is not so evident. The probability, according to my notion, is against it, since general laws seem sufficient for that end. Shall we say no particular providence is necessary to roll this Planet round the Sun, and yet affirm it necessary in turning up *cinque* and *quatorze*, while shaking a box of dies? or giving each his daily bread? The light of Nature affords us not a single argument for a future state; this is the only one, that it is possible with God, since He who made us out of nothing can surely re-create us; and that He will do this is what we humbly hope. I like the Duke of Buckingham's epitaph – "Pro Rege sæpe, pro Republicâ semper, dubius, non improbus vixi; incertus, sed inturbatus morior. Christum advenero, Deo confide benevolenti et omnipotenti, Ens Entium miserere mei! (qtd. in Darwin, *Letters*, 23).

[18] Lucretius's *De Rerum Natura* also insists that a chance atomic convergence created the universe, a universe that is still developing and will one day inevitably fall apart (Lucretius, Book V, ll. 807-10). Darwin, however, does not seem to buy into the idea that matter is governed by "blind chance" rather than the Laws of Nature.

The Duke of Buckingham's epitaph gives purpose to Darwin's initial use of ENS ENTIUM in his letter, and, roughly translated, it means "Being of Beings." The rest of the epitaph does not really carry much weight in this discussion because it speaks more to the nature of the Duke of Buckingham's life than it does to any conversation on the role of God in the creation of Nature. Why Darwin draws on this particular epitaph to explain his appreciation of the Latin sobriquet "Being of Beings" for God is beyond the mere lived life of the Duke of Buckingham, but perhaps it was merely an epitaph he came across in his studies, as many of his other letters, such as those to the German philosopher Reimarus, reference Erasmus's young, wild speculations on the resemblance between the action of the human soul and that of electricity. Darwin was seeking connections across time and space, believing that science could provide those answers.

In his letter to Okes, Darwin's anti-aleatory approach to understanding the workings of the world sought to prove that there was more than providence or God's will shaping Nature. Darwin gives God, the "Being of Beings," a place as the progenitor of Nature, but states that "no particular providence is necessary to roll this Planet round the Sun" in order to show that God started the world going, but is not necessary to keep it going, as the Earth will revolve around the Sun with or without God's intervention. In *Temple*, the speaker proclaims "GOD THE FIRST CAUSE!" (Darwin, *Temple*, Canto I, ll.223). This echoes the quotation "A Jove principium, musæ! Jovis Omnia plena. VIRGIL.," which Darwin uses later in line 223 of *Temple*, that is from Vergil's *Eclogues*, meaning "From Jove my song begins: everything comes from him" (Vergil III, ll. 60). Yet, Darwin does not simply hearken back to the Roman pantheon; instead, weaving in Christianity through St. Paul's Acts 17:28 in the line "In him we live, and move, and have our being. ST. PAUL.," Darwin attempts to lend Christian legitimacy to the idea that Nature stemmed from a "Being of Beings," but Nature is no longer operationally unified to that entity because the laws of Nature and the evidence from the layers of limestone with shells of aquatic animals, vegetables, and terrestrial animals show that the world is changing and growing simply by the nature of what exists and contributes to the world on its own.

Darwin's lengthy description that follows line 223 in *Temple* gives a purely hypothetical, perhaps somewhat scientific, description of how Darwin imagined the Earth coming into being. First, there is the odd use of plural Earths that "from each sun with quick explosions burst" (Darwin, *Temple*, I, ll. 229). While the use of plurality is actually from *The Botanic Garden* where he discusses the existence of "*Five* sister-nymphs to join Diana's train" and states that maturity is reached at different points by the males in order to show that plural is necessary in order to benefit the creation of society (Darwin, *The Botanic Garden*, I.I.1, ll. 107), it is the peculiarity of Darwin's need to extrapolate from the creation of nature, not merely to one instance in the creation of Earth, but to expound that this creation happened from many suns and to many Earths, although he does seem to suggest that the "Earths" he refers to are just other planets in our own solar system instead of imagining the existence of other solar systems.

In fact, Darwin drew on Dr. Edmund Halley's observations that the ocean levels had decreased throughout the short period of human history, remarking that "'ORGANIC LIFE [once existed] beneath shoreless waves," in order to color in the blank spaces where his imagination could not reach. Darwin knew there had to be a time when the Earth was completely covered with water, but he could not imagine how it came to be what it was in his time; thus, Darwin even suggested in a footnote to line 268 that the role of chemistry in shaping the Earth's shores and land masses "deserves further investigation" (Darwin, *Temple*, I, ll. 295). Darwin's imagination is at full height when he considers the role of chemistry: "'First HEAT from chemic dissolution springs, / And gives to matter its eccentric wings;'" (Darwin, *Temple*, I, ll. 235-36). *Temple* here ties back strongly to *The Botanic Garden* because Darwin predicates the existence of Nature on the chemical properties of heat and how matter forms from the dissolution of the energy held in heat.

While this is an intriguing idea, his readers could only have interpreted it as a strange imaginative deviation from any understanding of the properties of heat. "'IN earth, sea, air, around, below, above, / Life's subtle woof in Nature's loom is wove" (Darwin, *Temple*, I, ll. 251-52). These powerful sensations and places of life are mentioned in the first volume of *Zoonomia*; Darwin uses them to focus in on the immense beauty of the universe that is encapsulated on a microscopic level, showing that Darwin, as poet, can afford to slow down and explain the idiosyncrasy that comes with combining "earth, sea, air" together in their form of creation. The mention of "Nature's loom" gives additional meaning to line 246's "fibre-woven frame" that serves to highlight Darwin's key idea that the building materials of life are "lines" or "threads" that have been "glued" together (Darwin, *Temple*, I, ll. 242-43, 253). Darwin explains that the stickiness of attraction without repulsion allows the particles to adhere to one another; therefore, for Darwin, the act of creation explains the laws of nature, for without repulsion in a state of attraction there is growth and development. If things stick together, then they form a cohesive creation.[19]

[19] Most of Darwin's theories of connectivity came from his association with the enigmatic Scottish doctor William Small and other members of the Birmingham Lunar Society. Small was trained at Edinburgh under

While this commentary and explanation is simple, Darwin's complex need for connectivity across Nature is revealed here in this text as well. Darwin combines various disciplines of science in order to connect their proffered knowledge toward something larger. Thus, it is evident that Darwin's *Temple* brings together and imaginatively gives purpose to his older texts. Where *Zoonomia* remarked on Dr. Hales's experiment on the rise of sap-juice in a vinestump and the pressure exerted on the sap within the confines of the vine (Darwin, *Zoonomia*, I.XXIII), *Temple* applied those same principles to mammalian arteries and blood in the capillary vessels, serving to qualify life and give simplified terms to complex activities so as to unify nature. Darwin's *Temple* was an attempt to collapse the differences between observations and laws of nature, encouraging his readers to look further into the causes of things, instead of simply accepting Nature for what it showed to be true through many singular examples.

For Darwin, the act of writing *Temple* was propelled by an intellectual need to unify the forces of nature and determine how from "[p]oints glued to points a living line extends" (Darwin, *Temple*, I, ll. 253). Darwin viewed each of these points as a measurable, quantifiable aspect of the arterial or nervous system, representative of their descent from a living line within the body as well as an echo to other systems in other bodies. The vastness of Darwin's connections extends from the creation of land out of the ocean to the nerves and presence of "young SENSATION" in the brain (Darwin, *Temple*,

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William Cullen (1710-1790) and John Brown (1735-1788). For additional context of Scottish medicine, see Maureen McNeil *Under the Banner of Science: Erasmus Darwin and his Age*, 148-53; for connections to reason and to David Hartley's (1705-1757) *Observations on Man, His Frame, His Duty, and His Expectations* (1749) and Roy Porter *Flesh in the Age of Reason*, 377-80. These along with others informed the majority of Darwin's psychological theories. More on the general scientific milleu of the eighteenth century can be found in James E. McClelland III's *Science Reorganized*, 109-152.

I, ll. 270). The mere fact that sensation is young, while Darwin is old as he writes this poem, connotes special importance on his own early years of exploring nature.

While there are many varied means to approach the world, Darwin's experienced, wiser, older intellect sought after a unified theory in a natural, organic form that spilled out of him best as poetry. The similes and metaphors throughout worked to bring closer the physically despondent activities of nature. For Darwin, who was never satisfied with the weirdness and randomness inherent in nature, there could not be multiple distinct scientific fields totally independent of one another by their nature. However, Darwin found himself in good company with more of the Romantic scientists that he met near the end of his life. The Romanticists, especially Percy Bysshe Shelley and Mary Shelley, picked up where Darwin had left off.

One reason why this quest to unify science plagued Darwin is that he removed himself from the medical community he was a part of so that he could go in search of new applications of science that were enhanced by his friendships and personal connections with the Lunar Society of Birmingham. His expanding knowledge of other fields highlighted the similarities of medicine with biology, chemistry, and geology, while simultaneously distancing him from the medical community that he was trained in. However, the more Darwin worked to see the connections of science across each field, the further he separated himself by adhering to his commitment to progress, regardless of popular opinion. Darwin was a noted slave-abolitionist, teetotaler, and religious skeptic, which drove away more people from him than gained him allies. As noted in King-Hele's biography of Darwin, Erasmus Darwin's written work initially enjoyed great success, but fell out of favor because his unorthodox views of evolution and his poetry's ornate didacticism made him more lunatic than respectable.

However, this does not mean that Darwin worked in complete isolation. Darwin found distinct advantages to aligning himself with the collaboratives of gentlemen-scientists that represented the Royal Society and his own Lunar Society, of which he preferred the second because it openly sought new connections across disciplines and who had control over those disciplines in order to discover new applications of scientific knowledge. Darwin and the Lunar Society wanted to spread their own scientific knowledge, rapidly and to new audiences; moreover, they wanted to gain new information from those new audiences. Therefore, anyone who became involved in this collection and application of knowledge was both embraced for their desire to learn and exploited for the new information and ways of thinking that they brought to the collaborative. Overall, the unification work of the Lunar Society served both themselves and the others who were on the fringe through the precipitation of knowledge.

Yet, to Darwin, this was an advantage. In *Temple*, he compares his unification work to that of Dr. Edmund Halley, who was an expert in geology as well as astronomy. Darwin does not seek to explain Halley's work, but merely mentions that the "ocean has decreased in quantity during the short time which human history has existed" and "the exertions of vegetable and animal life convert the fluid parts of the globe into solid ones" (Darwin, *Temple*, I, ll. 268n). This Darwinian explanation harks back to his simplicity that things are attracted to, repulsed by, or contracted together by the forces that exist throughout nature; however, given what was accessible to Darwin at this point in history, it is evident why he marks the point as a "curious conjecture . . . deserv[ing] of further investigation" (Darwin, *Temple*, I, ll. 268n.). Darwin's *Temple* is just as much a poem as it is a platform for Darwin to explain nature, as seen through his eyes and shaped by what he has read or encountered.

In addition to Darwin's reliance on Halley, Darwin freely used new, un-yet recognized terms and names for the scientific phenomena he referred to in *Temple*. These newly given names that were assigned by Linnaeus and Muller, names which Darwin drops in his notes in order to inform his reader about new discoveries. Using more elegant language than Linnaeus or Muller, Darwin paints a beautiful dance of the "moving specks," "living wheels," "undulating wires" and "invisible animalcules" (Darwin, *Temple*, I, ll.281-94). These first forms are, for Darwin, part of the "Spontaneous Vitality" that comprises life (Darwin, *Temple*, I, ll.290-310). Here, Darwin gives context to his diatribe on the connections of creatures great and small. In a similar fashion to Lucretius's *De Rerum Natura*, Darwin begins giving purpose to his woven story. Where Lucretius sought to contemplate and "suppose all sprang from all things" (Lucretius, *De Rerum Natura*, I, ll. 255), Darwin provided his readers with the knowledge and facts necessary to understand and trust that his own interconnected scientific explanation revealed the truth of nature.

However, it is for this self-same reason that Darwin's *Temple* is much more difficult to wade through, both for the scientist and for the interested layperson. Darwin includes "Imperious man" in his discussion of Nature; thus, by putting mankind as ruler of "the bestial crowd," Darwin clarified that it is humankind's duty to discuss and provide order to the truth of nature that had been revealed to the poem's speaker in the

Temple of Nature (Darwin, *Temple*, I, ll. 309-10). This paradox is best represented in the earlier lines 227-50, where Darwin first documented carefully his ideas on evolution.

> Ere Time began, from flaming Chaos hurl'd
> Rose the bright spheres, which form the circling world;
> Earths from each sun with quick explosions burst,
> And second planets issued from the first.
> Then, whilst the sea at their coeval birth,
> Surge over surge, involv'd the shoreless earth;
> Nurs'd by warm sun-beams in primeval caves
> Organic Life began beneath the waves. (Darwin, *Temple*, I, ll. 227-34)

In these lines, Darwin knew he had to pick his words carefully so as not to suggest more than what he meant to convey and not to limit himself to the lowest common denominator of what most readers might believe to be plausible. In this balance of detail and unity, Darwin explained that, "Ere Time began," "Chaos" was both "flaming" and caused an explosion that initiated a temporal event into a timeless context. Because Darwin began so early in the lineage of the earth, he grounded this theory in William Herschel's observation that Darwin notes himself in *The Botanic Garden* that "if these innumerable and immense suns thus rising out of Chaos are supposed to have thrown out their attendant planets by new explosions, as they ascended; and those their respective satellites, filling in a moment the immensity of space with light and motion, a grander idea cannot be conceived by the mind of man" (Darwin, *The Economy of Vegetation*, I, ll. 105n). This paradox of unity and detail comes at a junction of what would anachronistically be called the "Big Bang." Darwin's lines from *Temple* in conjunction with his explanation from *The Economy of Vegetation* from *The Botanic Garden* gives some context for why specificity had to be sacrificed to unity. In order to create a beautiful system from only the information he knew and could reasonably speculate from, he chose words carefully, but did not pay attention to the details of what "explosions" actually meant and where the "flaming" nature of this process stemmed from. Darwin wanted his readers to believe his perspective so much that he loaded *Temple* with enough explanatory notes to assuage a reader, but did not provide enough detail for any sage reader to truly believe in Darwin's connections; as a result, Darwin's work became increasingly saturated with another Romantic purpose: to connect the minutiae to the macro in this first Canto.

The pressure to adhere to modern standards of unity and detail breaks around line 365 where Darwin returns to contemplate the Egyptian hieroglyphics and their connection to the Eleusinian Mysteries, mentioned earlier in lines 137 and 76. By distracting his readers from the specifics of his "First Heat from chemic" discussion and how "Earths from each sun" were born, Darwin attempts to use the hieroglyphics and the Egyptian culture to encode his evolutionary explanations in an older time from which the pursuit of scientific knowledge was not recorded. The Egyptian strand became the answer to Darwin's problem because it gave Darwin the dichotomy of scientific method versus shared understanding. Darwin struggled with his elitist desire to adhere to the scientific method and the ethical imperative to share what he learned with others. The information Darwin and his fellow gentlemen-scientists of the Lunar Society were gathering was of value, not just to themselves, but to the entire community. It was their duty to communicate successfully what they had learned, just as the Egyptian hieroglyphics sought to document the scientific progress their own culture had gained in order to share it with others.

During these Egyptian-inspired lines, the poem's speaker returns to marvel at Dione, *Temple*'s guide, and to state that Egyptian scientific knowledge existed "'ere rose the science to record . . . chemic arts'" (Darwin, *Temple*, I, ll. 365-67). The poem continues to explain that the hieroglyphs justified the Egyptian quest of poets and painters "to give form and animation to abstracted ideas, as to those of strength and beauty" (Darwin, *Temple*, I, ll. 372n). Darwin's age was permeated by a desire to understand the lost scientific wisdom that many believed was located within the mystery of the hieroglyphics.[20] Dione, "the Nymph – The Muse," claims *Temple*'s speaker as the mediator of this newfound knowledge and bestows upon him the responsibility to share this knowledge (Darwin, *Temple*, I, ll. 379). Dione speaks "'Drawn by your pencil, by your hand unfurl'd, / Bright shines the tablet of the dawning world" and thus proclaims the speaker's knowledge sufficient enough to share with the world (Darwin, *Temple*, I, ll. 381-82). This speech from Dione allowed Darwin to endorse the idea of knowledge that could be "by your hand unfurl'd" to expose greater insight to the world around him. Darwin encouraged his reader to rediscover the lost knowledge that was still contained within nature.

After welcoming the speaker into the crowd, Dione and the other muses associated with nature enter once again to close the Canto with musings on the beauty of nature and the importance of life:

> First her sweet voice in plaintive accents chains
> The Muse's ear with fascinating strains;
> Reverts awhile to elemental strife,
> The change of form, and brevity of life;
> Then tells how potent Love with torch sublime

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[20] For more, see Martin Bernal, Chapter 3 of *Black Athena: The Afroasiatic Roots of Classical Civilization, Vol. I: The Fabrication of Ancient Greece, 1785-1985.*

> Relights the glimmering lamp, and conquers Time.
> — The polish'd walls reflect her rosy smiles,
> And sweet-ton'd echoes talk along the ailes. (Darwin, *Temple*, I, ll. 443-50)

This segment makes the speaker and other muses initiates, as this talk of echoes comes from Urania initially, allowing the reader and speaker to prepare for the second Canto's emotional stress on the transience of life, love and sexual reproduction's abilities to defeat time and morality, and the amplification of knowledge as the Eleusinian Mysteries' third scene of the torch procession is echoed in relighting of the lamp in lines 447-48.

The first Canto's intersection of Enlightenment science and the pantheons of Egypt, Greece, and Rome helped Darwin distinguish between the individual deities and what they represented in terms of categories of knowledge or modes of thought. These muses stood in for scientists of various disciplines; each deity had vast yet distinct knowledge of the natural world, but what Darwin seems to dwell on is their lack of cohesion that only the Romantic scientific mind could include so expansively because of the Romantics' reliance on beauty and aesthetics. As well as the rise of Romanticism in the 1790s, Darwin's involvement with the Lunar Society in Birmingham gave him access to scientists of a variety of specialties, and it is evident that this close partnership gave him and the others an advantage in the application of various fields of science to one another. This society also gave him the ability to see connections more easily across disciplines of science and bring their underlying connections to the forefront.

CREATIVITY AND DISCOVERY AND TRUTH IN CANTO II; THEN, THE MIND OF CANTO III

Part of the Romantic agenda was to bring to the forefront new means of understanding the roles of creation and discovery. The goal was to understand the world better through creative acts that led to discovery, which ranged from thinking of the world differently in new ways that had not been done before to compiling what was already known in new fashions. Erasmus Darwin's creative, new thinking of evolution likely came to him after being sent a number of curiosities (i.e. fossils) by Josiah Wedgwood after the excavation of the Harecastle canal tunnel in Shropshire. In a letter to Wedgwood, dated July 2, 1767, Darwin replied humorously that "the bone seems to be the third vertebra of the back of a camel and the impressions on some of the rocks appear to be those of ferns and irises," which obviously was nothing more than a joke (Darwin, *Letters*, 190). King-Hele notes that Darwin goes on in his letter to ask Wedgwood the strata in which the fossils were found, the thickness of each stratum at that point, and the order in which the fossils were found in the strata (King-Hele, *The Collected Letters of Erasmus Darwin*, 77). This letter exemplifies Darwin's interest in evolution at a time when many others sought new ways to dismiss any evidence through religion or politics, which means that it is a good sign to see Darwin's unusual humor in this letter.

Darwin's fascination with evolution was too much for the local community. After complaints by the clergy of Lichfield where Darwin practiced medicine and raised his young family, Darwin removed his carriage's motto *E conchis omnia*, translated as "all from shells," after the local rector Thomas Seward likened Dr. Erasmus Darwin to Epicurus and wrote "He too renounces his Creator, / And forms all sense from senseless matter . . .

/ O Doctor! change thy foolish motto, / Or keep it for some lady's grotto, / Else thy poor patients well may quake, / If thou no more canst mend and make" (Seward, "From atoms, in confusion hurl'd," ll. 23-34). However, Darwin was spurred on by these criticisms, especially when he grew older and more confident in his beliefs of evolution. It is this Darwin who is best speaks his theory of evolution in Canto II.

Canto II focuses on the reproduction of life by lamenting the shortness of life, affirming Darwin's old age and proximity to death. In fact, the well-read Darwin supplies the best reflection with his note to line 1, which is Hippocrates's introduction to his own aphorisms: "Life is short, science long, opportunities of knowledge rare, experiments fallacious, and reasoning difficult" (Darwin, *Temple*, II, ll. 1n). Darwin uses this Hippocratic quote to urge other scientists to join the quest for knowledge, despite its difficulties. Just like Darwin's other references to the Great Chain of Being, Darwin considers the accumulation of science and knowledge to be a worthy goal and a quest that extends far into the future.

Darwin's focus on the "long line of Being" instead of a fixed, vertical, hierarchical "great chain of being" becomes apparent in Canto II, lines 19-20. After a discussion of the connectivity of natural reproduction, Darwin takes advantage of French philosopher Julien Offray de la Mettrie's *L'Homme machine* (1747) not to help his audience understand that humans are not machines, but rather to divulge the inventions of the Lunar Society, which he lists within the poem from lines 21-30 of Canto II. Richard Lovell Edgeworth had invented a "robot caterpillar" and a "walking table" that was capable of transporting 40 people, while Darwin had constructed a spring-powered artificial bird and Matthew Boulton advanced thermometer design and precision (King-

Hele, *Erasmus Darwin: A Life of Unequalled Achievement*, 228, 81, 137-38, 49). Darwin's inclusion of other members of the Lunar Society in his poem on science sought to ratify its purpose and give support to the science shared within the society, elevating its status and garnering it additional attention. The diverse work of the Lunar Society also helped propel Darwin's understanding of evolution forward.

With similar words to *The Botanic Garden* or *Zoonomia*, Darwin's second canto more closely aligns his beliefs with his own understanding of evolution and evolutionary success that would be carried from generation to generation. In line 118, Darwin borrows from Plato's *Symposium* to imagine a world where the female sex had not yet been created and assumes that a hermaphroditic quadruped had the "potent wish in the productive hour" and "[c]alls to its aid Imagination's power." This simple comical statement from the character of Aristophanes brings to light what can and cannot be created or destroyed by the act of creation. In *The Symposium,* this creation acknowledges that this quadruped was in the perfect state, although, hilariously, it meant that the perfect state of human beings, as described by Aristophanes, was meant to cartwheel from place to place; but by splitting the pair, the progeny were made to be more like their creator and were taught to follow a code of conduct that defines humans' role as procreative — this is what Plato believes is Aristophanes's tragic interpretation of the story of creation. However, Darwin gave this story new life. Darwin used this story to justify why the universe could not have been created in a perfect state and also as a means to reconcile the perfect state of the quadruped with the present state of a biped; for because humans currently walk around as bipeds, it is assumed that both Plato and Darwin believed that their readers would acknowledge that the mobility of humans had changed over time. Darwin also acknowledges that creation stories are a part of every culture because there is a need for creation stories in human culture to inform and instruct the current state of the created world. For Darwin, his creative interpretation and reliance on older creation stories that he believed would compel human cultures to recognize a collective past that is outlined by science would be his way to reach a more general audience. Ultimately, by connecting his creation story within the *Temple of Nature* to another creation story in *The Symposium*, Darwin attracted authority and gained power for his new theory of evolution. However, as Darwin tells the creation story, it is evident that he has a different value system from Plato and even holds different things and ideas in higher regard than other members of his own culture.

By this phrase and connection to Plato's *Symposium* and Aristophanes's slight erratic suggestion of the process of creation, Darwin used the opportunity of these particular words and their connective counterparts to the *Symposium* to explain in his note that first progeny are formed in likeness, form, and feature to the imagination of the father, endowing the male of the species with the ability to carry its traits forward without the assistance of the female sex. Darwin's work here aligned his theory of evolution again with theories that had been presented before, but perhaps in less than serious contexts. After this consideration, Darwin introduces his reader to the Creation of Eve, "the Mother of Mankind" (Darwin, *Temple*, II, ll. 140). Typical of a physician with a health-conscious mind for the world, Darwin ushers Eve into the world with warnings of disease and odd notations about pear trees that had been engrafted for over a century that they had become diseased and unable to produce fruit. While this may or may not have been an argument against inbreeding, Darwin seems to have recognized the importance of choosing a mate that does not possess hereditary diseases; thus, Darwin's unusually connective mind showed the value in exposing the critical knowledge that can be gained from crossover conversation between human sexual reproduction and that of plants.

While Darwin is ostensibly discussing the sexual reproduction of plants, the conversation also serves as a sexual education for the Romantic reader, who might not have any other access to scientific description of the nature of sexual reproduction of other species. In his descriptions of mating, Darwin cautioned that the "birds, which do not carry food to their young, and do not therefore marry, are armed with spurs for the purpose of fighting for the exclusive possession of the females, as cocks and quails" (Darwin, *Temple*, II, ll. 321n). Darwin had a great deal of knowledge about the sexual reproduction of plants and animals, so much so that he knew how a bird grew and then hatched from an egg, explaining how there is a small air pocket in an egg that allows the chick to break the "air-bag with its beak, and thence begin to breathe and to chirp" signaling its entrance into the world (Darwin, *Temple*, II, ll. 351n). Echoing the *Loves of the Plants* more so than any other previous work, Canto II blends sexual reproduction and love with examples of flora and fauna. Yet, for the all the beauty of sexual reproduction and its balances and harmony, Darwin ends Canto II quite quickly on notes of the muses' commentary on the biblical flood and "terrestrial food" (Darwin, *Temple*, II, ll. 456).

Darwin used Canto II to justify the necessary creative elements that needed to accompany any understanding of the evolutionary process, as it pertains to humans. Not only does Darwin's reader need to be creative, but this reader would also have had to draw on vast perspectives on knowledge, attempting to see through Darwin's evolutionary theories as they pertain to seemingly everything under the sun. In order to truly believe Darwin's theories of evolution for human development as well, this required a stretch of the imagination, which he provided room to stretch through a consideration of both Egyptian hieroglyphs and their knowledge that may have been lost to the ages in Canto I as well as the Greek perspectives of human creation through Plato's presentation of Aristophanes's theory in *The Symposium*. My argument is that Darwin knew his audience well enough to know that he needed to present evolution in context with older theories and ideas in order for the idea to gain any traction from his more general audience. He wanted to educate others about the explanatory power that science had for giving structure to the world. I argue that Darwin knew science had the potential to act as a cognitive system to provide strong and significant ties between institutions and ideas in the eighteenth century. Darwin urged more individuals to learn about science through his poems so that more individuals would become involved in the process of producing new scientific discoveries through the cogent, cohesive institutional movement that shaped the many scientific societies in which most people learned about science and were urged to conduct more scientific experiments. Darwin's connective mind wanted to see everyone else enraptured by the promise of connections through science. I interpret Darwin's intent on reaching a broader audience to indicate that he believed the future of scientific information lay in the necessity of more people becoming involved in the scientific process and the creative thought that had to accompany it. Darwin's appreciation of the mind is clear in the encouragement he gave in the unique ways that he wrote about experiencing the world and putting it into its proper scientific contexts.

Thus, Canto III on the "Progress of the Mind" begins just as Canto II ended with two muses conducting scientific experiments from lines 1-34. These experiments range from chemistry to optics to electricity to magnetism, gravity, and heat before reconsidering the first Canto's mythical, mysterious creation of life in new scientific forms. The first is his chemistry-based observation about the gaseous mixtures of oxygen, "azote-gas" (or nitrogen), and hydrogen and how, when mixed, "[f]orms the wide waves, which foam and roll below" (Darwin, *Temple*, III, ll. 13-15, 16). Darwin's poetry on optics grows most beautiful in its description, scope, and fascination as he describes the ways light can be manipulated through a prism to show the seven colors of a rainbow, "the sevenfold threads of light" in line 18, or focused into "one bright point" in line 20, like a child playing with sunlight through a magnifying glass to burn ants by focusing the sun's parallel rays into a spot. Darwin's fascination with the energy in sunlight and his wildly connective imagination allows him to jump seamlessly to the topic of static electricity, pondering various scientists' concepts that electricity exists as "two kinds of fluids diffused together or combined" that, Darwin explains, give off a positive or negative charge (Darwin, *Temple*, III, ll. 21). Darwin's nod to magnetism is more subtle because he only briefly considers the effect of the "poles opposing" on a compass's needle, indicating his lack of understanding of the Earth's magnetic forces at work that caused a suspended, free-moving needle to move with the magnetic forces of the Earth (Darwin, *Temple*, III, ll. 27). Yet he views magnetism and gravity as two separate forces, although he considers gravity to be an "attractive ether" and heat a "repulsive ether" in his note to line 21, which indicates that his purpose is not simply to consider the science behind the workings of nature, but rather to hone in on the way these two forces worked together to produce life in Canto I and evolutionarily shape it into humankind with the correlating feature of the mind (Darwin, *Temple*, III, ll. 21n).

How Darwin's mind worked is just as powerful a study as the scientific concepts he commented on. Darwin's speaker converses with Urania about how humans even know such things, and she indicates that knowledge comes from feeling and the other human senses so that, more than anything else, humans can grow to understand ourselves, which she remarks upon with indignation in line 48: humankind "'weighs and measures all things but himself!'" Urania seems to give Darwin a new means to study nature in the instruction to study humankind itself. With the "piles immense of human science," Urania wants Darwin to look closer at his own humanity and consider the material developments of the mind, as well as the evolutionary developments, that progressed humankind so far. Urania's focus argues for a more materialistic, less human-centered view of the world, one that piques Darwin's curiosity.

Just as materialism was the primary focus in *Zoonomia*, Darwin chose to divide all physical and mental responses of the brain into four categories of irritation, sensation, volition, and association in *Temple of Nature*'s lines 55-92. These lines allow Darwin to make the neurological connection of the mind's ability to make the body act in particularly human ways, i.e. the way humans think and interact with the world around them. And while Darwin chooses to focus on the four categories of brain response, he also uses this section to discuss the importance of humankind's opposable thumb as a distinguishing factor from other animals (Darwin, *Temple*, III, ll. 122). Just as much as he wanted to prove the humanness of the mind, he wants to separate humankind from animals, but keep both encompassed in the physical building of the Temple of Nature, showing that both belonged to the overarching world of Nature. Darwin's description of humans' mental powers are a good analogue for how his own poetic creativity happened.

By providing this discussion on the mind, it is quite likely that Darwin simply recorded how his own mind functioned creatively and connectively. Darwin's interest in the mind's role in poetry and thought helped him give context to creative scientific interpretations. However, Darwin's thoughts tend to wander most in this Canto because he considers new evidence to support his argument in poetic ways, making scientific observations poetic truths and constructing the nature's true form from that base. The wandering nature of this segment helps the reader get a glimpse of how Darwin's own mind worked, both in its connectivity as well as its consideration of the validity of new ideas in context of older ones, giving him the knowledge of how to break old systems of knowledge and forge new ones. However, Darwin himself is not the only one he ascribes this power to. The muse of the poem also gets lost in thought about how the world connects for her and how it is seen as connecting for others.

The muse or speaker of the poem seems to be caught in the same quest. In line 81, the speaker considers "each passing moment" a chance to "compare the passing trains of our ideas with the known systems of nature, and reject those which are incongruous with it" (Darwin, *Temple,* III, ll. 81, 81n).[21] Not only are these passing moments new opportunities to connect newly formed knowledge to vast stores of old knowledge, but the chance for new associations to come to the thinker. These new associations come through comparisons of the similarities between humans with animals, which was an

[21] This idea is also explored in Darwin's *Zoonomia,* Section XVII. 3, ll. 7 where Darwin terms it "Intuitive Analogy." The distinct use of "intuitive" here brings up the dichotomy of intuitive and discursive, where intuitive things are naturally accessible by humans and discursive things take time, effort, and concentration to understand, much like the sentiment of Hippocrates's quote that Darwin used above in Canto II.

irreverent comparison to make in Darwin's day because it was considered to be irreligious and insulting to the mainstream Christians. Urania declares:

> Proud Man alone in wailing weakness born,
> No horns protect him, and no plumes adorn;
> No finer power of nostril, ear, or eye,
> Teach the young Reasoner to pursue or fly. —
> Nerved with fine touch above the bestial throngs,
> The hand, first gift of Heaven! to man belongs. (Darwin, *Temple*, III, ll. 117-22).

Here, Urania chooses to show the reader and poet's speaker the animal instincts that humans lack, showing the connective ambiguity that Darwin seems to possess on the subject of the superiority of humankind to all other animals. Urania's speech seems to elevate the variations across each individual species to larger indications of variety in "Nature's *form*" as Darwin so aptly highlights with italics (Darwin, *Temple*, III, ll. 130). These varieties allow Darwin to consider how humans truly perceive and experience their surroundings through the mind.

SAMUEL TAYLOR COLERIDGE AND MATERIALIST IDEOLOGY

By considering how the mind forms images of the world in lines 131-62, Darwin entered into a conversation that had long piqued the interest of Samuel Taylor Coleridge. Darwin entered into a problem stated by Locke and Hobbes's first discussions during the Enlightenment about the mind itself. Locke states that most, yet not all, of our ideas are linked to sensory experiences, thus simpler ideas better resemble the sensing activities they were initially taken from; and as such products of a direct interaction of the mind with its environment, the more clear and reliable they prove in recollection. Locke also implicitly entertains the idea of the mind as more like an eye because of Locke's own ability to remember things via images, rather than words, spatial location, or other forms. Samuel Taylor Coleridge was influenced by Hobbes's interpretation of the mind as a faculty for storing and producing images in the mind from the use of the senses and the act of storing these images in the mind. For all Hobbes's contributions to the Enlightenment, Coleridge and Darwin each departed from this Hobbesian/Enlightenment-based perception that the "imagination is nothing but decaying sense" (Hobbes 3). For Coleridge, the mind is a powerful faculty and the word "mind" actually refers to the physical space where mental flexibility and fluidity occur, expressing meaning in conjunction with intentionality.

In order to best understand this conversation through Darwin's mind, it is necessary to turn toward Coleridge's similarly minded perspective on the conversation in order to gain perspective. Coleridge is also known for his vastly connective mind, which allowed him to think so expansively. This expansive mind encouraged him to hunt down knowledge in all forms. Luckily for him, knowledge was readily available at the time that, as E. J. Holmyard noted in *The History of Technology, Vol. 2*, "any educated man [of the Romantic Age] with dexterous fingers could acquire without difficulty a sufficient command of the subject [of natural philosophy] to experience the thrill of standing at the threshold of the unknown" (244). This comment and the integration of Coleridge's place among other intellectually curious individuals emphasizes a particular characteristic of the Romantics: science was popular among all thinking people, and those interested not only in the natural world but also in the future of English society. Forward propulsion of science was cheered on by many of Darwin and Coleridge's contemporaries; and slowly, the elitism of science wore off as it was realized that the study of science was not as complicated or specialized to put off anyone who was interested in science.

Coleridge's interest came largely from Humphry Davy's popularizing efforts. Davy took the time to dazzle his audiences, which Coleridge was usually a part of, and elevate the goals of chemistry without adhering to the gentleman-scientist's esoteric language. Kathleen Coburn notes in "Coleridge: A Bridge between Science and Poetry" that Coleridge and science are "characterized by an imaginative faculty in looking at the specific in their field of vision, and also at the wider ranges of more general and complex human considerations" (Coburn 81). Throughout her article, she corrects the misconception that Coleridge was anti-science. She points to Coleridge's well-documented friendship with Humphry Davy, stating that the two "found common ground in a passionate desire to carry further the Newtonian picture of the grand design of nature and also in the conviction that, by the grace of God, the new revolutionary humanitarianism blowing over from France, and by the critical philosophy from Germany, and by the literary and moral purgation going on in the return to naturalness in English poetry, men's lives were going to be transformed" (Coburn 83). Coburn contextualizes the optimism shared by Coleridge and Davy and the way they saw the world revolutionizing itself. This revolution came from the cross-cultural expansion and exploration that Coleridge and others ventured to expand. In fact, Erasmus Darwin was right at the heart of this revolution, as he was both poet and scientist, whereas Davy and Coleridge were a scientist and a poet respectively.

Coleridge's role in the scientific revolution is tenuous, yet ultimately is included in any discussion of the spread and popularization of scientific knowledge, as his relationship with Davy proves their interdependence with one another. Coburn makes an observation from a short section of Davy's biography, written by John Ayrton Paris, that involved a scientific moment that shed light onto Coleridge's true interactions with science. Coburn writes about one story in particular in order to exemplify Davy's reliance on Coleridge:

> A paralysed patient had been encouraged to believe in the success of Davy's nitrous oxide treatment. Coleridge was present when Davy, as part of the examination, put a thermometer under the man's tongue. Thinking that the treatment had begun, the man enthusiastically acclaimed the good effects all over his body. Davy, throwing a meaningful glance at Coleridge, told the chap to return tomorrow. After about a fortnight's treatment of thermometer-under-tongue, the patient was dismissed cured. Now Coleridge was always interested in what we should now call psychosomatic illnesses, in delusion of all kinds, as phenomena. Indeed, coining the word, he said there should be a science of psycho-somatology. (Coburn 85)

Coleridge writes about this "psycho-somatology" in his own letters in an effort to explore the control the imagination has over the physical body (Coleridge, *Letters*, 1, 557). Coleridge's vast store of notebooks and letters indicates Coleridge's vivid interest and legitimate participation in Davy's work. In fact, Coleridge even considered his scientific suggestions to Davy to be worthy of consideration by the chemist and his world: "So I hoped it would have been when Sir H. Davy adopted my suggestion that all Composition consisted in the Balance of opposing Energies" (Coleridge, *Letters*, 1, 438). Coleridge's imagination is what allowed him to become a good conversationalist with Davy and other scientists, even commenting on Joseph Cottle, publisher of *Lyrical Ballads*, in another notebook, to state the elemental composition of his dear friend and object of Coleridge's sillier side, which served to lighten up and expand further Coleridge's perceptions of chemistry (Coleridge, *Notebooks*, Vol 1. 24, 59). And it is clear from his notebooks that

Coleridge's puns, metaphors, and jokes were his attempts to learn chemistry, especially its mode of thought and results. These documented thought patterns gave Coleridge a means to compare how others thought and imagined the psychological connections. Davy and Coleridge's friendship helps us appreciate the rivalry that was developing between people of science and letters — for both dealt in what Davy's brother John called "objects of contemplation," both aspired to present "pure and independent sources of amusement and gratification" (J. Davy, *Memoir*, I. 153-54). Humphry Davy, perhaps because of to his association with Coleridge, was able to read his audience well when he declared to them that science could be a "source of consolation and happiness [that would help] the different orders and classes of men . . . contribute more effectually to the support of each other than they have hitherto done," and that ultimately the study of natural philosophy could unite a people through common reverence for life, the natural world (Davy, *Works*, II, 322, 326). Davy's imagination bestowed on science the ability to heal the divisions of humankind and unite them under a new standard of service to science.

Yet science was not the only new mode of instruction. For as much as they were friends, Coleridge still asserted his own form of intelligence as best when he defended poetry. Coleridge noted that the benevolent service of poets "brings the whole soul of man into activity [and] diffuses a tone, and spirit of unity" (Jackson 319). Like Davy, Coleridge understood that one of the central purposes of a thinking person in their age was to be, as he stated in the *Biographia Literaria*, "the instruction or refinement of his fellow citizens" (Jackson 179). And as the public's teachers, Coleridge believed, men of learning, science, and letters all should inquire into "those connections of things, or relative bearings of fact to fact, from which some more or less general law is deducible. For facts are valuable as they lead to the discovery of the indwelling law, which is the true being of things, and sole solution of their modes of existence, and in the knowledge of which consists our dignity and our power" (Jackson 342). Yet what is fascinating is that, in a 1809 geological lecture, Davy noted that the explanation of the natural laws can only be obtained by the "exertion of all the faculties of the mind; . . . the imagination, the memory, and the reason, are perhaps equally essential to the development of great and important truths" (Davy, *Works*, VIII, 354). Moreover, Davy also noted that he considered the "diffusion of knowledge [to be] the grand privilege of human nature" (Davy, *Works*, VIII, 354). These similarities in how people of science and people of letters in the Romantic Age viewed and expressed their purposes were no accident, for both groups operated in an essentially creative intellectual capacity and were vying for the attention of the same audience, an audience who desperately wanted answers to a growing list of questions about the world around them. By comparing Coleridge and Davy with Darwin, I advance my argument that the relationship between poets and scientists was more complicated; yet I think a stronger conclusion can be formed from the relationship of Coleridge and Darwin.

To consider further the disparate roles of poet and scientist, I will consider Coleridge and Darwin, as they both suffered from generalities and the unavoidable need to over-connect the world through the expanse of the imagination; yet they both made observations that were very practical and possessed a curiosity that was often specific. Darwin, like Coleridge, wanted to use the flexibility of his imagination to search for the laws of nature, just as Coleridge sought for the laws of poetry, drama, literature, and art.

Coleridge's description in the *Biographia Literaria* of the imagination derives its vitality and strength form the fact that, although he is talking about the nature of poetry, he might as well be discussing Davy's chemistry or Darwin's flora and fauna observations, especially because it is evident that Coleridge and Darwin both saw experimental science and the use of the imagination as a kind of poetry of the natural world. For Coleridge, the prime function of poetry is the connective act of reconciliation of observations and truths of the natural world; this then allows for the poet to pursue the ability to reconcile the abstract speculative views of practical nature with the practical observations of daily life. This pursuit results in a doubling of the universal and particular connections that constitute truth, both scientific and poetic, bringing to bear the similarities of the creative forces that inspire both poetry and science. Ultimately, for Coleridge and seemingly for Darwin, the poem needed to be a living organism, a two-way dynamo of reconciliation of all things imaginable and yet-unimaginable. This activity of the mind allowed for the exploration of scientific knowledge and the creation of poetry and created a unity of their endeavors; regardless of field or discipline, it is necessary for the human mind to be capable of exploration, inquiry, imagination, creativity in order to affect the way we all think about life and the way we live life.

While Darwin focuses on the scientific aspect of seeing and experiencing, pondering how the mind physically worked, Coleridge added to the scientific pursuit by considering how the imagination functioned in this role as go-between for the universal and particular connectivity. In *Biographia Literaria*, Coleridge proclaims the distinction of the imagination to be Primary and Secondary. The Primary Imagination is "the living Power and prime Agent of all human Perception, and as a repetition in the finite mind of the eternal act of creation in the infinite I AM" (Coleridge 325). Coleridge determined this is where perception takes place with the active areas of the mind; for Coleridge, it was the access to the divine. Yet, if given the chance to respond, Darwin would have called the Primary Imagination the mechanical responses and senses that the body produces. Thus, the Secondary Imagination for Coleridge is "an echo of the former, co-existing with the conscious will, yet still as identical with the primary in the *kind* of its agency, and differing only in *degree*, and in the *mode* of its operation" but still possessing the ability to unify the external world to the imagination (Coleridge 325). The Secondary Imagination is once removed from the Primary and is commonly referred to as an echo of the Primary. Coleridge notes that the Secondary Imagination can be more powerful because it has the ability to create the conscious will. For Coleridge, then, the imagination is not a special faculty cultivated by poets and readers of poetry or even observers of nature, it is simply life coming to consciousness.

This is what Darwin was missing — the consciousness or psychological aspect of the mind that Coleridge possessed and wielded so well — that which cannot be "*recognized by sight*" (Darwin, *Temple*, III, ll. 220). In only considering the physical aspect of the nerves in *Temple*, he was not able to comprehend the vastness and interconnectedness of the mind when he explained the process of sight and memory of an image in the mind with the words: light "[b]ends to their focal point the rays that swerve, / And paints the living image on the nerve" (Darwin, *Temple*, III, ll. 137-38).[22] Without more than observational knowledge, Darwin attempted to discern the material reality of how vision, sight, and the process of thought occurred.

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[22] There are more connections in the brain than there are stars in the known universe.

And while Darwin did not consider the psychological aspect of the mind, he did consider strongly the similarities of the "stimulated part of the retina" and "the visible figure of the whole in miniature" in order to examine the process by which we "instantly recall the tangible figures" (Darwin, *Temple*, III, ll. 131n). In this note, Darwin also directs his reader's attention to Bishop Berkeley's *An Essay Towards a New Theory of Vision* (1709). An Anglo-Irish Anglican bishop of the Church of Ireland and documented writer on the subject of metaphysics, Berkeley published his first work as an empirical account of the perception of distance, magnitude, and figure, and its objective was "to shew the manner wherein we perceive by sight the distance, magnitude, and situation of objects. Also to consider the difference there is betwixt the ideas of sight and touch, and whether there be any idea common to both senses" (Berkeley pp. 1). Darwin's goal resembled Berkeley's more than Coleridge's, although Berkeley and Coleridge shared the intent to ponder the metaphysical understanding of the mind where Darwin did not. Berkeley assumed that touch could provide immediate access to the world; yet visual ideas of an object vary with one's distance from the object, both literally and socially, implying that ordinary objects are composed of ideas. Berkeley's later works provide fodder for Darwin's love of interconnected things, showing that Darwin appreciated Berkeley's worldview, as Berkeley explains how an individual "collects" the ideas of distinct senses to form one thing in the mind (Berkeley pp. 43). Coleridge's distinction of the Primary and Secondary Imagination stems directly from Berkeley's distinction of the mind's qualities, which makes Darwin's *Temple* an even odder descendant because he seems to overlook that mental distinction, preferring to consider the variations and similarities across all senses than the internal dissection of one sense (Berkeley pp. 43, 48-49, 61).

Darwin's desire to connect all the senses, and seemingly all of nature, is reflected in the beautifully compassionate writing style and conversation he engaged with throughout his text. Darwin wanted to engage in a cross-nature dialogue about how everything is connected across space, time, and nature. While this is not exactly a sustainable conversation, as it is impossible to converse about all of nature's connections and cross-connections, Darwin seemed to believe these connections truly exist. Darwin has been proven right in some cases, as micro-technologies operate on minute levels of their macro counterparts and the neural networks of the brain echo water movement across the land. To find resonance in earlier works in other disciplines, it is clear that even Plato and Euclid in fifth and fourth century B.C.E. Greece, respectively, held the Golden Ratio ($\sqrt{(5+1)}\ \div 2$) to be a higher standard of beauty across nature and believed it to be a subject of useful discourse about nature. The Golden Ratio gave concrete means to talk collectively about the world around them, meaning that thinkers could speak in terms understandable by others about the Golden Ratio's naturally evident phenomena in flower petals, cauliflower, hurricanes, the human female uterus, and the DNA molecule. Then, the thirteenth century mathematician, Leonardo Bonacci — more commonly known as Fibonacci — pointed out the use of the Fibonacci sequence ($a_n = a_{n-1} + a_{n-2}$) to determine what is needed to create or build something that approximated the Golden Ratio, a more poignant example of which for the modern reader is the size of a credit card; yet, it is also present in ancient Sanskrit poetry, and the structure of Vergil's *Aeneid*.[23]

Darwin attempted the same mental work as these three mathematicians; he sought to define a common language that gave him access to the commonalities of the world around; however, instead of doing it as a mathematician and using the language of math, he attempted to do it in English and in a poetic device of "fanciful personification as at once outmoded and heartlessly frivolous" (Priestman 2). While Darwin's poetry certainly met that criterion, it was intended to show, not tell his readers the interconnectedness of nature. As Anna Seward puts it in her *Life of Erasmus Darwin*, "he seldom mixes with the picturesque the (as it is term in criticism) *moral epithet*, meaning that quality of the thing mentioned, which pertains more to the mind, or the heart, than to the eye" (Seward 174). The desire to show the interconnectedness of nature through his poem in most successful in Cantos III-IV, which is a sign that Darwin was trying to make an accessible principle doubly accessible through a vast range of examples.

After a long diatribe on the aesthetics of beauty and Hogarth's analysis of beauty and taste, Darwin moves to discuss "Nature unchastised" (Darwin, *Temple*, III, ll. 258). Darwin laments that the "fields are ploughed, the meadows mown, the shrubs planted in rows for hedges, the trees deprived of their lower branches, and the animals, as horses, dogs, and sheep, are mutilated in respect to their tails or ears;" so that when the reader encounters "undisguised nature," there is a certain "charm of novelty" that the shock of

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[23] The Golden Ratio of a credit card can be determined by; Sanskrit poetry's adherence to the Golden Ratio was first recorded by Acarya Hemacandra around 1150-1170 CE; and, more on the Golden Ratio of Vergil's *Aeneid* can be found in Martin Gardner's chapter "Fibonacci and Lucas Numbers" in *Mathematical Circus* published by the Mathematical Association of America in 1996 or George Eckel Duckworth's 1962 book *Structural Patterns and Proportions in Virgil's* Aeneid*: A Study in Mathematical Composition*. (Ann Arbor, MI: U of Michigan P, 1962).

nature's true form conveys (Darwin, *Temple*, III, ll. 258n). The "charm" in "undisguised nature" is what Darwin sees in the engineering feats and scientific marvels that occurred in his time, particularly in regard to the environment around him. The enchantment of nature, Darwin argues, only comes from its comparison with the changes that humans have wrought on the environment, such as land reclamation from the water in Holland that was occurring around this time or the ha-has that were so popular in eighteenth century England where trenches, instead of fences, were built to keep animals corralled so that the countryside view from the manor could be seemingly as "natural" as possible. This ideology of molding the land to make it appear more natural than its current state is as intriguing as it is complicated; for it seems that improving the natural world through invention was, in fact, the motivating factor that drove Darwin and his friends from the Lunar Society of Birmingham toward inventing. So, in light of Darwin's turning away from direct modification of nature's plants and animals, perhaps Darwin's advice here is caution not to extend too far with human modifications of nature? Perhaps Darwin's fascination with nature indicates amusement with "greater variety of form" in nature than in human creation, despite human involvement with genetic modification through grafting apple trees,[24] breeding roses, or crossing pea plants had already been

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[24] Greek (Pseudo Hippocrates, a follower of Hippocrates, wrote *On the Nature of the Child* in 424 BCE and Theophrastus, a student of Aristotle and widely considered father of botany, wrote that "propagation [of one tree] in another tree" occurred through grafting) and Roman (Marcus Porcius Cato, an agriculturalist and early Latin writer, explained that grafting and layering of fruit crops could produce new speices of fruit in c.180 BCE in *De Agri Cultura*) sources indicated that grafting was well-known and widely practiced throughout the Mediterranean by the fifth century BCE. So much so that by the eighteenth century, practical advice on grafting was a common, widely accepted theme of gardening books. The sixteenth edition of *The Gardeners Kalendar* by Philip Miller in 1775 had fourteen references to grafting tasks that needed to be scheduled throughout the year. The text Darwin references in his note is from Thomas Andrew Knight's 1795 paper to the Royal Society, *Observations on the Grafting of Tree*.

demonstrated to create more sustainable, reliable diversity (Mudge, et al. 438, 453, 457, 468).

Darwin's consideration of the human intervention in nature occurs in Canto II, as well, where Darwin mentions that the "grafted trees with shadowy summits rise, / Spread their fair blossoms, and perfume the skies" (Darwin, *Temple*, II, ll. 167-68). Darwin seems to be split on where to place the blame for unhealthy vegetation. Here, he states Knight's observations that the "diseases of potatoes attended with the curled leaf" and "strawberry plants attended with barren flowers" owe their sad existence to "having been too long raised from roots, or by solitary reproduction, and not from seeds, or sexual reproduction" (Darwin, *Temple*, II, ll. 167n). Thus, it is here that Darwin creates the binary: natural, sexual reproduction = good, unnatural, grafting = bad. In this binary, Darwin sides with the natural course of the world, one which he believes to be a product of evolution and natural progress toward something better. Darwin seems to believe that the best form of nature is nature left alone.

Next, Darwin provides a vast consideration of humankind's ability to reason, which is where I argue that he makes the best argument for the application of rationality toward science, which helps him build to the final idea of Canto III: "REASON'S empire" (Darwin, *Temple*, III, ll. 401). In this twelfth to last stanza, Darwin considers the "use of voluntary power" by humans, which he explains comes from advanced human senses that "distinguishes man from brutes, and has given him the empire of the world, with the power of improving nature by the exertions of art" (Darwin, *Temple*, III, ll. 401n). Thus, it becomes clear that Darwin's ideology, espoused by the idea that nature can and should be improved on, comes with some limitations, mainly that these changes should only occur when they are the result of "exertions of art" in the quest for refined beauty and taste and through which "All human science worth the name imparts, / And builds on Nature's base the works of Arts" (Darwin, *Temple*, III, ll. 409-10). Thus, this is what separates humankind from animals: humans have the capability to use language — for Darwin, "the *means*" necessary — to rationalize the world around them and thereby build a better future through the accumulation and dissemination of knowledge through written and spoken language (Darwin, *Temple*, III, ll. 438).

Darwin's elitist status as a gentleman-scientist approaching a new age of science made him see that the capability of making connections was not his alone, but rather all humans possessed unique contributable value to the pursuit of scientific knowledge, thought, and development. This capability of making connections and thought is the same that gives humans access to happiness, which is Darwin's final maxim, "High on yon scroll, inscribed o'er Nature's shrine, / Live in bright characters the words divine" that echoes the Biblical maxim's somewhat self-same phrasing: "'IN LIFE'S DISASTROUS SCENES TO OTHERS DO, / WHAT YOU WOULD WISH BY OTHERS DONE TO YOU'" (*Temple*, III, ll. 484-87). This demonstrative moral echoes Blake's "Songs of Innocence" in the simplicity with which Darwin seems confident enough to answer the problems of the world. In this penultimate stanza, Darwin states that humankind would be much better off if this maxim was "sincerely obeyed by all nations" and "would a thousandfold multiply the present happiness of the mankind" (Darwin, *Temple*, III, ll. 485n). Darwin's lack of innocence and possible *Weltzschmerz* after 70 plus years on earth at the time of writing *Temple* would seemingly make it impossible for him to deliver such an innocent solution to the vast problem of the world's happiness. Yet, he does it anyway, asking the kings and nations of the world to hear it and “obey!” (Darwin, *Temple*, III, ll. 490). After this poignant delivery of the importance of happiness to humankind, Darwin’s third canto reaches its close in a simple hug of Peace by Virtue. This simplicity consolidates Darwin’s position as author of *The Temple of Nature*. His life was consumed with seeking out new knowledge, applying it to new purposes, and determining new places to look for the connectivity he knew existed in the world. The simplicity of Erasmus Darwin’s theory of evolution allowed Darwin’s last great work its own legacy.

CANTO IV AND THE *TEMPLE*’S SIGNIFICANCE FOR FUTURE READERS OF THE POEM

Throughout all of *Temple of Nature,* but especially in Canto IV, Erasmus Darwin’s exuberant responsiveness and desire to connect with the expansiveness of the natural world allowed him to connect across time to future scientists. With his shrewd recognition that analogy and association are necessary to declare key truths about the connections across all forms of life, Darwin showed that there was knowledge extensively invaluable locked within the interconnectedness of nature. Martin Priestman notes that the poem’s four cantos and extensive annotations deliver “a great deal of the hard knowledge, speculative brilliance, and poetic daring of previous works in verse and prose which had in their turn greatly influenced Blake, Wordsworth, Coleridge, and many others” (Priestman 1).[25] *Temple* offered future readers, especially Darwin’s own grandson Charles Darwin, a full expansive landscape for thought, hinting at the existence of a

[25] Debts which have only truly been acknowledged by the scholarly community after Desmond King-Hele’s 1986 work *Erasmus Darwin and the Romantic Poets*. Even though Coleridge claimed in his *Biographia Literaria* that “I absolutely nauseate Darwin’s poem [*The Botanic Garden*]” and his work is heavily influenced by Darwin’s ideas, both in agreement and as a point of differentiation (qtd. in King-Hele, Desmond. *Erasmus Darwin: A Life of Unequalled Achievement*. 103-19. And, Ian Wylie’s “Coleridge and the Lunaticks.”

system of evolution that needed future scientists to collect evidence and establish on their own terms and in a different social landscape. Darwin's legacy lived through what *The Temple of Nature* offered to future pursuits of science.

In Canto IV, "OF GOOD AND EVIL," instead of Urania, the poem's muse frames the spoken introduction. The Muse praises that "—Blest is the Sage, who learn'd in Nature's laws / With nice distinction marks effect and cause" (Darwin, *Temple*, IV, ll. 7-8). This blessing is paired with a note to line 7 that states Vergil's *Georgics*, II, 490-92: "Blessed is he whose mind had power to probe / The causes of things and trample underfoot / All terrors and inexorable fate / And the clamor of devouring Acheron." These Latin lines are commonly recognized as Vergil's tribute to Lucretius's *De Rerum Natura* plus his work on the accumulation of scientific knowledge that was done without fear of earthly criticism or the influence of scientific knowledge on nature of the afterlife. Thus, despite local arguments throughout the entire poem with Lucretius on whether the universe was formed from atoms by chance or through the inevitable result of natural laws, Darwin universally labels himself a Lucretian scientist-poet.[26]

After establishing himself as a Lucretian, Darwin sinks into a tirade about the importance of the interconnectedness of flora and fauna in the world, mimicking today's crisis of the loss of honeybees in the natural environment that has caused tremendous havoc throughout all crops and the nature of growth. It is not until line 67 that the poem's Muse returns to ponder the miseries of humankind that are simply more important that the natural realm: "THE brow of Man erect, with thought elate" (Darwin, *Temple*, IV, ll. 67). This line and the ones that follow (ll. 67-108) carry with them the evolutionary

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[26] For additional context on this issue, see Farley, J. *The Spontaneous Generation Controversy from Descartes to Oparin*.

implication of being elated upwards through the capacity of thought into an erect position where our minds sit aloft the rest of our physical bodies. The Muse meditates on the range of human nature to become involved in the allure of the Seven Deadly Sins, as the Muse lists and contemplates each: Greed, line 77; Avarice, line 97; Pride, 103; Sloth, 79; Anger, 89; Lust, line 81; Envy, line 105-08. This reference to the Seven Deadly Sins helped Darwin frame the nature of good and evil.

To provide context within this summary, religion in the close of the eighteenth century was dominated by eschatological concerns. Yet this approach is different from the common preachers' approach in those days. Darwin notes in line 87 that "[m]any theatric preachers among the Methodists successfully inculcate the fear of death and of Hell, and . . . [the people] dare not reason about those things, which they are directed by their priests to believe. Where this intellectual cowardice is great, the voice of reason is ineffectual" (Darwin, *Temple*, IV, ll. 87). Darwin's dislike of religion's proscribed binaries stems from the Methodistical presentation of evil in the world. Such "evil" derives from what Darwin calls the senses of irritation, sensation, volition, and association and from where Darwin calls the "extremities of the nerves of sense," placing the evilness of humankind off in the greatly exerted senses of our human bodies (Darwin, *Temple*, IV, ll. 93n). Darwin seems to believe that evil stems from the improper association of ideas.

Yet, after reflecting upon the contributions of the categories of the Seven Deadly Sins, the Muse begins to contemplate the natural evils of disease and natural disasters. The distinction of evils that can be carried by humankind and those that must be overlooked gives *Temple* a more kind approach in the suggestion that, as humans, we must learn to forgive each other. Somehow, however, the forgiveness comes through the way we teach others. He offers forgiveness as a means to come to terms with previous treatments of women, or perhaps his own personal treatment of women as he specifically wrote for his two illegitimate daughters, through a note that encourages the reader to look into his *Plan for the Conduct of Female Education* where Darwin explains how women must be educated in mind, body, and soul. Darwin built, what he deemed to be, appropriate plan of female education out of his other works, such as *Zoonomia*, where he states that the children have to learn to imitate adults in order to grow well (Darwin, *Zoonomia*, XVII, 2). He believed the need to teach each other and the need to have shared knowledge among all the students are more valuable because together they can create a community of learning. Thereby, Darwin claimed the value of education was best learned through conversation in a way that allows education to redefine the parameters of society. Looking forward, Darwin's inclusion of an educational path for women and all children. This act of inclusion was unique because it came before a moment of the poem that sought to find balance in the world.

In the next section of *Temple*'s Canto IV, the Nymph of Nature, also known as Urania, replies to the Muse to inform her that she "Presents the evil, but forgets the good" (Darwin, *Temple*, IV, ll. 140). Thus, without any further consideration of the evil of the world, the Nymph delivers a poignant reflection on Lucretius's *De Rerum Natura,* Book III, lines 931-62 that bewails the fact that humans are created and destroyed by the ticking of time. Urania revises some of the Muse's statements from the earlier section helping the Muse and the reader to see that the poetic imagination can be led astray through the subjective feelings of the moment, such as the "melancholy mood" of line

139 or the "Libration . . . balance . . . [or] oscillation" that are reflected in lines 143, 144, and 144, respectively. Urania's perspective tips the scales in favor of the good that exists in the world. This good, Urania claims, marks all scientific pursuits as good.

In line 145, Urania calls upon Time once more: "Hear, O ye Sons of Time!" This incantation prompts the condensed deist argument for science that is within the lengthy note to line 147n: "ancient philosophers, who contended that the world was formed from atoms" — meaning Democritus, Epicurus, and Lucretius — were on the right track for asserting atomism, but they failed because they did not recognize that atoms combined according to, what Darwin calls, "immutable attractive forces" such as "general gravitation, chemical affinity, and animal appetency." Darwin calls out these ancient thinkers in particular because he believes if they had more adequately thought through their ideas, then there would be a stronger belief in the ebb and flow of cause and effect in nature. For Darwin, the idea of causality does lead back to an ultimate "first cause," or Big Bang, and is the only foundation for his belief in God; therefore, Darwin believed atomism supported his belief, not that of the atheists such as the Epicureans and, later and most notably of the Romantics, of Percy Bysshe Shelley.[27]

After asserting the gist of his argument that even the ancient world endorsed connectivism in the note, the next lines from 151-318 consider the value of various forms of beauty to the sensations of Irritation, Sensation, Volition, and Association. Yet it is the concept of Volition that sparks Urania to trace the scientific intellectual history,

[27] Priestman also notes that Darwin may have had in mind Hume, whose skepticism as to whether causation could ever be proved led to a devastating assault on deistic "natural religion," which was viewed by eighteenth and nineteenth-century thinkers as the shared ground between Orthodox Christians and rational materialists, such as Darwin. See Priestman, Martin. *Romantic Atheism: Poetry and Freethought, 1780-1830*, 12-28.

considering the advancements and contributions of Newton, Herschel, Archimedes, Arkwright, and others. Volition connects to Isis and the banks of the Nile where textiles were created, hearkening back to his prediction made in *The Loves of the Plants* that cotton cloth "will become the principle clothing of mankind" (II, 87n, 261n, 264). In an ever-connecting fashion, the production of textiles brings Darwin round to discuss writing on the ground, such as Archimedes did to teach his students, and finally the invention of the printing press that sparked the Enlightenment, encapsulated in lines 265-66: "Ages remote by thee, VOLITION, taught / Chain'd down in characters the winged thought." Darwin prizes the stability and formality that the written word produces, as the spoken word is mutable and therefore the written word must become the more stable form of scientific communication. "[T]he immortal Press" allowed "the births of science [to] thrive, / And rising Arts the wrecks of Time survive" (Darwin, *Temple*, IV, ll. 270, 271-72). Darwin elevates the written word far above and beyond, bestowing upon it the power to rid society of all divergent knowledge, such as "necromancy, astrology, chiromancy, witchcraft, and vampirism" (Darwin, *Temple*, IV, ll. 270n). The unification of such diverse fields can only come through written documentation of their connections. For while the written word and the act of reason do have the ability to help change minds and influence common sense, Darwin does seem to believe that the written word will solve all the world's ills. This innocence is what characterizes Darwin's works because he seems to believe that every human is intelligent and capable of individual thought that leads them down the path of reason. Darwin seems to think that rationality can wipe away the evil present in the constructs of society.

And, just as quickly as the consideration of the four senses appear, they settle as St. Cecilia, patron saint of music, appears to wipe the slate clean and allow Urania to return once more into the poem. Her intercession helps the Muse to see the importance of cause and effect in the world. She states that all organisms are Time's children and must die, due to the cause of "silent mandates" and "laws unknown" that govern aging and death (Darwin, *Temple*, IV, ll. 344, 346), but they are replaced by their offspring. The poppy seed's natural response to spread "Ten thousand seeds . . . / Profusely scatter'd from its waving heads" allows the plant to let its progeny live on in the following spring (Darwin, *Temple*, IV, ll. 349-50). Darwin establishes the same argument of cause and effect for the tadpole and herring before moving to human reproduction, considering that "'if unrestrain'd, / By climate friended, and by food sustain'd . . . / would spread / Erelong, and deluge their terraqueous bed'" (Darwin, *Temple*, IV, ll. 369-72). Darwin sees human life as kept in check by "war, and pestilence, disease, and dearth" and part of the overall cycle of life and death (Darwin, *Temple*, IV, ll. 373); and while he states that "Alchemic powers the changing mass dissolve," meaning that some magic of alchemy decays the organic matter that made up life, Darwin clearly states that this same organic matter is "[b]orn to new life" and "adds to the sum total of terrestrial happiness" (Darwin, *Temple*, IV, ll. 387, 387n). Darwin sees the multiplication and spontaneous production of new beings to be advantageous to nature, as with each new spring, Time and Death are defeated by "a change of forms" (Darwin, *Temple*, IV, ll. 398). This change of forms, Urania explains, is "[e]merging matter from the grave return[ed]" (Darwin, *Temple*, IV, ll. 399); yet, Darwin seems to collapse resurrection and reanimation into the same idea in lines 403-04: "Thus sainted PAUL, 'O Death!' exulting cries, / 'Where is thy sting? O

Grave! thy victories?'" (Darwin, *Temple*, IV, ll. 403-04). Here, Darwin co-opts the First Letter to the Corinthians, where St. Paul explains that the resurrection of the body in heaven is of the human, physical body, into his own belief that the whole of the dead human body's organic matter is reborn in other organisms with the "consciousness of its previous existence" (Darwin, *Temple*, IV, ll. 403n).

As evinced by the note, Darwin saw his own poetic style coming out of the inherent, material interconnection he had as a human in the world. Darwin's interconnectedness allowed him to imagine his own body as once part of other flora and fauna and humankind, expressing the belief that he was conscious of his matter's previous existence as other forms of earthly matter. This is not St. Paul's notion of sharing in the joy of resurrection in heaven and communion of saints and loved ones, but rather how Darwin imagines the reward of life: "The sum total of the happiness of organized nature is probably increased rather than diminished, when one large old animal dies, and is converted into many thousand young ones; which are produced or supported with their numerous progeny by the same organic matter" (Darwin, *Temple*, IV, ll. 410n). Darwin's endorsement of rationality above all else becomes so lofty and disconnected here that it seems like Darwin believes anything is possible in nature; and as Darwin lifts the Phoenix ("Arabia's Bird") to become his means to defeat Time, he boldly proclaims: "how Reproduction strives / With vanquish'd Death, — and Happiness survives; / How Life increasing peoples every clime, / And young renascent Nature conquers Time" (Darwin, *Temple*, IV, ll. 451-54). Darwin's happiness is delivered through the conservation of matter. Perhaps it is because he was close to death, but Darwin is far too optimistic, even for his time.

Left with only one enemy to conquer — as he had already discussed and defeated the power of the spoken word over the written word, the threat of present knowledge without context, and limited inclusion of others who had valuable information to offer at the Temple of Nature — Darwin turns his focus on considering the nature of scientific knowledge's connection to Time. The twelfth-to-last stanza in the fourth Canto of *Temple* allows Urania to sing a euphoric, empathetic note, one disciplined by the irretrievable, lost knowledge, and brevity of time:

> So erst the Sage with scientific truth
> In Grecian temples taught the attentive youth;
> With ceaseless change how restless atmos pass
> From life to life, a transmigrating mass;
> How the same organs, which to day compose
> The poisonous henbane, or the fragrant rose,
> May with to morrrow's sun new forms compile,
> Frown in the Hero, in the Beauty smile.
> Whence drew the enlighten'd Sage the moral plan,
> That man should ever be the friend of man;
> Should eye with tenderness all living forms,
> His brother-emmets, and his sister-worms. (Darwin, *Temple*, IV, ll. 417-28)

These lines eloquently state Darwin's all-inclusive understanding of nature and humankind's role within it. Darwin used these lines to speak to the accumulation of natural knowledge that has been transmitted through human growth and change in understanding over time; here, citing the Sage, who is named as Pythagoras in Darwin's note to this line, Darwin draws attention to the sagacity of this idea. Darwin roots his idea in ancient, forgotten wisdom by noting that "perpetual transmigration of matter from one body to another, of all vegetables and animals, during their lives, as well as after their deaths, was observed by Pythagoras . . . as all creatures thus became related to each other" (Darwin, *Temple*, IV, ll. 417n).

Later, the climax of Urania's speech is reached, and she addresses the poet, reader, and all of humankind as "Sons of Time" in line 429 and, ultimately, the Muse and virgins of the Temple of Nature are convinced thoroughly that Darwin's argument and understanding of nature is correct, signified by the "applausive thunder" and "holy echoes" and illumination of the figure of Nature herself in lines 466-68. The reader is also reminded, through the combination of the "breezy dawn" of the first canto's line 155 and the "vesper song" of the fourth canto's line 469, that this four-canto long exploration of Nature's "TRUTH DIVINE" occurred over the course of one day (Darwin, *Temple*, IV, ll. 524). Through the positioning of the Muse and the virgins of the Temple as the readers of his poem, Darwin urges his world to change their mindset and listen to the accumulation of scientific knowledge that stood before them, suggesting that the "transmigrating mass" can transfigure naturally. The early breakthroughs that informed the composition of chemistry gave hope to Darwin's theory of interconnectivity. This breadth and depth of knowledge encouraged them to take risks in applying that knowledge in new ways to new applications by expanding their world.

DARWIN'S LEGACY IN SMITH AND CHARLES DARWIN

Ultimately, what gets Erasmus and Charles Darwin in trouble is that the Darwins suggest that evolution can be a better response to the Fall than Christianity could offer, whereas Charlotte Smith's *Beachy Head* simply suggests that there are other ways to access the same knowledge. The Darwins posit that perhaps the biblical "knowledge of good and evil" stemmed from human vices and natural disasters, both of which add to the Muse's inability to "prove to Man the goodness of his God" (Darwin, *Temple*, IV, ll.

134). Erasmus Darwin and the other Romantic poets spurred on Charles Darwin and other scientific explorers of his ilk. In Gillian Beer's chapter, "Darwin's Reading and the Fictions of Development," from *The Darwinian Heritage*, she notes that Charles Darwin's development was strongly shaped by his interactions with reading the Romantics, his grandfather included.

However, this is a problematic link; for, while it clearly exists, most of Charles Darwin's references to the Romantics are merely his own interpretations of their works, rather than based in any evidence. In fact, Byron's *Childe Harold's Pilgrimage* and Shelley's *Prometheus Unbound* show up in C. Darwin's private notebooks of 1837 and 1838 that were written on his first return from the voyage of the *Beagle*. C. Darwin's reading habits are intriguing because they demonstrate that when he looked back in history for a good referent to build his case for evolution, he immediately returned to the Romantic Age for the insights explored therein. Then, Paul H. Barrett points out in a note to his edited version of the notebooks that C. Darwin thought back to "Walter Scott [*The Antiquary*] vol II, p126, says seals knit their brows when incensed" when considering the activity of seals (C. Darwin 79).[28] These casual remarks indicate that C. Darwin's understanding of the world was moderated imaginatively through the Romantic poems that served as the foundation to Darwin's creativity. Much like his grandfather, C. Darwin contemplated the lives of plants and senses and behaviors of animals, pondering the sublime and passionate distinctions that hallmarked humanity. In C. Darwin's reading notebooks, he echoes the very sublime and Romantic idea that first the individual looks at his or her surroundings, then reflects upon them. This "first look, then reflect" concept

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[28] From 2009 edition of C. Darwin's reading notebooks, *Charles Darwin's Notebooks, 1836-1844: Geology, Transmutation of Species, Metaphysical Enquiries*.

allowed C. Darwin and the Romantic poets to take their readers on as partners in the invention of new ideas and new ways of looking at the world.

So where did it all go wrong? The Romantics dreamed of a culture where science was just another means to understand the world, meaning that it could fall under the purview of poetry. However, besides American poet Oliver Wendell Holmes's 1858 "The Deacon's Masterpiece or The Wonderful 'One-Hoss Shay': A Logical Story," it is difficult to find any scientific poems in existence in the Romantic Age. Both Darwins saw through the mind's eye the beautiful, brilliant connections and immense changes across all of nature. For both Darwins, the extinct, the fossilized, the inanimate, and animate were in a certain way as alive as the present forms each could witness and experience, plus just as necessary to the argument of each Darwin about the reality of evolution and the changes the world experienced. The Darwins' was a world of imagination and nature, where shrewd observation is expanded by a sense of the underlying mystery of connectedness. For Erasmus and for Charles, the role of the "gentleman-scientist" gave them additional power and conferred on them confidence in their work that was not as readily given to other scientific explorers.

CHAPTER TWO: THE LUNAR SOCIETY OF BIRMINGHAM AND THE BLOSSOMING OF PRACTICAL SCIENTIFIC APPLICATIONS

In the long eighteenth century, collaboration allowed individuals to bounce ideas off one another and explore the realm of possibility in idea form before transferring those ideas into application. Collaboration is necessary for the success of inventions and engineering new ideas into actuality. The imaginative property allowed for groups of individuals to think through bigger and better ideas that had the potential to change the world around them. Thus, these qualities are evident and quite commonplace today as the concept of group collaboration is a promoter of interpersonal competence and organizational effectiveness. The bond shared by the members of the Lunar Society of Birmingham offers an interesting example for study. In fact, Jenny Uglow's popular *The Lunar Men: Five Friends Whose Curiosity Changed the World* analyzed the nature of curiosity in the 1760s by stating that the Lunar Society was just a group of English countrymen who got together to perform typical "elementary school" scientific experiments and Boy-Scout-type projects for their communities (Uglow 3). They built canals, launched balloons, named plants or gases or minerals, and brought the Industrial Revolution to England's countryside. The difference between country and cosmopolitan science was explored on the vast countryside where there was space for these experiments to be performed and perfected. Ultimately, the Lunar Society was characterized by their love of exploration and the performative aspects of science; and this type of scientist became the catalyst for the modern age. This group, among other collaborations of the age, provided a sense of optimism that humankind could progress toward perfection, but only through science.

There are many ways that a society can progress; and in the eighteenth century, progress takes on two forms: religion and education. Keith Thomas suggests that religion held the power to push magic into non-existence, allowing science to sneak in as the answer to many complex questions; David Spadafora offers religion and education as the most popular expressions of progress. Together, these two scholars point to religion as the common thread, but religion, while definitely a player in the development of progress, merely forged the possibility to dream about the future of a divine millennium where perfection could be reached through Christianity.

This pursuit of perfection was also, as Keith Thomas documents in *Religion and the Decline of Magic*, a staged battle between religion and magic. The emergence out of an age of superstition into enlightenment and rationality was a difficult one because there needed to be a certain degree of trust in the logic systems constructed by science about how the world worked. For years before, religion had held sway as the great mediator of knowledge through which others learned and understood the world around them. Through teachings and interpretations of the Bible delivered by priests and other authoritative members of the community, religion was the only origin story worth knowing. However, as more individuals began to read and think critically in the sixteenth and seventeenth centuries, religion's usurpation of magic and the rationality of science started on a direct path toward each other. Thomas's work is useful because he provides a summary of the work of English statistician Gregory King's calculations to show that eighty percent of the English population in 1688 lived in villages or hamlets, especially ones like Birmingham nestled into the English countryside. Thomas concludes that "it was the general social importance of religion [not any serious spiritual value] which enabled it to outlive magic" in the small towns of the English countryside (766). However, the change came not through religion, but in what science could offer these outlying village hamlets.

While science was one way to bring order to the world, there were other individuals in this time period who had access to other forms of knowledge and thus sought to usher in order and progress through education and learning. David Spadafora looks at the eighteenth and nineteenth centuries as the time period that birthed modern thought and progress. He suggests that Britain "possessed a constitution widely hailed at home and abroad as unparalleled, that gave birth to the technological marvels of the Industrial Revolution" (Spadafora 3). This particular set of political circumstances that Spadafora outlines shows "the way in which a given exponent of the idea of progress conceives of a movement, betterment, and the facet of existence undergoing beneficial change" (Spadafora 7). It is this definition of progress that best encapsulates the work of the Lunar Society of Birmingham. Therefore, it is not surprising that the revolutionary ideas of the late eighteenth century were both political and scientific in nature. Philosophers like Locke or Rousseau sought to ground knowledge on demonstrable first principles that could merit the assent of all parties. Thus, in this sense, this quest for perfection was grounded in perfection of mankind through knowledge and education. This meant that progress must be fundamentally grounded in the pursuit of a more scientific and universal foundation to replace the much contested claims of religious and metaphysical traditions.

The rising importance of education, in some form or another, in the eighteenth century made the scientific revolutions of the late eighteenth and early nineteenth centuries possible. To ground the importance of education in the formation of culture and the cultural shift that occurred in order to prioritize education, I have chosen to pair this discussion with a theoretical groundwork from Raymond Williams's *Culture and Society: 1780-1950*, because of its more sophisticated take on Marxism, an ideology which came out of the Industrial Revolution that the men of the Lunar Society of Birmingham were bringing to bear.

Williams's work in *Culture and Society* begins by complicating the traditional Marxist notion of base and superstructure (viz. economic mode of production is the base and this determines the superstructure — the legal, political, cultural, educational aspects of society) with broader notion that "social being determines consciousness;" and thus acknowledges that, after Marx, the base was generally used to refer to "a unitary 'area' within which all cultural and ideological activities could be placed" (Williams 57, 55). This area, that Williams implied in this quote, had a direct relationship between the reproduction of knowledge and any external reflection upon it was based in the superstructure when, in reality, that relationship is often indirect. The unitary area, or base, for the Lunar Society of Birmingham seems to be not only its physical location and access to resources, but the strong presence these men had in their own community. This brings value to the discussion of the diverse roles that these men could play in all aspects of the community in Birmingham.

This type of socio-politico-educational group shows off the *process* of reproduction, or "mediation," in which something radically different from either reproduction or reflection *actively* occurs. This is what signified, both internally and externally, that the Lunar Society and its goals were markedly different from those held in high regard by other communities and individuals throughout England. In these types of "homologous structures," Williams suggests that the two exist in correspondent structural relation to one another; thus, for every technical advancement the men of the Lunar Society made, there had to be more pure reasoning and pursuits of truth in other formats to fill out the society. The Lunar Society of Birmingham, because it was not as popular as the Royal Society in London, served a purpose to align its members with the base of industry, couching themselves in terms of inventors, discovers, and manufacturers, rather than positioning themselves as the successful owners and superstructure of Birmingham's community. Viewing themselves as the base of culture gave them the cultural freedom needed to grow and think without the restraints of their own daily lived culture looming over them. By imagining themselves as aligned with their own workers, they were better able to consider how to improve the industrial conditions of their workers. This relationship and individual positioning propelled the Lunar Society forward because, as they were in a remote part of England, they were not subject to such scrutiny and were able to take bigger risks and make more significant changes to the landscape and production methods that had given Birmingham its recognition.

Williams also reconsiders "the base" of Marxist ideology and argues that it must be redefined from a fixed economic or technological abstraction into a *process* through which specific activities of people in real social and economic relationships, containing contradictions and variations take place; these variations are the social network of Birmingham and how the Lunar Society was created from those folds in the fabric, so to speak. Similarly, with respect to "productive forces" within the base, this cultural movement in Birmingham was a microcosm of what Williams suggested in that there was a desperate need to move beyond Marx's notion of them as producing commodities and toward an understanding of "productive forces" in which "the most important thing" workers ever produce are themselves and their histories. This understanding of the human roles of these individuals and their collectivism allows modern readers to look at the Lunar Society of Birmingham as a necessary focal point for innovation and a catalyst for change and improvement. These individuals collectively wanted a better world, and they realized that they simultaneously had to be part of the labor system and had to control the larger forces at play in order to make a difference and spread their ideology. This changes the understanding of labor as purely commodity-based production, which gives greater commodization value to character and the imagination in the Romantic Age and the ideology that followed from the close association these individuals enjoyed.

GEOGRAPHY OF BIRMINGHAM

The growth of Birmingham is predicated on its unique position in England, just as much as it was on the individuals who called it home. Dr. William Hutton remarked that Birmingham naturally became a stronghold of the Industrial Revolution where "implements and Toys for distant parts / Of various metals, by mechanic Arts, / Are finely wrought, and by the Artists sold / Whose touch turns every Metal into Gold" (Hutton 285). Yet growth of this midland English town was not a result of years of growth or natural resources such as navigable rivers; and thus, Birmingham has long confounded historians and geographers for it grew from an unknown industrial village of 15,000 in 1700 to 84,000 in 1801 (British Association Scientific Survey 141-43, 173-86). As Thomas Bladon who was a local Presbyterian minister noted in 1762, the "wonderful increase of Buildings, multitudes of People, and advancements of Trade" must be a direct result of the activities and enterprises of individual trades workers, tinkerers, manufactures, and groups of such thinkers whose diligence, enterprise, and technical ingenuity conferred new geographical value on a formerly remote place, which, under the auspices of the countryside and separation from London, allowed their businesses to flourish and provide fresh conditions favorable to the growth of the community (Bladon 6).[29]

Birmingham's growth also allowed the city to diversify its resources, assets, and characteristics. Matthew Boulton's Soho Manufactory, founded in 1761, gained great success from the industrial liaison Boulton built with the masters, tradesmen, and coal miners of the town. This relationship encouraged the growth of the city to the northwest of Birmingham, especially its reach toward the coal mines and with Edward Ruston's mill for laminating metals, the Birmingham Canal, and other Lunar Society members' homes along this side of the city, it is evident that the Lunar Society members played a significant role in Birmingham's rapid growth, new enterprises, and industrial success.

Upon visiting Birmingham in 1765, Hutton remarked, "I was surprised at the place, but more at the people. They possessed a vivacity I had never beheld. I had been among dreamers, but now I saw men awake. Their very step along the street [showed] alacrity. Every man seemed to know what he was about. The town was large, and full of inhabitants, and these inhabitants full of industry" (Hutton 13). Hutton's observation about the unique status of Birmingham and its residents spoke to the curious nature of those who lived and made their lives there. Their written work echoed this cheery

[29] See M. J. Wise, "Birmingham and its Trade Relations in the Early 18th Century." *University of Birmingham Historical Journal*. 2.4. (1949), 53-79.

readiness and looked toward a better future of their own making. It comes as no surprise that the Birmingham ballad poet and advocate for political liberty John Freeth sang of the Lunar Society, here called the Birmingham Boys, in such happy tones in *Inland Navigation — an Ode* in 1769:

> What mortals so happy as *Birmingham* Boys?
> What people so flush'd with the sweetest of joys?
> All hearts fraught with mirth at the Wharf shall appear,
> Their aspects proclaim it the Jubilee year.
>
> [. . .]
>
> The Tradesman, Mechanic, and Cottager too,
> Shall all share the bounty that soon must ensue,
>
> [. . .]
>
> Birmingham, for arts renown'd
> O'ver the globe shall foremost stand:
> Nor its vast increase be found
> To be equall'd in the land.
> From the *Tagus* to the *Ganges*,
> Or from *Lapland Cliffs* extend
> To the *Patagonian Strand*,
> For mechanic skill and pow'r
> In what kingdom, on what shore,
> Lies the place that can supply
> The world with such variety? (Freeth ll. 100-42)

As Freeth notes in his Preface, "I was obliged to turn [my songs] upon such temporary and local subjects, as might best serve the cause of the party I had espoused" (Freeth iv). The cause of the party he refers to is revolution. Revolutionary ideology, brought across the Atlantic from the American colonies and widely spreading throughout the Continent, sparked optimism and hope in many throughout England. Freeth sees the act of revolution happening before his very eyes, but on a much smaller scale, in his native city. Freeth's own pride in his city of Birmingham rings true in this segment of his ballad, where he recognizes the Lunar Society's members as "mortals" in order to ground their godlike abilities in developing the city and "flush'd with the sweetest of joys" to show the benefits they bring to the city. Freeth also bestows this happiness on all the members of the city who are soon to share in the wealth of the city, as Freeth seems to imagine the city's prosperity to be shared among all its citizens, not just reserved for the few. Freeth's belief in the revolutionary ideals espoused in democracy allow him to proclaim Birmingham as part of this revolutionary movement. This moment was not won by democracy or liberty in Birmingham, but rather by mechanical industry, skill, and power. This was not a political revolution, as the one Freeth sided with across the Atlantic, but rather, this was an ideology revolution that stood to separate science and art, making them distinguishable and labeled as such. Freeth proclaimed that science was still superior to art, but that art like his poetry of science was more accessible to the everyday person, and thus more democratic.

Using a poem to analyze the work of the Lunar Society sheds new light on the work being done in Birmingham. Freeth's focus is on the art of the movement of scientific innovation, which makes his commentary so unique. Freeth's art could describe the science that seemed unreachable through any other medium, as those mediums were moderated by the gentlemen-scientists. Art and science seem to be more complex, but that is partially because Freeth was a creative artist who showed that art is an expression of a thought to convey idea, emotion, or ethos. This is tangential to what he praises in his ballad, which is "mechanic skill and pow'r [in . . . /] such variety." In Freeth's list, the skills of symmetry, attractive materials, meticulous workmanship, elegant shape, virtuoso craftsmanship all show intelligence, fine motor skills, conscientiousness, planning ability, and access to rare materials are used by Freeth, as well as other more scientific members of Birmingham in their own acts, in his creative act of ballad composition to create new ways to experience the world and express intense emotion, such as his politics. Ultimately, the ethos Freeth sought to convey was that which represented the whole of Birmingham: a confluence of factors necessary to construct a better future and the determination of individuals to work toward a better life for themselves and others.

LUNAR SOCIETY MEMBERS

Active for at least sixteen years, assuredly from 1775-1791, yet possibly as early as 1765,[30] the Lunar Society in Birmingham got its name from their monthly practice of meeting on the Monday nearest the full moon, in a practical nod to the ease of traveling under a full moon. As with any revolutionary activity, these collaborative members met in small groups. Their purpose was to ask: how could science and technology be made to better serve society?

Indirectly borrowing group dynamics, ideology, and formatting of a group from Benjamin Franklin, the Lunar Society met at Matthew Boulton's Soho House on the outskirts of Birmingham. Matthew Boulton, himself the brilliant industrialist who built from James Watt's design the new engines that ushered in a new era of industry, opened his home to nearby scientists and welcomed experiments into his dining room that, to present day, bears the sobriquet of the "Lunar Room." Matthew Boulton was the first

[30] There is great argument about the active dates of the Lunar Society, partially because there were so many members who came and went over the years and the only stable factor was Matthew Boulton's Soho House where the meetings were held. Boulton is said to be the heart of the Lunar Society of Birmingham, but other members needed to be present and involved in order for the society to be considered a collaborative organization. There is evidence in the letters of Boulton and Darwin that they met together as early as 1765, but not on a full moon's schedule or with any regularity.

industrialist to introduce workers' insurance and sick pay. With Boulton (1728-1809) often sat James Watt (1736-1819), the designer of the great steam engine; Erasmus Darwin (1731-1802), a poet, inventor, physician, and botanist who published his own theory of evolution and developed a mechanical steering system that would later be used on Henry Ford's Model T; Joseph Priestley (1733-1804), a rebellious Unitarian cleric and scientist who first isolated oxygen and discovered carbon dioxide; Josiah Wedgwood (1730-1793), fondly called the "Father of English Pottery," who was dedicated to improving his manufacturing techniques and seeking better means to complete his work; William Hershel (1738-1822), the astronomer who discovered Uranus; John Smeaton (1724-1792), a civil engineer and mathematician who built canals and the Eddystone Lighthouse to withstand the pounding of the waves through the use of hydraulic lime; James Keir (1735-1820), the chemist who made an affordable soap for the masses; Richard Lovell Edgeworth (1744-1817), a keen inventor and educator; William Murdoch (1731-1802), the inventor of the gas light; William Small (1734-1775), a mathematician and philosopher; William Withering (1741-1799), a physician and botanist who discovered that heart disease could be treated with digitalis from the foxglove plant; and Thomas Beddoes (1760-1808), a country physician that recorded many cures and expanded the frontiers of medicine. Approximately a dozen men at its height, the Lunar Society of Birmingham unified themselves as a pioneering collaborative with the goal to weigh and consider the conglomeration of science and social change.

Historian Jacob Bronowski remarks: "What ran through [the Lunar Society] was a simple faith: the good life is more than material decency, but the good life must be based on material decency" (Bronowski 274). We dream retrospectively, that the countryside which gave birth to the revolutionary ideals of the Lunar Society was as idyllic as Oliver Goldsmith's *Deserted Village*; however, that is a fiction, as the country was a place where men and women worked from dawn to dusk. But the available material decency that Bronowski describes made a world of difference in the lives of these individuals, partially because they had the most to gain in any societal improvement. Thus, while Josiah Wedgwood made a fortune selling decorated porcelain to the kingdoms, courts, and principalities of Europe, his earthenware pottery transformed the kitchens of the laboring class.

In fact, fifty years later, civil engineer John Nicholson published *The Operative Mechanic and the British Machinist* in 1825 to proclaim that the impetus of the Lunar Society was still alive and well. Nicholson's work was addressed to the engineering designers of 1825, encouraging them to live out the ideals of the Lunar Society. In the inscription at the front of the book written to George Birkbeck, President of the London Mechanics' Institution, Nicholson addresses his readers:

> In an age like the present, when the rich and powerful identify their interests with the welfare of the poor and uninformed, when the wise and good combine in furthering the diffusion of sound principles and useful knowledge among those who constitute the most important, though hitherto the most neglected, portion of the community, there is not one who can view the future in the past but must anticipate with such data before him, a change as brilliant in its effects, as it is honorable to those who are engaged in promoting it. (Nicholson 2)

Here Nicholson expresses two essential sentiments of the Industrial Revolution and acknowledges the brilliance of the Lunar Society for dedicating themselves to ushering in a new world, changed by the unification of society and driven by scientific pursuits. First, Nicholson states that those who have access to technology and understand it are thus responsible for improving the lot of the poor, which echoes the educational goals of the

Lunar Society. Second, Nicholson states that the other is that good work rewards the engineer who does it. At Nicholson's time, there was still a grace and form and beauty that reflects a higher purpose of revolutionary work of science and industry, as Nicholson stated, to "identify their interests with the welfare of the poor."

The most boisterous and rambunctious member of the Lunar Society of Birmingham, Joseph Priestley recorded in 1771 in *An Essay on the First Principles of Government; and on the Nature of Political, Civil, and Religious Liberty* that

> nature, including both its materials, and its laws, will be more at our command; men will make their situation in this world abundantly more easy and comfortable; they will probably prolong their existence in it, and will grow daily more happy, each in himself, and more able (and, I believe, more disposed) to communicate happiness to others. Thus, whatever was the beginning of this world, the end will be glorious and paradisiacal, beyond what our imaginations can now conceive. Extravagant as some may suppose these views to be, I think I could show them to be fairly suggested by the true theory of human nature, and to arise from the natural course of human affairs. But, for the present, I waive this subject, the contemplation of which always makes me happy. (Priestley 7)

Priestley's optimism is similar to Erasmus Darwin's in *Temple of Nature*, except Priestley's seems more rational and direct, for it was moderated through a more concrete understanding of scientific knowledge. Priestley's knowledge of science gave him the tools necessary to imagine a world similar to what we live in today: where people live longer, thanks to improvements to healthcare; people are happier, in light of reduced workload and stress to survive; and life in the modern world is much more comfortable for most people, when it comes to the basic necessities. Priestley imagined the world progressing, like Darwin did, from a state of chaos and disorder to a state of perfection, the latter of which could only be attained through human achievement and hard work through science.

Darwin's work in the Lunar Society of Birmingham brought education of all types to the forefront, showing that their revolutionary work was not just limited to their own disciplines. In "Erasmus Darwin, Thomas Beddoes, and 'The Golden Age' of the 1790s," Michelle Faubert looks into the role of the natural in establishing British revolutionaries along the same lines as their French counterparts. Drawing on Paine and Burke, her analysis exposes Darwin and Beddoes as the revolutionaries they were by comparing them to the "sans-culottes" of France; this reduction of an aspect of ideology to mere Frenchness, as well as their own radical ideology espoused and practiced in the Lunar Society of Birmingham, made their more naturally informed sense of the world seem appealing to a growing few through its radicalness. Yet, in this progressive world, being radical and able to consider other viewpoints was not enough. The Lunar Society espoused divergent ideologies about how best to teach and educate others. Darwin's educational plans seemed to support a collective education that not only taught material, but trained behaviors. This passive, imitative environment allowed younger children to learn the correct behaviors through observing older children, children across ages and knowledge levels, and also allowed them to teach each other, and emulate each other's interests and curiosities. Darwin wrote that, in these circumstances, children "acquire a kind of practical physiognomy" that would make them more intelligent and interesting companions (Darwin, *A Plan*, 115-17).

A growing concern with the education of his own children made Darwin more interested in the education of women. Darwin's educational plan had a very specific audience in his two illegitimate daughters who were schoolmistresses and ran a very traditional school with a conventional curriculum. Yet this, too, was a fresh perspective in eighteenth-century standards for girls. Girls' education before the Romantic Age was minimal at best. Girls were usually educated at home in ways that would prepare them to be wives and mothers.[31] Yet there was great dissent over the intellectual subjugation of women. For example, Daniel Defoe, author of *Robinson Crusoe*, wrote in 1692 that "one of the most barbarous customs in the world, considering us as a civilised and a Christian country, is that we deny the advantages of learning to women. . . . Their youth is spent to teach them to stitch and sew, or make baubles. They are taught to read, indeed, and perhaps to write their names, or so; and that is the height of a woman's education?" (Defoe 95). Defoe's indignation at the lack of education for women was a seriously cultural question, but the early eighteenth century was neither prepared nor willing to embrace serious, significant cultural change. Thus, by the height of the Lunar Society in the 1770s, occurring simultaneously with the American Revolution and other works of liberty on the Continent, there were more people willing and ready to embrace the fact that women's education was necessary to grow a society.

Contributing to the medical field's growth, Beddoes's medical anthology of 1799, *Contributions to Physical and Moral Knowledge, Principally from the West of England, Collected by Thomas Beddoes, M.D.*, framed medicine as "The science of human nature is altogether incapable of division into independent branches. Books may profess to treat separate of the rules of conduct, of the mental faculties and the personal condition. But the moralist and the metaphysician will each to a certain point encroach upon the

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[31] For additional context, see Karen O'Brien, *Women and Enlightenment in Eighteenth-Century Britain*, Cambridge: Cambridge UP, 2009.

province of the physiologist . . . Physiology therefore – or more strictly *biology* – by which I mean *the doctrine of the living system in all its states*, appears to be the foundation of ethics and pneumatology" (Beddoes 9, 3-4). Beddoes, as a country physician, occupied a field closer to modern day psychology and political theory than modern medicine; although, in his time period, Beddoes did write what was recognized as very solid medical work. In "An Analysis of an 'Essay on the Public Merits of Mr. Pitt, By Thomas Beddoes, M.D.," Samuel Taylor Coleridge summarized Beddoes's claim that "a Physician is peculiarly well-qualified for political research," meaning that, in the post-revolutionary society of the Romantic Age, doctors became more socially valuable because physicians could support political perspectives and social programs that politicians wanted to push forward (Coleridge 310).

Beddoes was fascinated by the process through which we determine "the laws that regulate feeling" and in an age of sensibility the need to determine the importance of sense and feeling controlled all aspects of intellectual pursuits of the Romantic Age (Beddoes 3-4). Thomas Beddoes collected the provincial doctors' knowledge of medicinal cures and practices for his own knowledge and as a textbook for other doctors. He waxed philosophical on the importance of human nature, regretting the fact that he could not classify his medical and physical knowledge in any more specific quantities. He longed for a theory that would explain how to regulate feeling and deliver good health to others. His explanations are long-winded, but easier to comprehend than some of the other medical texts of the age, suggesting in his introduction that all individuals should be capable of understanding science. He explains that young people in the Romantic Age may feel "ALL ACCOMPLISHED," but because they do not understand what goes on in their own bodies. He prejudices individual understanding of science over any other knowledge base. In fact, he states that his "leading principle is to provide for the most perfect possible ascertainment, and entire publicity of all the phenomena, occurring in charitable establishments for the relief of the indigent sick" (Beddoes 7). Beddoes believes that all scientific phenomena should be publicized and should become public knowledge for the benefit of all individuals. This popularization and democratization of science allowed mankind to be on equal footing, at least in the eyes of Beddoes.

Beddoes, especially, espoused the ethos of the gentleman-scientist. He published his text without providing any instructions for educating others, like his fellow Lunar Society members did in their works. Thus, it seems that Beddoes was a little short-sighted in regard to how his knowledge would be shared with others. He viewed his own work as valuable, but there is no documentation that would endorse the idea that Beddoes thought his own work important enough to share with others. In his article on "The Many Worlds of Thomas Beddoes," Robert Fox details the many different roles that Beddoes played in late eighteenth century society, but notably one of them is not that of an educator, at least not in any written, documented evidence. Beddoes took it upon himself to prove himself correct among his literary circle of friends, an endeavor that proved his cleverness more than his own intelligence. For example, Fox describes an occasion where Beddoes forged a correspondence from Darwin that would prove his side of the argument. Beddoes was clever enough to imitate Darwin's writing style, including a "profusion of notes" that were stereotypical of Darwin's prose. Beddoes dabbled in politics by revealing how he interpreted others in the poem he passed off as Darwin's. Thomas Beddoes also believed himself knowledgeable of all the social diseases of English society, which made Beddoes a likely candidate for the Lunar Society's mission to bring the ideology of the French Revolution to Britain.[32]

The members of the Lunar Society in Birmingham did a variety of things to encourage growth; in addition to advocating for education reform, the members each believed in their own best practices and supported them through financial means or implementation in their own schools. Thomas Day, the only member of the Lunar Society it seems who did not have a penchant for invention, lent the other members money to carry out their own work. Additionally, Day did see himself as an intellectual, though, just too deep in the study of man to consider anything else.[33]

One other individual was significantly impacted by the educational system espoused by the members of the Lunar Society; however, this individual's work focused more on boys' education, but the format of the schooling stands out as connected to the work of the Lunar Society of Birmingham. Thomas Wright Hill, the son of a feed corn dealer, lived in Birmingham from 1763-1851 and had graduated to an apprenticeship at a brass founder, where he used his free time to mold systems to simplify phonetics. His free time was also spent like the Lunar Society's members, with no boundary between family and school. Like all other educational reformers of this time, the school that he opened in 1803 at Hill Top in Birmingham included his teenage children as teachers and each of his boys, through this model, became distinguished men of the community. After five years of the school's opening, Hill noted that "I had the unspeakable pleasure to find

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[32] See Fox 212.

[33] He was also entirely corrupt morally, as he adopted two girls of eleven years old, renaming them Sabrina and Lucretia, he trained them to be the perfect wives. And while he proclaimed himself only a man for the study of society, this did not prevent him from using "Tar-water" — a substance with the power to subdue strong spirits — to cure the inflammation in Maria Edgeworth's eyes (Sadler 9, 17).

that my boys could for a whole week conduct the school, now larger than ever, without any assistance from me. In a few years, they will not only have the real power, but from age would be entitled to the public confidence" (qtd. in Armytage, *Four Hundred Years*, 83). Slowly, the Hill Top School became a "schoolboy republic" where behavior, academic responsibility, and conduct were administered, judged, and operated by the pupils, an educational refraction of Priestley's ideals (Armytage, *Four Hundred Years*, 87). This philosophy of worldwide scientific humanism was the philosophy of the Lunar Society of Birmingham and the Hill Top School was just one of many arms that shepherded through its ideology into practice.

While the Hill Top School did create a legacy and gave the community many strong thinkers, it was Maria Edgeworth who encouraged Hill and his sons to tone down the republicanism of their school. As her father was a rigid disciple of Rousseau, Richard Lovell Edgeworth let his son grow as much as possible as a result of "the education of Nature and accident" (Edgeworth, Vol. 1, 178). Edgeworth recorded that his son "had less knowledge of books than children half his age . . . [but] of mechanics he had a clearer conception, and in the application of what he knew more invention than any child I had then seen" (Edgeworth, *Memoirs*, Vol. 1, 44). This value for mechanics and their application was the hallmark of the Lunar Society and their families. Yet what is unique is that Edgeworth applied the same praise to Maria Edgeworth, commenting in *The Memoirs of Richard Lovell Edgeworth Begun by Himself and Concluded by His Daughter, Maria Edgeworth* "[Maria] seems to have this taste for mechanics, *too*!" (Edgeworth, Vol. 1, 56). The Edgeworthian ideal for education seems, by modern standards, to be much more gender-inclusive than anything the Hill family reached for in theirs.

Life for Richard Lovell Edgeworth and the members of the Lunar Society of Birmingham revolved around mechanical inventions, and these structural instincts extended to the educational field as their children were reared in the same fashion, all with the hope that they would all take on the engineering interests of their fathers. In this quest, Edgeworth enlisted his eldest daughter Maria. Edgeworth was already well-known as a social engineer through his six years' tenure as a Royal Commissioner on Irish Education; and in 1809, he suggested the formation of a schooling association that would establish "secondary schools" throughout the country (Edgeworth, Vol. 2, 378). In this use of the term "secondary school," Edgeworth implied a thoroughly modern and, perhaps even, Montessorian conception of education that valued STEM (Science, Technology, Engineering, and Mathematics/Medicine) and tinkering. Edgeworth and his daughter Maria's magnum opus on education was published in 1798. *Practical Education* reflected their long-term experiments on child rearing; and in a reassessment of Rousseau's educational theories of "nature and accident" that Richard had praised earlier, Maria, like Erasmus Darwin and Thomas Wright Hill, endorsed Joseph Priestley's ideology instead, thereby aligning herself with the dynamics of the Lunar Society.

On February 28, 1785, Matthew Boulton, leader of the Lunar Society of Birmingham, noted that, in regard to his son's education, "'Indeed for me,' he wrote 'to pretend to lead him into any philosophical pursuits would be absurd, as the advantages he may reap in that way from his Friends at home both in Theory and practice are so infinitely superior to any I could pretend to hold out to him'" (qtd in Robinson 304).

Many of the Lunar Society members did not see any benefit in the educational systems of the day. Boulton's son's education was quite evidently planned out for him by his father, as his schoolmaster Reverend Henry Pickering notes in a December 5, 1779 letter to Matthew Boulton: "I do not mean to say that we are calculated to finish his Education on that liberal and genteel Plan that you I know wish and intend to adopt but I think at his age we can do as well for him as Schools in general at a greater distance" (qtd. in Robinson 302). Boulton's exquisitely laid plan for this son's education was not out of the ordinary for members of the Lunar Society. The Lunar Society was a group characterized by exquisite inquisitiveness, revolutionary thoughts and concepts, and vast creativity in knowledge, theory, and application. Their amateur status in the world of science freed them from the rigid structures and outlines of the Royal Society and other scientific institutions. This same thinking applied to educating their children.

Boulton, Watt, and Joseph Priestley sent their sons to the Continent, where they toured factories, took notes on industrial processes, and read books with new thoughts and revolutionary ideology. For this trip, they packed tools in their bags to join and work with and record the successes of these new processes. Unsurprisingly, in time, each son became a large-scale manufacturer and archetypal captain of industry, inheriting the businesses and success, rather than becoming well-versed in all arenas of knowledge. Although Wedgwood's biographer, Eliza Meteyard, notes that the Boulton-Watt partnership was passed into the hands of the sons, going into "a sleepy decline . . . upheld rather by the traditions of the past than by any genius or business capacity of those who had succeeded," there was also the recognition that the business grew in the hands of the sons, much more than it did in the hands of their fathers (Meteyard 2). This distinction between the business success of the sons and inventive, scientific success of their fathers is made into a significant variant in the lack of heritable value of the Lunar Society's collaboration. After the Lunar Society, there was an increasing need to capitalize on the knowledge that was available, not simply to amass more of knowledge simply for the benefit of the Society.

This supposition is made by Erich Roll in *An Early Experiment in Industrial Organization*, in which he singles out the uniqueness of the collaborative efforts of the Lunar Society toward education. Roll states that "the fathers had been builders, the sons were organizers; and, although the older generation had laid the foundations, the new built a superstructure of such unique elaboration that it becomes difficult to balance on the merit of the two generations" (Roll 270). The Lunar Society not only built machines, but it also built thinking members of society. Even James Keir, a member of the Lunar Society, remarked that "Mr. Boulton is a proof how much scientific knowledge may be acquired without much regular study" (Keir 8). While the amount of time studying is not of that much importance here, what is more fascinating is that these individuals truly believed that education could change them, especially as each of the members of the Lunar Society was proud of his gentlemanly status, but they were also self-made men, which was more important to each of them. This made education the key to the industrial, scientific, poetic, and interdisciplinary future that each of them imagined together through the Lunar Society of Birmingham.

Richard Lovell Edgeworth explains the importance of teaching children poetry. In *Readings on Poetry*, both Richard and Maria Edgeworth explained the importance of teaching children poetry. They break it down into less complicated ideas, but still present more complicated ideas in whole to children, claiming in the Preface that "[e]xperience has convinced the author of the following pages, that children seldom understand the poetry, which they early learn by rote, and that thus, instead of forming a poetic taste, they acquire the habit of repeating words to which they affix no distinct ideas, or of admiring melodious sounds which are to them destitute of meaning" (Edgeworth iii). The importance of understanding why is conveyed in a backwards-looking tone when expressing the importance of taste, which was so key to understanding the eighteenth century mind. Yet both Edgeworths are distinctly Romantic because in their writing and actions, they encouraged the need to understand why and it is this curiosity that aligned them with the other members of the Lunar Society of Birmingham in driving the pursuit of knowledge and the means of progress forward.

UNIQUENESS OF BIRMINGHAM

The Lunar Society had a significant impact on the individuals and community of Birmingham. The confluence of circumstances that were provided by the vast stores of knowledge, innovative collaboratives, and industrial pressures allowed the Lunar Society's members to understand both the scientific and economic implications of their work. They quickly realized that the gentlemanly pursuit of science was nothing more than an amateur's hobby. The genteel old world of science was quickly favoring the innovators who could capitalize on their knowledge through partnerships with other like-minded individuals. Erasmus Darwin, James Watt, Matthew Boulton, Josiah Wedgwood, Richard Lovell Edgeworth, Thomas Beddoes, and Thomas Wright Hill: these men of Birmingham struggled with elitism and democracy. At times, they wanted to keep science in the hands of the elite, thereby making it exclusive, mysterious, and, therefore, more complex — a move which required a scientist, like one of them, to act as an intermediary in informing, but not educating, others. But at other times, they needed to open up science in order to garner more information and insight into the way the world worked, thereby making the practice of science welcoming to anyone who had something, even the smallest thing, to the conversation — a move which welcomed women into science and begged them to ruminate on scientific information and respond with new perspectives. This was their legacy: they were educators, although they each struggled with how to educate others without losing their own status as elite gentlemen-scientists.

The Lunar Society's unification of the various cultural strata with scientific knowledge lies in their desire to know their traditions and be willing to break them. In this rational distinction, there lies a certain cognitive beauty through the separation that comes from being able to distinguish the traditions that came before and what is right and best for the current world. The scientific strain of Romanticism breaks with tradition in order to favor evolution and the power that change has over the world. This tradition best shows itself in how Percy Bysshe Shelley wove a story in "Ozymandias" around the "'Two vast and trunkless legs of stone'" that represented a once great culture "'Nothing beside remains. Round the decay / Of that colossal wreck, boundless and bare, / The lone and level sands stretch far away" (ll. 12-14). Part of the Romantic *Weltzschmerz* was the understanding that time removes many things, but that culture remains present, even though it morphs into something new. The men of the Lunar Society of Birmingham were very much aware of the shifting power structures and the opportunities for change. This process involved what Lisa Zunshine calls "deconstruct[ing] and demystif[ying] each instance" so that it no longer carried with it the lingering ideology of former years and now made space for more independent thinkers in the world (Zunshine 21). In other words, the work of the Lunar Society of Birmingham was "deconstruct[ing] and demystify[ying]" the cultural instances they lived in in order to break down their universe to how things were made so as to really delve into the depths of cultural understanding of education and knowledge's place in the dynamic world.

Lisa Zunshine's *Strange Concepts and the Stories They Make Possible* traces the development of an essentialist, functionalist, psychological framework to understand the ways in which thereby allow her to show that "cultural representations . . . engage our evolved cognitive capacities" (Zunshine 2). This allowed her to focus primarily on the Romantics' educated categorization of knowledge in the world through how our devotion to categorization has the potential to limit us in our universal pursuit of knowledge (Zunshine 2). For Zunshine, it is necessary to interrogate essentialism's role in how "we can successfully 'deconstruct' and demystify each instance" to become better, more comprehensive thinkers about the world at large (Zunshine 21). In establishing the importance of character building to the meaning-making process, Zunshine's theoretical concept of determining the purpose of interpreting other's behavior and modifying one's own behavior accordingly: "we engage in mind reading when we ascribe to a person a certain mental state on the basis of her observable action" (Zunshine 59). She continues by giving examples that "when we interpret our own feelings based on our proprioceptive awareness (e.g., our heart skips a beat when a certain person enters the room, and we realize that we might have been attracted to him or her all along; when we intuit a complex state of mind based on a limited verbal description" or even "when we compose an essay, a lecture, a movie, a song, a novel, or an instruction for an electrical appliance and try to imagine how this or that segment of our target audience will respond to it," our minds engage in a complex study of how the different factors of the world are converging on our immediate experience (Zunshine 59). Zunshine consistently reminds her readers that successful authors are both aware of their historicity and their need to reinterpret the world around them, thereby buying into the idea that essences can impact material objects, which comes to bear in the materiality of a character's personality and the imagination for the Romantics. As humans, our cognitive architecture allows us to think complexly about the world, allowing us to make grand conclusions like Darwin about science and poetics or the Lunar Society of Birmingham about science, character, and community.

In addition, through the smaller ten-fifteen person scientific communities where women were welcomed, this conversation ground enhanced participation of the subordinate strata of the public sphere in stratified societies like the Royal Society and Davy's Royal Institution. These smaller scientific communities, like the Lunar Society of Birmingham and later in the Marcet family's social circle, created space for individuals to speak and be recognized for his or her contributions to the conversation, which acted as a proving ground for many women to enter the scientific community at large.

CHAPTER THREE:
MAPPING OUT THE ROLE OF THE PRACTICAL SCIENTIST IN THE FAMILY WITHIN MARIA EDGEWORTH'S *BELINDA*

This chapter investigates the tenuous boundaries between science and varying forms of pseudo-science displayed in Maria Edgeworth's *Belinda*. These boundaries exist in their various representations across an array of genres and discursive practices in the long eighteenth century, meeting their culminating point in the novel, especially poignant in the novel's depiction of family practices. Because general normative behaviors and practices were often still closely associated with familial well-being, I have decided to discuss the various domestic structures outlined in Maria Edgeworth's *Belinda*, particularly concerning familial loyalties and their relationship with changing views of science's place in the home, by analyzing Edgeworth's characterization of each individual in the novel and considering their position at the end of the novel. For in the act of blending and creating, the novelist promises the novel's ability to construct, modify, rectify, destroy, and rebuild the world's predominant views. The novel has these explicit powers, as Bakhtin states, because "[t]he novel is not merely one genre among other genres. Among other genres long since completed in part already dead, the novel is the only developing genre. It is the only genre born and nourished in a new era of world history and therefore it is deeply akin to that era, whereas the other major genres entered that era as already fixed forms, as an inheritance" (Bakhtin 4). The novel's status as a genre still in flux gives it the power to redefine the world around it, and by changing the world around it, the novel also changes the genre's standards that are deemed too critical by the author.

In response to the inadequacies of scientific societies to educate others, although they desired to instill similar views of proper behavior within the domestic sphere, I trace and translate my key conditions for familial structure by looking at the adult figures of the household and how they interact with the members of their own household and other households. This provides a model of differentiation that encourages dialogue and discussion, by pushing individuals into dialogue about what motivates their actions and behaviors toward the growing place of science and other rational activities in the home. The shift of science's place from that of a gentleman-scientist of leisure throughout the eighteenth century to a practical scientist in the family home, who can watch over the family's best interests, signals a change in thought that science was becoming practical. By practical, I mean to suggest that science was becoming part of everyday life, perhaps even a necessity in order to understand the changes in the world around the home and within. Therefore, I believe success of a unified family, as understood and portrayed by Edgeworth, to be predicated on each individual garnering independence and a critical mind through a deep respect and appreciation for the practical, useful application of science in the home and throughout an individual's life.

In Edgeworth's *Belinda*, I will analyze closely the role of the objective, practical scientist is placed within context of the sentimental, sensible home. In *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment*, Jessica Riskin delves into the "sentimental youth of scientific empiricism" and writes about it as a place of scientific understanding through a beautiful, seamless transition to the scientific method as the most viable means for interpreting nature (Riskin 4). She analyzes the importance of observation and experimentation through the words of the Romantic novel's characters. Riskin pulls from Denis Diderot's 1760s letter to his friend Sophie Volland an interesting question, "What is sensibility?" (qtd. in Riskin 1). And he responds, Diderot says that sensibility is "[t]he vivid effect on our soul of an infinity of delicate observations" (qtd. in Riskin 1-2). Because of the import that science and Diderot put on observations, here, science and sensibility walk hand-in-hand, which further explains the importance of novelist and scientist in the Romantic Age. Science and the morals typically discussed in the novel interacted during a period that was rife with political and social activism in efforts to nationalize and brand scientific pursuits as British; however, this occurred merely as a performance of allegiance to science in the novel. Most individuals in this time period had to perform an outward allegiance to science, because science had to take hold in Britain for Britain to be further reunited through science in the expanding, diversifying empire of reason.

Therefore, it is this confluence of factors that produced Maria Edgeworth's unique positioning through her father's work as an educator, her familial association with the Lunar Society of Birmingham, her school, her 21 siblings, and her brother-in-law, Thomas Beddoes, a peculiarly good case study for the pendulum's swing of the role of gentleman-scientist. Edgeworth was best able to document the impact this shift had on the people around her and in her moment. Edgeworth's cultural stratification and familial presence in Birmingham, Britain, and Ireland gave her the insight necessary to help shepherd in a new era of practical science into the home through her novels.

MARIA'S CONTEMPORARIES

While Maria Edgeworth is notable because of how and why she chose to convey the acceptance of science in familial and individual structures, she was not the only author of her time period to note the importance of educating boys and girls about science and record it in a literary fashion. The titular character of *Belinda* was educated about science and its applications, just as Lady Delacour and the Percival children were throughout the novel. The education of all throughout the novel is what makes Edgeworth's work intriguing, for Edgeworth was also educating her reader alongside each of these individuals.

One of Maria's contemporaries, Anna Laetitia Barbauld wrote the very popular *Evenings at Home,* which used stories in a variety of genres to instruct children about a range of scientific applications, such as the making of paper. However, because Barbauld wrote much of this work with her brother Dr. John Aikin, as is evident in the prevalence of stories and shared activities between a father and son, this text is geared toward children more generally, rather than specifically addressing the education of young women, which makes Edgeworth as well as Jane Marcet's texts more interesting because of their intricate experiments and question-and-answers on the subject matter of chemistry. For Barbauld, "the purpose of all education [was] to fit persons for the station in which they are hereafter to live;" and thus, in this consideration, middle-class girls needed to learn "everything that makes part of the discourse of rational and well-educated people," which here would include astronomy and other subjects that signified a modern education (Aikin and Barbauld 37-42).[34] These texts encouraged young men and women to seek new information and knowledge from the world around them.

Works like Aikin and Barbauld's *Evenings at Home* and Richard Lovell Edgeworth's *Practical Education*, which he produced with his daughter Maria, indicated the culture's immediate need for the transformative potential of new, insightful information to be readily available to all, a thought which Wordsworth dwells on in his apprehension of the cultural need for transformation in his *Prelude*.[35] This type of scientific education was a necessary part of the preparations required to form "a predominantly scientific culture," as noted by Brian Simon in *Two Nations and the Educational Structure 1780-1870* (Simon 53).[36] In this work, Simon claimed *Practical Education* was "the most significant contemporary work on pedagogy" (Simon 32). Edgeworth's unique contribution to pedagogical circles of her day did not escape her contemporaries either. She was recognized and respected for her work on education, which only bolstered her sales as a novelist.

Education is critical to analyze at this juncture of pure and applied science because the individuals of this time, scientists and non-scientists, had to cope with the impact of this "second" scientific revolution in their own ways. One strong influencer of

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[34] For more detail on the work of Aikin and Barbauld, see *Evenings at Home*, Edinburgh, Ed. William P. Nimmo, 1868, 1st ed. 1793. 5, 37-42, 113-16, 164-66, 219-22.

[35] For more on Wordsworth's transformative potential, see Jason N. Goldsmith, "Lyrical Ballads, 1800," *The Oxford Handbook of William Wordsworth*. Ed. by Richard Gravil and Daniel Robinson. London: Oxford UP, 2014. 215-16; Gillian Russell, "'Who's Afraid for William Wordsworth?': Some Thoughts on Romanticism in 2012." *Australian Humanities Review* 54. Bundoora: May 2013, 2-3; Paul Smethurst, *Travel Writing and the Natural World, 1769-1840*, New York: Palgrave Macmillan, 2012. 177-80, 182; David Simpson, "Timing Modernity: around 1800," *Wordsworth, Commodification, and Social Concern: The Poetics of Modernity*, Cambridge: Cambridge UP, 2009. 120-123.

[36] For more on the change of the structure of education in provincial Britain in the Romantic Age, see Brian Simon, *Two Nations and the Educational Structure 1780-1870*, London: Lawrence and Wishart, 1974. 17-26, 32, 36-44, 47-48; Robert Schofield, *The Lunar Society of Birmingham: A Social History of Provincial Science and Industry in Eighteenth-Century England*, Oxford: Clarendon P, 1963; Jenny Uglow, *The Lunar Men: Five Friends Whose Curiosity Changed the World*, 2002.

Maria Edgeworth's opinions and an indicator that they were taking hold in the culture was the Lunar Society that Maria's father and other men of Birmingham had established in the 1760s. The individuals of the Lunar Society, as well as other participants across the spectrum and especially those in the home, saw that this future would be determined by the youth of a generation's ability to interact naturally with aspects of applied science; thus, by a child playing with a mechanical toy, he or she is able to learn pieces of technology, applied science, and pure science through the simple act of play.

James Chandler suggests that Maria's father added six of his own chapters that were very practical in application and content, and her half-brother Lovell added the chapter on teaching chemistry (89). It is curious that the only chapter clearly collaboratively written by both father and daughter is "Tasks," where the duties and responsibilities of education are clearly outlined. It was only much later in the French translation that anyone questioned the complete silence on the topic of religion or the place of fairy tales and other stories in the schema of a "Practical Education." In fact, the only stories included were Darwinian in nature, from Erasmus Darwin's *Botanical Garden* or tales of industrial inventors and curious manufacturers that could conjure up marvels that even Maria, indoctrinated in her father's and the Lunar Society's practicality, questioned the necessity to include any stories, pondering: "'Why should the mind be filled with fantastic visions instead of useful knowledge?'" (Edgeworth, *Works*, viii). The beauty of the father-daughter collaboration in *Practical Education* is that it provides a detailed look into each individual's thoughts and concerns for the future of education in England. The most important aspect of this text is that it shows why Maria Edgeworth thought free play and creative exploration to be so important in her time.

In one example, Maria praises the active mind expressed through the child's ability to dismantle the talking doll, which shows that the child is being prepared for a world where things, words, sentences, images, and actions have to be taken apart to be better understood (Edgeworth, *Works*, 13). The act of play prepares children for more than what their current circumstances can allow. The opening chapter of *Practical Education*, titled "Toys," sets the tone for the whole book. Maria applauds the initiative that prompts a child to dissect and tinker with the mechanical parts of a speaking doll. The spontaneity with which Maria records this very active learning process is simple, yet philosophical, setting the tone for her sixteen chapters within the text.

THE UNIQUENESS OF *BELINDA*

Each of the households in *Belinda* believes that it is doing what is best for its members, but the results are very different; therefore, the end of the novel cannot truly offer its support of any one family model. The three familial models under scrutiny are Virginia and her father Mr. Hartley, Lord and Lady Delacour and their daughter, and the Percival family. Ultimately, Edgeworth can be seen as a rational supporter of a modified system of domestic loyalty with differentiation of the individuals' character and the promotion of education through scientific means, but not beyond a socially accepted brink that would challenge the dominant social structures. Edgeworth's approach to the new domestic loyalty to science is one of independent female progress throughout the novel.

As such, the lives of each of the families in *Belinda* are elements of the novel as through this experiential life and its intersections with the other models of the novel the reader comes to experience and understand the development and refinement of reason and knowledge's role in reflective thought, as expressed in the familial models that educated and refined human growth through conversation and hard work to gain scientific knowledge. The evolutionary necessity for establishing a secure family environment hinges on the necessity for the adults to maintain personal responsibility for themselves, as well as on the responsibility of any resultant child rearing that they implicitly agree to when entering into a familial structure. The cognitive and moral development of the children actually strengthens and unifies each of the familial models with the apparent success of their children. From reflection on the different familial structures and their interactions, we infer that Edgeworth wanted women, from a young age, to be exposed to science. Edgeworth believed that women had to learn how to be comfortable with scientific information and the applications of science in order for them to be part of the new society that was unfolding in front of them. Embracing science gave families a chance at a better future, and the future lies in the titular character's decision to align herself with one familial structure over the others. Ultimately, this chapter will consider where Belinda fits into the argument for science in familial structures.

Anne K. Mellor writes of Maria Edgeworth as a "feminine Romantic" who opposed the radical social views of her masculine counterparts (38). In her discussion of the counterparts, Mellor includes William Blake, William Godwin, William Wordsworth, and Samuel Taylor Coleridge. Edgeworth's critique of family behaviors in *Belinda* signaled an implicit criticism of society in general. Mellor writes that many of the "women of the family-politic, the idea of a nation-state that evolves gradually and rationally under the mutual care and guidance of both mother and father," which seems so problematic as Maria had a personal and professional relationship with her father, as she barely knew her mother and lived with a succession of stepmothers (Mellor 65). Overtly, given Maria's publication history, Maria seemed to have stepped into the role of mother to help educate her own siblings. Emily Hodgson Anderson remarks upon the "pedagogical performances" featured in *Belinda* as well as Edgeworth's early works; for in these scenes, educators stage conditions in which pupils are guided toward making discoveries of knowledge for themselves (165).

Edgeworth's role as independent educator who led her siblings and readers to new discoveries becomes complicated by Elizabeth Kowaleski-Wallace's reading. Kowaleski-Wallace classifies Edgeworth as a "daddy's girl" for whom "identification with patriarchal politics provided an opportunity for self-definition [and a] chance for authority and for limited empowerment" (Kowaleski-Wallace 10, 96). Gary Kelly gives context to Edgeworth's work suggesting that all Edgeworth's novels, save *Castle Rackrent* and *Helen*, "followed plans and themes suggested to her by her father, corrected according to his criticisms, and published under cover of prefaces by him" (Kelly 91). This begs the crucial question: was Edgeworth simply her father's spokeswoman or a "surprisingly progressive iconoclast" (Kelly 3)? The sway her father may have had over her novels is not as strong; it appears that in the novel is where she began to delineate her own ideology. Thus, it is evident why Mark Hawthorne instructs Edgeworth's readers to pay attention to the multi-valent work of her novels. First, they appear on the surface to be "didactic, purely and simply . . . crudely dogmatic," perhaps in an effort to play along with her father's suggestions or desires (Hawthorne 3). Then, they provoke more conversation upon closer inspection as her novels reveal themselves to "advance her own doubts [in] a form of fiction that is at once outspoken and subdued" (Hawthorne 3). Many other Edgeworth critics[37] such as Kathleen Grathwol, Nicole Wright, and Heather MacFayden mark her as one who resisted binary classifications. Additionally, Richard Holmes states that Edgeworth spent time with many scientists in her social circle and "gave a novelistic spin to . . . accounts of experiments" in her correspondence to friends like Jane Marcet (Holmes 264). However, later in his text, Holmes disparages Edgeworth as nothing more than an admiring fan of the prominent scientists she knew; in this treatment, he overlooks Edgeworth's treatment of science in her novels to cherry-pick excerpts of her letters to create glowing praise of these male gentlemen-scientists (Holmes 274).[38] Whereas Ruth Watts, a historian, focuses on Edgeworth's life and work apart from her novels, which gives Edgeworth a more dynamic set of goals to accomplish through her writing. In focusing on rationality and science education in Edgeworth's novel *Belinda*, my dissertation expands on science's domain within the household, as well as in the formation of a family through the choice of suitor as husband and in child-rearing, and my work here expands on the thoughtfully considered innovative approaches used by these scholars.

"The Extraordinary Ordinary Belinda" — the first part of the title for Deborah Weiss's excellent article on Belinda's unique perspective gives a good place to begin a discussion of what sets Belinda apart from other Edgeworthian, as well as other contemporary novelists', female characters. Weiss finds in *Belinda* "traits commonly

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[37] See Nicole Wright's "Opening the Phosphoric 'Envelope': Scientific Appraisal, Domestic Spectacle, and (Un)'Reasonable Creatures' in Edgeworth's *Belinda*" *Eighteenth-Century Fiction* 24.3 (Spring 2012) 509-36.

[38] For additional perspective on Edgeworth's treatment of science in her nonfiction and fiction for children, see Kathryn Scantlebury and Colette Murphy's "Maria Edgeworth: Nineteenth-Century Irish Female Pioneer of Science Education" in *Irish Educational Studies* 28.1 (2009): 103-09.

ascribed to men, and those seen as natural to women, are set loose to float freely in the social sphere, attaching themselves to any individual, regardless of his or her sex" (Weiss 449). While this may be one way to rationalize the distribution of character traits, I believe there is something much more complex in what Weiss pointed out. Edgeworth seems to write people as they are, not as society wishes them to be. Any analysis of Austen's or Burney's works will show those characters possess a variety of traits as well, but what matters more for Edgeworth's characters' and their traits is that Edgeworth presents every character with the same degree of rationality as the next. There is not undue emotion to humanize, or make relatable to the reader, certain traits over others, but rather Edgeworth strives to present, equally and without bias, the traits present in everyday life. Edgeworth's novels present a rational reality that cannot be restrained by the obfuscation inherent to superstition and spectacle. The science-based scenes in *Belinda* are presented without being overly sensational, showing that Edgeworth wanted scientific education to be normalized into education at home and in schools. For Edgeworth, science was the means to liberate thought and encourage rational thinking in all areas of education.

In fact, Edgeworth even uses rationality to introduce how seeing things judiciously can lead to compassion for others. Lady Delacour most benefits from Belinda's rationality. Belinda is the one who helps Lady Delacour understand that the bruise on her breast may have another cause than the breast cancer Lady Delacour fears it to be indicative of. However, Belinda is not the only one who follows the mandate of rationality, for the Percival family also hold rationalism as their standard. These individuals together challenge others' misperceptions and raise new ideas for consideration. This approach to unify by rationalism connects the characters within the novel and, ultimately, if there even is a hero at the ending, the hero stands among those who choose rationalism as their life's guide. Rationalism and empiricism allow the individual to figure things out, like Dr. X—, rather than be told the truth of the matter by someone else. Dr. X— says to Belinda: "Every man, who has any abilities, likes to have the pleasure and honour of finding out a character by his own penetration, instead of having it forced upon him at full length in capital letters of god, finely emblazoned and illuminated by the hand of some injudicious friend" (Edgeworth 97). And Dr. X— even simplifies his own statement: "Every child thinks the violet of his own finding, the sweetest" (Edgeworth 97). It is true for anyone will learn a lesson or remember new information better if they come across it themselves. The problem within this is that some things must be learned through education because society has certain expectations that children and adults of particular ages should know certain things, regardless of whether or not they have had the natural opportunity to learn them. Thus, this is the problem that society faces in educating certain qualities into the person in the effort to create a better future.

Maria Edgeworth and her works demonstrate a desire to re-vision the qualities that represented the past into a better, more clearly defined future. Kathleen Grathwol states that Edgeworth's views on female education comprise "a radical revisioning of women's place in society" (Grathwol 73). While Edgeworth was not working on the same tasks of social reform as Mary Wollstonecraft, Maria Edgeworth took to writing commentaries of her own world in novel form. Her novels gave her the ability to reimagine the purpose of the family, the individual, and their interactions in a new way, while still conforming to the expectations of loyalty to her own family. Edgeworth's implement through this process was the subtle, layered commentary presented throughout the novel, making it difficult for the reader to determine the correct opinion of any character. Thus, Edgeworth's characterization of each individual and their interactions with others from other households exposes the complexities of character, behaviors, values, morals, and beliefs.

Domestic complexity makes space for science, because more women began to enter the public sphere in the Romantic Age. The research of Anne Mellor has emphatically demonstrated that women writers were anything but marginal, but the repressive norm of the female modesty discouraged women's literary ambition. Thus, the emotional solidarity of intelligent women becomes the means by which women writers could bond and reform their culture. Sandra Gilbert and Susan Gubar developed the concept of a "poetics of duplicity" to describe women's writing and the concept that pertains to Edgeworth's *Belinda*. Gilbert and Gubar write of "submerged meanings . . . hidden within or behind the more accessible 'public' content of [women's] works, so that their literature could be read and appreciated" (70). Edgeworth's text functions in this duplicity through the novel's thematic discussion of Belinda's marriage choice, while subversively discussing women's education and science. Belinda's decision to marry is constrained and seemingly predetermined by an educational process that wholly distorts the development of natural knowledge and rational judgment. In a microcosm, Belinda's interactions with each household represent a complex web of choices and expectations that its members must adhere to in order to be considered part of family and thus a contributing member of the family's future.

Loyalties to the family are laws of the heart and of the will, internal regularities whose force often binds the agent through his or her will as informed by love, rather than reason. In fact, loyalties' law-like nature provides the ground for the deep intuition that loyalties are somehow essentially shared and kept within the sphere of domestic morality. The moral center of the culture is stored, modified, and/or preserved within the familial structure of the home and as such there are "laws" that govern the various households in *Belinda*. These laws are translated into the space reserved for the domestic sphere and its interactions with the outside world, as it delineates what is inside or outside of the domestic purview.

By referencing the act of "mapping" in the chapter's title, I suggest an understanding of the situation of science and pseudo-sciences as paralleled in the particular geographical landscapes in the domestic sphere — or the "contact zones" of Mary Louise Pratt's formulation — and to the possibility that colonial fantasies, as suggested by Virginia and Mr. Hartley, are actually suggestive of the conquest of the domestic sphere by science and pseudo-sciences (Pratt 33-40). There is always something unique about the place from which ideas arise; thus, just as the Lake District held certain truths and beauty for Wordsworth, Birmingham possessed valuable qualities and attracted particular individuals to its cause of driving scientific application forward. Just as the last chapter makes note of Birmingham's influence on the creation and stimulation of the Lunar Society, Maria Edgeworth's *Belinda* and the characters she produced within benefitted from the same circumstances of a social turn toward rationalism to figure out the world around them, which is especially true in regard to the distinction between science and the pseudo-sciences that is sensationalized within the text.

Because expressions of scientific meaning in fictional contexts often implicitly operate to authorize certain epistemological axioms regarding the sciences and the pseudo-sciences, also known as their real and fictional counterparts, the characters represented in the familial structures in conversation here can also be shown to address fictionalized portrayals of scientific meaning-making, or take into consideration the breakdowns of those very attempts of meaning-making. For instance, Lady Delacour is the perfect example of a representation of the misuse or misperception of science, such as her formulations of superstitious beliefs when things do not seem to be what they appear. She is continually led astray by the "ruses" of Harriet Freke, distracted by the Percival family's practices of understanding by means of trust grounded in experimental processes, and has ultimately failed in her familial experiment to parent her child, Helena, with someone other than herself in order to live a more fully life as a lady of society, while still raising her daughter. Lady Delacour's perception of science is more akin to a perception of a pseudo-science that cannot be understood, partially because her perception is merely irrational and completely a sentimental understanding of what she believes science has the capability to do to her and the world around her. Lady Delacour's relationship with science is nothing more than a bastardization of the work of experimentation. Delacour believes that she can experiment to find the best way to live.

The portrayal of failed experiments and the challenge of achieving good health, while negotiating conflicting strategies for maintaining physical well-being, consume Lady Delacour's existence. She failed in another of her experiments, which had the aim of snagging Henry Percival as a husband and then makes do with Lord Delacour, even literally fighting his battles for him as she attempts to lead the household. Lady

Delacour's health is a constant topic in the novel as she confronts "breast cancer" throughout the novel, complicating her own understanding of what it means to be a woman. Interestingly enough, Lady Delacour is the only one throughout the novel to be afflicted with a physical disease. However, because of her confinement to her sick room, she can only see what is presented to her through her window or through those who come to visit her. It is here in her sick room that Lady Delacour is free from the "extraordinary exertions" that had previously designated her life (Edgeworth 217). In fact, it is Lady Delacour's presence in the sick room that keeps Belinda from having time to pursue other suitors than Clarence Hervey, especially keeping her away from Mr. Vincent, a choice that is applauded in a letter from Lady Anne Percival near the end of the novel (Edgeworth 450).

In fact, these social constructs that define the external portrayal of self are the same social constructs that encourage Lady Delacour to think that she is doing wrong by acting as two separate, disjointed personalities. "Abroad, and at home, Lady Delacour was two different persons. Abroad, she appeared all life, spirit, and good humour — at home, listless, fretful, and melancholy" (Edgeworth 10). This split causes Lady Delacour to lead an inauthentic life, which was the root of all of her problems. She thinks she has breast cancer because she is lied to by her doctor and because she cannot consider anything else to be real, as she is living an alternate reality that endorses her mode of thinking and shuns all other possible explanations. Thus, in this mindset of total belief in her alternate perception of reality, Lady Delacour maintains control over her situation by interpreting the significance of the duel that she and Harriet Freke had been in where Lady Delacour had been shot and that was what resulted in her "hideous spectacle" that she reveals to Belinda (Edgeworth 32). It is only after first going "through her bedchamber, and to the door of the mysterious cabinet" that Lady Delacour "with a species of fury, wipes the paint from her face" and throws herself at Belinda's feet to implore:

> "Am I humbled, am I wretched enough?" cried she, her voice trembling with agony. "Yes, pity me, for what you have seen; and a thousand times more, for that which you cannot see — my mind is eaten away like my body, by incurable disease — inveterate remorse — remorse for a life of folly — of folly which has brought on me all the punishments of guilt." (Edgeworth 32)

The mere fact that she exposes her true self to Belinda so early in the novel is a sign that Lady Delacour is asking for help, for some type of outside opinion, and perhaps an individual to act as a mirror to all her irrational behaviors, to help her transform her thinking to something more rational. Lady Delacour's despair about the circumstances of her own life makes her have tunnel vision and view her psychosomatic disease as punishment, a punishment she must bear in secret even to the point that she considers a mastectomy to remove, without confronting the issue, what she believes to be the problem because she is so unwilling to see the situation from any other perspective. In fact, while Mr. Vincent and Virginia also have secrets and inconsistencies in their lives, Lady Delacour is the only one who maintains control over her secret by closeting herself away from all society, not letting reason or rationality enter her private space within the domestic sphere. Lady Delacour must turn toward reason, as is best exhibited in the novel by science, in order to garner new perspective for how to live rationally. As is evident throughout the novel, this behavior is not only psychologically detrimental, but also physically detrimental to her health. Therefore, a transformation of thought and social norms must occur throughout the novel in order for Lady Delacour to think straight again and consider the true nature of her situation, confront the problem, and re-enter into her domestic sphere and society as a singular woman who is not living in an alternate reality. Thus, this differentiation between her sick room and all the other rooms in the domestic sphere of her household create the space necessary for the act of taking apart her character and putting it back together as one unified individual. Ultimately, this disjuncture in domestic identities leads to Lady Delacour's confusion and control she exerts over others throughout the novel.

Yet, according to Edgeworth's initial character sketch of Lady Delacour, the intent for her character was "a woman of wit and fashion, who married with the hope of managing her husband and his large fortune" (Edgeworth 479). This type of woman has to be more forward-looking in her perception of familial domesticity and must be more open and accepting of the natural place of science within the home. The site of science, for Lady Delacour, is how she chooses to raise her children in order to perform and align herself with a new understanding of rational society. However, Lady Delacour becomes a character for deeper cultural questioning because she is not the paragon of familial domesticity. She removes her daughter from her life in order to maintain her place as a society woman, although it becomes clear soon enough that Lady Delacour's true desire is to be a mother, yet by that point, she is stuck in a role of performing the calm, cool, desirable woman. Because of this alternate reality, she does not and cannot take full advantage of her rights as a mother and the role of a mother in a child rearing situation, an act that is also a bit of a science in its formation of what is best for a child in terms of how and what the child learns.

As Philippe Ariès states in *Centuries of Childhood*, there are historical and culturally conditioned perceptions of childhood, changing drastically from the Medieval conception of children as little adults or Aristotle's conception that children are valuable because they will become adults for as children they are deficient of what will one day make them adults (Ariès 3-7). These perceptions shape both the cognitive and moral development of the child. It is quite clear from Ariès's work that children in the Romantic Age held some sort of power and awe for adults as childhood was becoming a free space, unconfined by social constructs and the weight of society that individuals like Lady Delacour were beginning to despise. As Aries notes, the pursuit of science allowed the child free play of the mind by the modes of experimentation (Ariès 50-55). The trial and error methodology of interacting with the world allows the Percival family's method of child rearing as successful. This method is endorsed only by the inquisitiveness of the Percival children and their inherent rationality, a result of their continued exposure to science in their home and their mother's own comfort with the topic and the free play.

However, it is the gaps between the economic and social realms that expose Lady Delacour's and Lady Anne Percival's initial distance in ideology. The final proof that Lady Delacour had changed came in the final tableau of the novel, where Lady Delacour shows that she and her husband have decided actually to raise their own daughter, Helena. Initially, Lady Delacour's concerns were mainly with the expectation of the dominant social structure, referring to the conception that a society woman did not and should not raise her own children, thereby implying that with the ending that Lady Delacour and her husband decided to try out the ideology presented by lifestyle of the Percival family. "Now, where's my lord Delacour? He should be embracing me, to show that we are reconciled. Ha! here he comes. Enter lord Delacour, with little Helena in his hand. Very well! a good start of surprise, my lord. Stand still, pray, you cannot be better than you are. Helena, my love, do not let go of your father's hand. There! quite pretty and natural! Now, lady Delacour, to show that she is reformed, comes forward to address the audience with a moral – a moral! – yes" (Edgeworth 478). While this ending does suggest that Lady Delacour has conformed to a more emergent social structure, the ending is also presented with a considerable amount of satire, as suggested by the theatrical elements and staged cues in the final snapshot of the "Happily Ever Afters" for each of the characters. Thus, while the ending is good for aligning Lady Delacour with the Percivals, the performance itself is riddled with almost too perfect sweetness: the type which only comes from theatrical productions.

The ending proposed for Lady Delacour is both strange and unnatural as well as sweet and promising. The explicit directions given to each of the characters is exaggerated in the Delacour triad. They are not each independent individuals, but rather are only content and "pretty and natural" together, in this frozen state. This frozenness suggests that this behavior, imposed on each of the characters by Lady Delacour, is nothing more than the result of Lady Delacour's embrace of science's experimentation practices. She has finally decided to try her hand at experimenting, but instead of only experimenting with the lives and practices of her own familial domestic sphere, Lady Delacour has expanded her sphere of influence to almost everyone in the novel, arranging them in her perfectly structured tableau. Ultimately, this new perception of science still shows that Lady Delacour has not garnered the true meaning or place of science in the domestic sphere. She is still experimenting and acting within the realm of her own understanding of science.

The Percival family's function in the novel is to provide a backdrop of idealistic normalcy for Lady Delacour's interactions with her family and how she chooses to raise her child. For example, Lady Delacour is viewed as more of a complex character in comparison to the Percivals who do what they should, although they do not have the same power and influence as Lady Delacour. These aspects of power and influence construct the two possible forms of family life, but as the novel progresses Lady Delacour seems to drift toward the Percivals' more radical ideology about child rearing and familial unity.

Lady Delacour's initial alignment with the upper-class positions her to be a steady force of the dominant culture throughout the novel; yet, the novel's progress changes her position slightly. To some degree, Lady Delacour's function is comedic because her behavior is unwieldy so that any comparison made between Lady Anne and Lady Delacour makes each seem hilarious by their divergence. Lady Delacour lacks Lady Anne's language of the heart and true concern for her children; therefore, any criticism of Lady Delacour is perceived as a mere reflection of what she should be doing rather than what she cares to do with her time, further heightening her deficiency in personal responsibility, when compared to Lady Anne. Lady Delacour's sentiments change throughout the novel because the Percivals set up the perfect standard of familial life, which draws the novel's attention toward them. Lady Delacour has the power within the current structure, thus she has no desire to change herself, but the Percival family model is so intriguing that Lady Delacour's love of what is up and coming piques her curiosity and drives her toward accepting the Percival model.

Lady Delacour's contrast becomes even more apparent when she critiques the full spectrum of sentimentalism and society, where the spectrum encompasses the space between raw nature and the corruption of humankind. This is most strongly shown when she expresses her ideals on both children and colonization, collapsing the difference between the hegemonic understanding of the roles of children into nothing more than a submissive position to the empire's dominant power. Lady Delacour's revelation of her imperfect, ruined breast not only strengthens the friendship between Belinda and Lady Delacour, but it also is what sets the stage, so to speak, for Lady Delacour's confession of her life's follies that occur all at the insistence of fashion.

> [i]t was the fashion at this time for fine mothers to suckle their own children . . . There was a prodigious rout made about the matter; a vast deal of sentiment and sympathy, and compliments and inquiries; but after the novelty was over, I became heartily sick of the business; and at the end of about three months my poor child was sick too — I don't much like to think of it — it died. If I had put it out to nurse, I should have been thought by my friends an unnatural mother — but I should have saved its life. (42)

The disconnected way that Lady Delacour refers to her child, only referring to the now dead child as "it," is disconcerting. Lady Delacour followed the fashion of the time, even to the point that it caused the death of her child. By collapsing the difference between her own ability to think about and choose what is best for her child and society's ability to determine what is in fashion, Lady Delacour becomes a stagnant remnant of the dominant cultural forces, which encourage conformity to social norms. In retrospect and in conversation with Belinda, Lady Delacour realizes that there was the option to buck cultural norms, but this is something that did not occur to her when she was so absorbed in the sensationalist society. Being able to think clearly, regardless of one's surroundings, is a critical part of becoming truly rational and it is something that the Percival family exudes well, for they do not change who they are depending on where they are or in whose presence they find themselves. Therefore, in this light, it is easy to make comparisons between Lady Delacour and the Percival family. Lady Delacour appears to be part of the old regime, the dominant power. The Percivals instead want to explore the moralizing factors of life in nature as experienced through science's eye, the emergent power.

BELINDA'S PLACE AT THE END OF THE NOVEL

Ultimately, the question at the end of the novel remains: where does Belinda belong? Lady Delacour seems to put her with Clarence Hervey in the final constructed tableau, but when Lady Delacour had brought him into conversation before, asking "'Now we talk of the height of human absurdity, what are we to think of Clarence Hervey?'" (Edgeworth 271), Belinda responded with "'Why should we think of him at all?'" (Edgeworth 271). Her nonchalance conveys Belinda's self-control and logic in the situation. She has no need to experiment and further test out her feelings for him; for through thoughtful, rational consideration, she has already taken him into observation and concluded that he was no good for her, but that another suitor, like Mr. Vincent, was her best option. Perhaps from experience, Lady Delacour seems to privilege the position of first loves, as Henry Percival was her first love and Lady Delacour seems to be aware of the increased attention and praise given to the practices of the Percival family. She views their family as more successful and more preferable to what hers has turned out to be.

In *An Essay Concerning Human Understanding*, John Locke suggests that children are "white paper, void of all characters, without any ideas" who then need to learn how the world works (Locke 31). For Locke, Descartes's "resources" come from experience and interaction with the world, much like the behaviors and knowledge of the Percival children stems from their childhood where they were taught to model prototypical adult example behaviors, which in turn makes the adults, who are not raising these children, uneasy about the children's active roles in their own discursive process of figuring out what it means to be an adult. As such, Lady Anne Percival is perfectly in line with Locke's maxim to "Reason with children" (Locke 32). Edgeworth seems to side more with Locke on this philosophy of child development and the need for experimentation in youth.

Therefore, with the Lockean empirical understanding of the importance of knowledge and experience, Lady Delacour makes her recommendation to consider Clarence Hervey:

> "Why my dear!" said lady Delacour with a look of mingled concern, reproach, and raillery, "have you actually given up my poor Clarence, merely on account of this mistress in the wood, this Virginia St. Pierre? Nonsense! Begging your pardon, my dear, the man loves you. Some entanglement, some punctilio, some doubt, some delicacy, some folly, prevents him from being just as this moment where, I confess, he ought to be – at your feet – and you, out of patience, which a young lady ought never to be, if she can help it, will go and marry – I know you will – some stick of a rival purely to provoke him." (Edgeworth 273)

While there is truth in Lady Delacour's warning to Belinda on the matter of marriage to Clarence Hervey, Lady Delacour's resources that she draws upon here come from experience with the world on a particular level, a level that cannot be duplicated in other interactions with other sets of lovers because of the various dimensions and variables in a marriage. Her conclusions are ultimately flawed because they are based on an inability to reason properly, which is something that the daily practice of science teaches, and the assumption that whatever happened to her is bound to happen to other people. And because this is what Lady Delacour fears, the repetition of her missed opportunity to marry Henry Percival and her actual marriage to Lord Delacour, she believes she has to take action in Belinda's life to save her from this one singular fear in life, making the mistake of marrying the wrong man.

However, what Lady Delacour overlooks is the fact that Clarence Hervey is a snob, seemingly on constant lookout for other snobs to correlate and backup his own perspectives in the world. Hervey only performs proper social reactions to snobs because he distances himself through avoidance of other snobs. Lady Delacour, as she does not realize this, plays into his desires and gives him her approval of superior character because he avoids her! Hervey and Edgeworth's presentation of the narrator shows that the two are unified on this front, as the narrator seems to overly criticize Lady Delacour and her snobbishness; yet the narrator is also used to condemn Hervey for this same quality, almost suggesting that Hervey should be kinder to Lady Delacour because of what she has been through. Whether Hervey is disliked because of his personality and attitude as represented throughout the novel or because Edgeworth, through the narrator, holds him in certain contempt is bifurcated through Edgeworth's presentation of the characters in the novel. Seemingly, Edgeworth is very much invested in Belinda's choice and, in the meantime, does not worry about misrepresenting Hervey throughout the novel. Belinda's rationality makes her both more likeable as a character and endorses Edgeworth's placement of her independently separate from everyone else at the end. Thus, a look at how Edgeworth frames Hervey suggests how Belinda and the reader are supposed to consider him rationally. Edgeworth uses the phrase "pleasant young man" to describe Hervey at three key points in the text, before dropping the term completely.

First, Mrs. Selina Stanhope writes to Belinda to inform her about Clarence Hervey: "an uncommonly pleasant young man, is highly connected, and has a fine independent fortune" (Edgeworth 8). This passage indicates that Hervey is a man who is on everyone's radar, the one to be watched and judged strongly during all interactions with him. Mrs. Stanhope even cautions Belinda on her appearance suggesting that "nobody *can* look well without taking some pains to please" (Edgeworth 8). This nod to female beauty and the pressure on young women to look perfect is part of the act of looking in correct fashion at all times.

Second, that initial introduction to the name Clarence Hervey is shortly followed by a greater description, delivered by the narrator. Here, the narrator posits Hervey as the hero of the novel, calling him "a man of genius" with a "strong sense of humor and quick feelings of humanity" plus he "could be all things to all men and to all women. He was supposed to be a favourite with the fair sex" (Edgeworth 14). But, discretion is important to the establishment of intelligence and rationality. For, Hervey "might have been more than a pleasant young man, if he had not been smitten with the desire of being thought superior in every thing, and of being the most admired person in all companies" and was marked by a "chameleon character" in an effort to bolster and describe the complexities that comprised his character (Edgeworth 14). In this moment, the narrator delivers these criticisms with a very judgment tone against Hervey, which explains Belinda's inaction toward Hervey throughout the novel and reflects a fear of being judged by the reader and the other characters for her choice of Hervey. Edgeworth could not use Belinda to endorse Hervey's irrational unintelligence. Edgeworth's strong desire to define Hervey as the clichéd, intelligent, young, rich man makes his attitudes show strongly through the text itself. Yet it is important to know exactly who Hervey is and why he is presented as the likeliest match for Belinda, thereby making it critical for him to possess such a complex character as that is what is valued by the narrator and Edgeworth herself, Lady Delacour, Belinda, and Maria Edgeworth.

Third, the term is used again by Mrs. Stanhope, the "matchmaker general," in direct criticism of Clarence Hervey, stating "men of genius are dangerous husbands; they have so many oddities and eccentricities there is no managing them, though they are mighty pleasant men in company to enliven conversation" (Edgeworth 201). While Mrs. Stanhope leaves off the qualifier "young" this time, the sentiment has dramatically changed. Hervey is pleasant, but now that he is intelligent, he is not the type of man Belinda should be marrying. Mrs. Stanhope and Lady Delacour are indeed friends, but they seem to diverge on the importance of intelligence in a husband. There is certain pressure on Belinda to "marry better than her sister, or any of her cousins, and take place of them all" (Edgeworth 201). However, at this juncture of the novel, it becomes increasingly puzzling why Mrs. Stanhope disagrees with matchmaking Belinda and Clarence anymore — where initially all interest was on Hervey, now there was nothing but disdain for him, possibly due to the fact that Mrs. Stanhope believes he has "kept a mistress for some years" (Edgeworth 201).

Yet the term is dropped after this usage. Hervey is no longer called “pleasant,” but rather “generous,” “poor,” “discreditable,” and “the ruin of such a sweet, innocent looking young creature” when there are whisperings about Hervey’s affair with a mistress in the woods (Edgeworth 330). But Hervey’s actions are shortly explained away, allowing him to come back into good favor with Belinda and, almost more importantly, Lady Delacour. Hervey produces a packet of information that explains his connection to Virginia St. Pierre, showing that he was involved with “the romantic project of educating a wife for himself” (Edgeworth 362). While this was not exactly a common practice, it had roots in the Lunar Society as Thomas Day did the same thing with two young girls he had adopted, making it probable that Maria Edgeworth had heard about the project from her father or other members of the Lunar Society and wanted to offer her own criticism of the project through her novel; however, it is curious that she makes the project belong to the hero of the novel, perhaps suggesting that even a “man of genius” can be led astray by faulty ideology.

Throughout this chapter in *Belinda*, Hervey’s actions are explained by the narrator in order to “save our hero from the charge of egotism” (Edgeworth 362). The narrator describes the heroic journey of intellectual pursuits and revolutionary ideology encountered before the French Revolution, “when a spirit of licentious gallantry prevailed” and Hervey became “disgusted” by the “women, who were full of vanity, affectation, and artifice, whose tastes were perverted, and whose feelings were depraved, were equally incapable of conferring, or enjoying real happiness” (Edgeworth 362). Thus, it is from witnessing this disgusting depravity of pre-revolutionary France that Hervey decided to do something to remedy the situation in England.

The perfect circumstances happen upon him shortly after his return. Hervey saw a young woman watering rose trees in the picturesque New Forest and thus decided to follow her home, where he met her grandmother, learned her story, watched her grandmother die, and proceeded to adopt Rachel Hartley, bestowing her the new name of Virginia St. Pierre. The name of choice is not without significant import. In order to understand how Edgeworth positioned her characters, it is interesting to note that Jeanne M. Britton writes that Clarence Hervey makes Virginia into "an amalgamation of character and creator" so that she represents the heroine of Jacques-Henri Bernardin de Saint-Pierre's popular novel *Paul et Virginie* from 1788 (Britton 433).[39] Knowing that *Belinda* came out of Maria Edgeworth's character sketch of interesting characters, it is evident that the interplay of these characters is a crucial linchpin of the text. The characters of *Belinda* shape the novel's interior speculation and complexity of descriptive changes over the course of the novel because each of the characters is complex and dynamic simultaneously. As Britton aptly states, "'Character' is the lens through which *Belinda* demands to be read" (Britton 434). Britton notes that, unlike Virginia, Belinda "seems to have been schooled in the process of proper sympathetic identification: we learn early on that she is a reader of Adam Smith's *Theory of Moral Sentiments* [1759], a crucial text in the Romantic-era conception of sympathy" (Britton 439). Belinda is presented as an intelligent, rational character who can and should be able to choose the best suitor.

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[39] See Carolyn Vellenga Berman, *Creole Crossings: Domestic Fiction and the Reform of Colonial Slavery* Ithaca: Cornell UP, 2006. 88-99; and Susan C. Greenfield's "'Abroad and at Home': Sexual Ambiguity, Miscegenation, and Colonial Boundaries in Edgeworth's *Belinda*" in *PMLA* 112 (1997) 214-28.

While Belinda's correct choice of suitor is of grave importance to Lady Delacour, Belinda seems much more nonchalant about choosing a husband as she recounts Henry Percival's recounting of the same story, but with a much more scientifically derived conclusion. Henry explains to Belinda "that the omnipotence of a *first love* was an idea founded in folly, and realized only in romance; and that to believe that none could be happy in marriage, except with the first object of their fancy or their affections, would be an errour pernicious to individuals and to society" (Edgeworth 275). Henry Percival's conclusion is based on empirical data of both the quantitative and qualitative varieties, which he formed through his everyday practice of science that gave him a well-honed sense of rationality. He has decided that the principle of first loves requires the lovers to cling to whatever they learn first, rather than what is ultimately best for them judged on a more complex, dynamic, sophisticated system. His word choice and construction of the importance of marriage by stating the absurdity of clinging to a first love, especially if it is not well matched, shows the complex, forward-looking perspective of the domestic sphere in Henry Percival's purview. Also, because of Henry Percival's direct involvement in his children's upbringing, it can be inferred that the Percival children will also be blessed with this trait, allowing this domestic behavior to carry on to the next generation.

It is only through delving into the uniqueness of the Percival family and how it came into being, by direct means of Henry Percival's desire not to settle with his first love and to keep looking until he found his best match, that we can understand why Belinda must also end up with a rational, intelligent "man of genius." Trusting in his own reason, honed through knowledge and experience, Henry Percival knew that Lady Anne

Percival would make the perfect wife and mother for the family he intended to raise. The Percival children feel comfortable approaching their mother with questions as they go about their daily lives. Little Charles Percival talks to his mother in such a scientific fashion, with such a directed question, "'we have brought the sulphurs to you, because there are some of them that I don't know'" (Edgeworth 107). This mere admittance of a gap in his and his siblings' knowledge and their desire to learn what is right from their mother is a stabilizing element in the family. Lady Anne responds with vigor, "'Wonderful!' said Lady Anne, 'and what is not quite so wonderful, there are some of them that I don't know'" (Edgeworth 107). Lady Anne's praise and consideration of her own knowledge when she answers shows that there is a higher respect for knowledge in the Percival family, even if that knowledge has to be contemplated or looked up or experimented through to find the knowledge they were seeking. Lady Anne continues to walk them through the proper scientific process toward understanding the sulphurs the children are so fascinated by. For, in fact, Lady Anne's initial comment of "Wonderful!" sets the stage for the children to follow suit in their own experimentation and trials. By modeling proper scientific behavior, i.e. fascination with new reactions and compounds, the desire to figure things out, and the proper methods to follow in order to guarantee the proper conclusion, Lady Anne gives her children the methodology necessary to make them successful later in life. These overt moments of science help the reader see the contrast in Lady Delacour's actions as lacking in a scientific practice that endorses and instills rationality.

For comparison, later in the novel, Lady Delacour is visited by "a vision" outside her window and immediately assumes that it is a sign of mysticism and therefore signaled her upcoming death, a fate that the doctor who had been examining her breast cancer would have certainly confirmed (Edgeworth 307-09). If Lady Delacour had been in the practice of considering science on a daily basis and had become well-versed in rationality, then she would have been more likely to entertain other explanations of what she thought she saw out of her window. Her complete disregard for the interconnected activities is shown when Belinda immediately jumps to the conclusion that Lady Delacour's visions were nothing more than the product of opium, the drug necessary to keep the pain at bay. Lady Delacour scoffs at this, but her surgeon, Dr. X, has the proper scientific reaction and sallies forth into the garden to investigate any traces of the "vision." Thus, by choosing to investigate the cause of the reaction to see if all the other claims are built on a verifiable observation, Dr. X's medical procedures are immediately rewarded as it is discovered that Harriet Freke was the one in the garden, dressed as a man in order to play a trick on Lady Delacour.

Once Lady Delacour realizes her mistake, she immediately states "'My folly, and my visions, and my spectre. . . . [Harriet Freke's] malice and her *frolic* are consistent with her character, but my fears and my superstition are totally inconsistent with mine. . . . This morning you shall see lady Delacour *herself again*'" (Edgeworth 312). This proclamation of a return to herself in Lady Delacour's behavior is odd because it is inconsistent with a more rational approach to the world around her, suggesting that she has not learned how to practice rationality; for on one hand, she does become a much better mother figure after this point in the story, but she also embraces her own self and takes control over her own life and the lives of others, as demonstrated by the tableau ending. Yet what is unusual is that the novel does not end immediately after Lady

Delacour returns to normal. Given the rational actions that Lady Delacour has to take in returning to normal, as it is an activity not a definitive action in becoming her normal self again, she returns to normal over course of the unfolding of Belinda's choice of suitor and the entire affair about Hervey and Virginia. In practicing rationality, this continuously unfolding presentation of Lady Delacour's actions as "returning to normal," so to speak, imply that she was once rational and therefore develops a complicated way to understand her character change as if it had a logical precedent. However, there is no evidence that Lady Delacour ever was logical, although her romantic interest in Henry Percival does suggest that she was at least charmed by the thought of a rational, scientifically-based lifestyle. Lady Delacour's own words suggest that the observation of her change in character is more valuable than anything else, indicating the truth of the aphorism that "seeing is believing" because Lady Delacour proclaims with such enthusiasm and confidence that she shall be "*herself again*." This type of confidence, not only in which Lady Delacour believes to know herself so well, but also through which she has been able to revert back to that old state, is staggering, but it is really only from that proclamation that she can boldly assert the novel's final tableau.

This whole scene of Lady Delacour's return to "*herself again*" occurs over a series of cognizant realizations wherein science's power of understanding the everyday scenarios and meaning-making activity of the world is delivered through confidence of self and where the individual self belongs in the larger conception of the world. This type of psychological understanding helps put the characters of Lady Delacour's world into certain, definable categories. Rationality itself stems from proper consideration of self among others, which is the motivation for Lady Delacour to self-determine her own life and make the choices that lead to her own path in life. The fullest representations of humanity in *Belinda* show people to be curious, vital, and self-motivated. Yet, in Lady Delacour's case, because of her lack of success as a mother, it is also clear that the human spirit can be diminished or crushed and that the individual can reject growth and responsibility. For Lady Delacour, it is projection of her own desires onto Belinda that helps her rationalize the world around her and realize that she must reconsider the empirical foundations upon which she built her own life.

The best example that can be broken down to its constituent parts is Dr. X's response to Lady Delacour's condition. In this example, the rational response to a situation where one does not know everything or thinks that the foundational information may be flawed is the response that Dr. X takes. First, Dr. X— is introduced by the narrator as already being in the home, but before Dr. X— is allowed to see Lady Delacour, she calls for Belinda and reveals: "my prophecy is accomplishing — I know I must die" (Edgeworth 307). After Lady Delacour reveals this prophecy and the visions she has had, Dr. X— enters, "going calmly to the side of Lady Delacour's bed, [taking] her hand to feel her pulse" (Edgeworth 308). Dr. X's calm mannerisms instantly bring a new perspective to the situation; he suggests that Lady Delacour is not dying, which at first seems rather foreign to her because she has convinced herself that death is near. In fact, it is Belinda that calls the unusualness of the vision to Dr. X's attention. With Belinda's direction, he reassess the entire situation, even the knowledge he assumed was true because it brought him there. This causes him to assess the whole scene, including the garden where Lady Delacour had seen the figure that brought her so much distress, and the "doctor did not search long before he perceived footsteps in the borders opposite to the glass door of lady Delacour's bedchamber" (Edgeworth 309). And when they investigated further, they determined the true cause of the mystery, which was Harriet Freke's attempt to get the attention of Lady Delacour by dressing like a man. Eleanor Ty reads Freke's cross-dressing as a "moment of deviance" that reveals "the ways in which Edgeworth attempted to work out the contradictions inherent in the ideological constructions of gender in the late eighteenth and early nineteenth centuries" (Ty 165). The identity reveal of Freke as well as Belinda and Dr. X's roles in exposing her help expose the fact that gender identity is socially and culturally constructed based on cultural norms, which ultimately complicates Lady Delacour's return to becoming "*herself again*." On the whole, this scene is very odd, especially in context with Dr. X's scientific conclusion that Lady Delacour does not actually have breast cancer and that she will not need to undergo a potentially deadly surgery. The oddness exudes from each character's realization that one of their fundamental beliefs was in fact horrendously misguided and out of place.

This particular scene, for all it reveals about the mystery of Lady Delacour's illness and "cancer," is one of the most gothic and sensationalist of the novel. *Belinda* is a critique of sensibility because Lady Delacour is so played upon by her emotions, but Belinda herself, as well as Dr. X and the Percivals, stand out as extraordinarily rational by comparison. However, Weiss's article exposes Belinda as "The Extraordinary Ordinary Belinda," which gives unique insight to the changing social norms that made rationalism normal for both men and women in the beginning of the nineteenth century. The radicalism of Mary Wollstonecraft's critique of social, political, and economic structures of her day brought the notoriety of systemic change to the forefront[40] and, as Weiss notes, "Edgeworth took Enlightenment concepts of the cultural formation of the individual — ideas used by radical male thinkers such as William Godwin to argue for the universal equality of 'mankind' — and applied these concepts to the formation of feminine identity" (Weiss 441). Edgeworth opened up the discussion of individual formation of character to be a product of cultural, rather than natural influences.[41] Edgeworth's focus on character creates a space for discussion about her culture's gender codes in the realistic world of her novel. Weiss suggests that we look to the Edgeworth's philosophical engagement with Enlightenment thought and read Belinda as a female philosopher, which was a character that was present throughout fiction in the 1790s and early 1800s.[42] Both Belinda and Harriet Freke are presented as the binary of rational and irrational female philosopher, respectively. Belinda aligns more with the mainstream female rationality that Wollstonecraft encouraged in her work, but Freke represents the worst case scenario that could be enacted by female irrationality. This distinction between what people believed to be true of women and what was actually true of women's rights in the late eighteenth century. Belinda's alignment, as well as Lady

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[40] For more on the work of Godwin, see William Godwin's "Chapter 4 – The Characters of Men Originate in their External Circumstances" of *Enquiry Concerning Political Justice and Its Influence on Modern Morals and Happiness* (1793; London: Penguin, 1985): 97.

[41] While Claudia Johnson notes that Edgeworth scrambled the gender codes that idealized the authority of law and custom with the ultimate intent to question their foundations and undo them, Johnson still notes that Edgeworth "in conservative fashion upholds the traditional social arrangements that expose women to the problems she herself laments, on the grounds that defying such arrangement will not promote their happiness" (Johnson 160).

[42] Johnson notes that the female philosopher disappears from the English novel around 1815. (Johnson 21). However, other scholars see Belinda as a caricature of the female philosopher that works as an experimental figure to discuss female rationality and independence. See Ian Topliss's "Mary Wollstonecraft and Maria Edgeworth's Modern Ladies" in *Etudes Irlandaises* 6 (1981); and Judith Butler's *Romantics, Rebels, and Reactionaries: English Literatures and Its Background 1760-1830* (Oxford: Oxford UP, 1981).

Delacour's actions throughout the novel plus how she arranges the novel's tableau, endorses a forward-looking perspective that bolsters the Percival family.

By endorsing the Percival family and their more rational understanding of individual and group change in the domestic sphere, Edgeworth complicates her final tableau by reaching back through the entire text to draw out the subtle complexities that had been previously exposed throughout the entire text. If the tableau had been presented at the beginning of the text, then the text would have more power to break down such a backwards-looking perspective as expressed in the tableau, through the text itself. However, when the tableau is the ending, the reader is left to question if anything that occurred in the text even made a difference in how Belinda and the reader assessed the need for rationality within the familial structure, questioning the act of transformation that Lady Delacour makes in abandoning her alternate reality in shrugging off her old split character. Thus, the tableau seems to suggest that Lady Delacour's actions with Belinda throughout the novel compel each character forward along Edgeworth's authorial intent to expose the two as complex, flawed mirrors of each other. The complexity of the characters and the nature of their own identities converges in the novel itself.[43]

Within the realm of alternative (someone who finds a different way to live and wishes to be left alone in it) and oppositional (someone who does the same and wants to change society in light of it) cultures, there are both *residual* and *emergent* forms that inform our cultural fabric. Residual cultures are those whose values, experiences, etc.

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[43] Mikhail Bakhtin has formulated a complex understanding of the rise of the novel and its place in the world. "[T]he extraordinary difficulty inherent in formulating a theory of the novel" comes from the complexity of the characters' interactions with one another and with their own pasts within the novels (Bakhtin 4). Bakhtin states that the novel is the only genre created within and for the modern era, the era of science and the fading of the pseudo-sciences. It is within this complexity of social constructs, characterization, and the role of rationality that gives rise to the novelists' experimentation with the various combinations and forms of the novel.

cannot be expressed in terms of the dominant culture, but which are still rooted in some previous social formation. Residual cultures are most often distanced from the dominant culture, but can also get incorporated in it, like Lady Delacour's unsuccessful acceptance of scientific ideology at the end of *Belinda*. Lady Delacour does not understand science and its accompanying understanding of rationality as a way to moderate the outside world. Emergent cultures are those that are continually being created within the dominant culture, potentially in opposition to it, but almost always necessarily incorporated by it. Alternatives can be tolerated by the dominant culture until they become practiced in ways that challenge it. The cultural consumption of an object gets complicated when you think of an "object" of art (viz. a Shakespeare play) that is continually reinterpreted/recreated, through performance, and so becomes a "practice" with which one may challenge the dominant culture. The value the cultural interpretation of objects applies to far more than art and thus requires us, as analyzers of culture, to "break from the common procedure of isolating the object and then discovering its components" to "discover[ing] the nature of a practice and then its conditions" (Williams 44, 47). Because of the growing diversification of dominant ideology inherent in the culture as presented in the novel, it is difficult for Lady Delacour to break with her daily practices, which means that Lady Delacour will stay the way she is until the dominant society accepts rationality and science as inherently necessary for the successful of the culture.

Therefore, just as Belinda could not marry any of her suitors for their lack of rationality and clarity of thought, Virginia could not marry Clarence Hervey because she is represented in the novel as too emotional and imaginative to enter into a relationship with a "man of genius." Thus, as the Percival family stands in as the domestic norm, the tableau of a transformed Lady Delacour invites additional challenges to domestic life through asserting who should be involved in the process of establishing scientific knowledge through rational consideration of observations in the world around them. This focus on the family as the site wherein rationality will change the future is where Jane Marcet's *Conversations on Chemistry* holds the most value because she wrote her lessons on chemistry as being conveyed by a skilled, educated woman to two young girls.

CHAPTER FOUR: JANE MARCET'S *CONVERSATIONS ON CHEMISTRY* AND THE EDUCATION OF A NEW GENERATION

Jane Haldimand Marcet, author of the very popular *Conversations on Chemistry*, which went through at least sixteen editions in Britain and more than 27 in the United States plus three acknowledged French translations, followed Antoine Lavoisier's schema of chemical classification and explained chemical reactions in terms of affinity, aggregation, repulsion, and gravitation.[44] This text, which can be read as initially simple, yet is more advanced and complex for its time period, allowed Marcet to initiate beginners into the scientific community of chemistry. Her advocacy and work in the public sphere informed the scientific community that experimentation must accompany lecture, in order for the material to be properly understood by a wide audience. Marcet worked to educate others as she herself learned and honed her knowledge of a vast array of topics.

Marcet (1769-1858), daughter of a London-based Swiss merchant and wife of Dr. Alexander Marcet, MD, FRS,[45] a wealthy and socially connected London physician, was the period's prominent female science writer and enjoyed a vast circle of friends who informed her studies of chemistry.[46] The eldest of ten children of an affluent Anglo-Swiss couple, Jane's close ties to Geneva advanced her lifelong writing career. Jane's life was divided between residence in London and frequent visits to Geneva. Perceiving Genevan politics and intellectual life as normal, Marcet grew up with an education that was

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[44] Today, these forces are known as electromagnetism, strong nuclear interaction, weak nuclear interaction, and gravity, respectively.

[45] Medical Doctor and Fellow of the Royal Society.

[46] The Marcets boasted a large social circle of friends, including Davy, Thomas Malthus, Harriet Martineau, Maria Edgeworth, and numerous other Continental scientists, among them Berzelius, Candolle, de la Rive, Prevost, and Picet.

strongly focused on the promotion of science.[47] Her "early education had been somewhat unusual in that she and her brothers and sisters were taught by the best available tutors, the subjects being the same regardless of the sex of the child" (Polkinghorn 4).[48] This is most likely due to the fact that, in Genevan families, property was traditionally passed on in comparable shares to male and female offspring, which meant that Marcet eventually inherited a notable portion of her father's sizeable fortune — something that allowed Jane and her husband Alexander to retire from professional work to pursue more personal research-based chemical vocations.[49] This financial freedom gave the Marcets the ability to travel and explore their lifelong passion in their pursuit of knowledge.

During her long life, Jane Marcet wrote over fifteen book-length texts, including *Conversations on Chemistry* (1805), *Conversations on Political Economy* (1818), *Conversations on Natural Philosophy* (1819), and *Conversations on Vegetable Physiology* (1829).[50] In her preface to *Conversations on Chemistry*, Marcet comments that, in her day, the newly established public institutions for the "dissemination of philosophical knowledge" were also "open to both sexes [proving] that general opinion no longer excludes woman from an acquaintance with the elements of science" (Marcet

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[47] See Montandon's *Le Developpement de la Science a Geneve aux XVIIIe et XIX Siecles: Le Cas d'une Communaute Scientifique* (Vevey, 1975); S. B. Taylor's "The Enlightenment in Switzerland" in *The Enlightenment in National Context*, Ed. R. Porter and M. Teich (Cambridge: Cambridge UP, 1981): 72-89.
[48] The biographical information on Marcet provided is based on Cicarelli and Cicarelli 2003; Polkinghorn 1993; Armstrong 1938. Additionally, much of this information is preserved at the Archives Marcet, Fondation Guy Pourtales, Etoy, Switzerland, and I am incredibly gratenful for Yvonne dePourtales for facilitating my access to PDFs from the archive.
[49] For more on Genevan inheritance and educational practices, see L. Kirk's "Genevan Republicanism" in *Republicanism, Liberty, and Commercial Society, 1649-1776*, Ed. D. Wooton, (Stanford: Stanford UP, 1994): 270-309. For an account of the scientific education of daughters in patrician families in Geneva and the treatment of these women as they grew, see the passing mention and cursory summary in C. Campbell Orr's "Albertine Necker de Saussure, the Mature Woman Author, and the Scientific Education of Women" in *Women's Writing* 2 (1991): 141-53.
[50] For a complete list of her works, see Bette Polkinghorn's *Jane Marcet: An Uncommon Woman*. Aldermaston: Forestwood, 1993. 133-34.

6). Marcet's confidence in the accessibility of a publicly accepted space for women in scientific communities led her to publish *Conversations on Chemistry*, first anonymously in 1805, and then in 1806, after positive reviews and publication success, to proclaim her authorship publicly.

Authorship held value in the public sphere as reputation and written quality of work were typically elided; and from a theoretical standpoint, Habermas's *Structural Transformation* can be used to trace the cultural origins of the public sphere[51] to the letters and novels of Marcet's time, citing the eighteenth and nineteenth-century print capitalism as the impetus for this expansive genre formation. It credits those bourgeois genres with creating a new subjective stance, through which private individuals envisioned themselves as members of a public (Habermas 41-43, 48-51). Thus, Habermas grounded the structure of the public sphere subjectively in the very same vernacular literary forms that also gave rise to the imagined community of the nation (Habermas 373-74). Habermas's work shows that this practice obscures the existence of systemic obstacles that deprive some members of the public sphere the capacity to participate on a par with others, as full partners in public debate, i.e. without an introduction by a gentleman-scientist member of society to legitimatize their work. At this time, this hierarchical practice marginalized many individuals, but I want mainly to focus on how gentleman-scientists used the public sphere to alienate and frame women's scientific work. Thus, I argue that the only way for these women to seek out the social, political, and economic ills of society and lead in the movements to rectify them was to participate actively in and contribute to the communities they were a part of.

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[51] Habermas was well aware of the ambiguity of the term "public sphere." See Habermas, 1989: "The usage of the words 'public' and 'public sphere' betrays a multiplicity of concurrent meanings" (1).

In order to rethink the public sphere, Marcet and other women like her had to reduce the disparities in political and public voice through conversations in social settings and the publications in the expanding print market. In public sphere theory,[52] public opinion is considered legitimate if all who are potentially affected are able to participate as peers in deliberations and conversations concerning the organization of common affairs. In effect, the theory holds that the legitimacy of public opinion is a function of two analytically distinct characteristics of the communicative process, which are inclusiveness and participatory parity. Respectively, these two refer to the open ability for all individuals with a stake in the outcome to participate fully in the conversation and the full ability for those individuals to state their views, add to the agenda, have their viewpoints considered equally, etc. Basically, the inclusiveness refers to *who* can participate and the participatory parity refers to *how* they can participate. Thus, from a sociological perspective, "the importance of the public sphere lies in its potential as a mode of social integration" (Calhoun 6).

Habermas clearly delineates that participation in the discourse of the public sphere is both scientific as well as political. For among the Romantic public's scientists, both amateur and professional, there was a great interest in and support for natural philosophy, as demonstrated by the powerful old guard and the up-and-coming members of the middle status groups. Access to scientific knowledge came to be such a valuable form of cultural capital during the Romantic Age that, as a result, every scientific individual sought their own space to explore, discover, and publish scientific knowledge. However, the possession of this form of cultural capital was not limited, as Habermas's

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[52] See Habermas 1989, 1992, 2001.

model might seem to imply, to landed, wealthy, gentleman-scientists. The discourse of science also brought many individuals, who had not been represented in previous discussions, into the public sphere. A surprising number of independently or self-educated women participated in the public discussions and practice of science.[53] Several of those women wrote important texts on science; in fact, tradition and notes have it that Marcet's textbook inspired Michael Faraday to study science. Perhaps the book's most famous reader, Faraday received his first introduction to electrochemistry through its pages while he was apprenticed as a young bookbinder. In later years, Faraday fondly referred to Marcet as his "first instructress," not Davy or Priestley or any other of the scientists of the era (qtd. Brück 63). As Marcet exemplifies, the knowledge was not necessarily accessible to any individuals in the audience upon first lecture; however, as she states, with further conversation, she was able to understand the lectures with much more range and so would many others, thereby requiring that conversations on the topic be accessible and fundamental.

Habermas's distinction here of inclusiveness and participatory parity explains Marcet's dilemma with her own text. *Conversations on Chemistry* wanted to expand who was involved in standardized scientific communities and how they could interact with one another. Marcet's work aimed to bring more people into the conversation by sharing her understanding of chemistry with others in the same way how she learned it. I argue that, because women in the eighteenth and nineteenth centuries were largely denied scientific authority, Jane Marcet chose a contradictory strategy when disseminating scientific knowledge to others in her popularizing publication that both confirmed and

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[53] See Nancy Fraser on the subject of women and the public sphere.

challenged the traditional and restrictive gender and education norms. Marcet's expansive desire to learn more fields of study is also intriguing because it showed that her desire to include others in public sphere conversations was not restricted to chemistry. She truly believed that the how and who mattered in scientific education.

MARCET IN CONTEXT

Based on her experience and social interaction with famous and amateur scientists of her day, Marcet wrote *Conversations on Chemistry* to instruct beginners and women on the basics of chemistry by mimicking her own form of instruction: conversation and experimentation. Marcet noted in her preface that, as a woman "venturing to offer to the public, and more particularly the female sex an Introduction to Chemistry," she needed to explain to her audience her own background in the subject (Marcet 5). Despite the fact that she admitted some apprehension in the realization that her work may be considered by some to be "unsuited to the ordinary pursuits of her sex," she "felt encouraged by the establishment of those public institutions, open to both sexes, for the dissemination of philosophical knowledge, which clearly prove that the general opinion no longer excludes women from an acquaintance with the elements of science" (Marcet 6). However, it is critical to note that there is a significant difference between allowing women to attend public lectures and accepting them as authors of original works in these historically gentleman-only sciences.

Thus, what we might call Marcet's leap of faith in her contemporary society turned out to be well founded, at least in terms of the general acceptance of her own works. *Conversations on Chemistry* was widely acclaimed and enjoyed numerous editions, and Marcet's work had significant impact on subsequent authors' efforts, including Harriet Martineau and Millicent Garrett Fawcett. The Bluestockings, such as Madame de Stäel, Mary Wollstonecraft, Helen Maria Williams, Anna Laetitia Barbauld, and France Wright, engaged in a wide variety of subjects, while many of the great hostesses of the day, such as Lady Holland, Lady Beaumont, Lady Margaret Blessington, and Lady Elizabeth Melbourne, were marked by their intellectual passions that birthed new conversations. However, it becomes difficult to trace Marcet's inspiration for the classical, yet slightly divergent form by which she taught chemistry through the conversations of Mrs. B., Emily, and Caroline in *Conversations on Chemistry*. Marcet's work was, overall, not that unusual for her class and social status, but her work entered into a larger conversation on the topic of educating others on chemistry. In fact, paving the way for Marcet, Margaret Bryan seems to be the only logical antecedent in the context of women participating in the production of scientific textbooks for girls.[54]

Bryan's texts were well received by the scientific community, and *A Compendious System* included a letter from Charles Hutton, a professor of mathematics at the Royal Military Academy, who had reviewed the manuscript and rejoiced that the "learned and more difficult sciences are thus beginning to be successfully cultivated by the extraordinary and elegant talents of the female writers of the present day" (Bryan xi). Marcet inherited a form with a number of male-oriented conventions, but based her rendition of the popular work *Conversations on Chemistry* on a mysterious Margaret

[54] Although others include botanist Sarah Mary Fitton (1796-1874), mathematician and astronomer Mary Somerville (1780-1872), geologist Mary Horner Lyell (1808-1873), astronomer Caroline Herschel (1750-1840), as well as more literary-based female writers who were strongly engaged through familial and social connections with scientific matters of the day like Mary Shelley, Joanna Baillie, Anna Laetitia Aiken Barbauld, Anna Seward, and Maria Edgeworth. These women were engaged with the sciences, but they did not create a textbook for educative purposes to the degree that Marcet and Bryan did. Therefore, Marcet and Bryan become the only logical comparisons.

Bryan. Very little biographical information is available on Mrs. Bryan; thus, it is difficult to ascertain where her knowledge or independent approach to writing on science might have originated. The *Dictionary of National Biography* identifies her as a "beautiful and talented schoolmistress" married to an equally mysterious Mr. Bryan (*DNB*). Gates and Shteir offer that she taught science at girls' schools in London and Margate, basing her writing on these experiences (Gates and Shteir 8). Bryan penned at least three physics and astronomy books for young readers: *A Compendious System of Astronomy* (1797), *Lectures in Natural Philosophy* (1806), and *An Astronomical and Geographical Class Book for Schools* (1816). An engraving of Bryan and her two daughters appeared in the frontispiece of her first work and pictures her with her left hand resting on the base of a celestial globe, while holding her writing quill in her right hand.[55] The engraving portrays her as more than a passive transmitter of knowledge and indeed Bryan's writings demonstrate that she had skill in the use of astronomical instruments. For example, Brück notes that an 1811 letter to William Herschel discusses her attempts to observe a comet that year (17, 18). So this mysterious Margaret Bryan seems to have cleared a path for Marcet simply through her presence in the scientific community.

However, Marcet did not gain knowledge in isolation, as it seems Bryan must have; rather, Marcet thrived on the lively public and social sphere of London and its relatively small scientific community. This scientific community shared their knowledge with the public in large public lectures that were hosted by the burgeoning scientific societies of the day. Marcet's Swiss education helped her understand the form of instruction that was employed in public lectures. Marcet's ability to walk into Davy's

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[55] A portrait by William Nutter, based on Samuel Shelley's stipple engraving frontispiece from the 1797 edition, is held by the National Portrait Gallery in London and can be found at through their website.

public lectures and garner even a general understanding, which she then honed with her husband through conversation, gave her the opportunity to bridge the gap between the nascent expert scientific community and the general public.

Mary T. Brück suggests that Marcet's more classically faithful methodology allowed her to push the boundaries of the role of the demure popularizer of others' original works and study (63). Central to Marcet's works is the masterful weaving of conversation in the common vernacular and everyday examples to illustrate scientific concepts. This work, aided by descriptions of experiments, used common household items as well as more specialized scientific apparatus to elevate the education of Marcet's readers. In this way, Marcet was able, through leading her life as example, to create a culturally acceptable literary and cultural space for British women to write about the world and its underlying chemical principles for a wide range of audiences. Susan Lindee notes that there is also "evidence that young men attending mechanics' institutes used Marcet's text, and medical apprentices favored it in beginning their study of chemistry" (Lindee 9). The variety of audiences that Marcet could attract set her apart from the other authors of the day. Because Marcet focused on a scientific, determinant area of study, she was able to use the domestic setting she understood to close the gap between experts and non-experts that the Royal Institution and other scientific societies were attempting to expand by excluding anyone who was not in their society and narrowly-defined field.

The inclusion of science in a domestic setting, although limited primarily to informal, amateur experimentation and popular books, paralleled the progressive educational philosophy of feminist writer Mary Wollstonecraft (1759-1797), who suggested that education should "be grounded in everyday individual experience"

(Wollstonecraft, *Vindication* 22). Thus, the transmission of scientific knowledge became a part of the expectations of "good mothering" and afforded these teacher-mothers additional opportunities to reinforce moral lessons (Gates and Shteir 9). This behavior was exemplified in Edgeworth's *Belinda* through Lady Percival's teacher-mother role and was lived out through Jane Marcet's own life.

Wollstonecraft, whom some critics cite as the "principal inspiration for Marcet," likewise believed that the "first object of laudable ambition is to obtain a character as a human being, regardless of the distinction of sex" (Cicarelli and Cicarelli 110; Wollstonecraft 14). Therefore, Wollstonecraft posited that "day schools, for particular ages, should be established by government, in which boys and girls might be educated together" (Wollstonecraft 209). Joanna Rostek argues that Marcet "has Mrs. B. explain that women should be taught . . . in order to be able to duly perform their most essential duty, namely that of being good mothers" (Rostek 25). And Hilda Hollis notes that "Mrs. B is simply explaining what learned men are responsible for discovering: no glory accrues to her for this popularization" (Hollis 387). While being a good mother is certainly a benefit of being well-educated and there may not be any new discovery in repacking and presenting scientific discoveries in new ways, it is not the only reason why educating women should be pursued. In *Vindication*, Wollstonecraft inspired her readers with the phrase: "Make women rational creatures, and free citizens, and they will quickly become good wives, and mothers" (Wollstonecraft 222). Marcet, who is decidedly less radical than her predecessor, seems to adopt only the latter, gendered, and conservative line of reasoning from this statement. Thus, it seems that, for Marcet, being a well-educated mother contributes to the national welfare, precluding the impossibility of a future where men and women would exist in separate spheres. However, there is the lingering thought that more is at stake here. Not only is Marcet popularizing the scientific discoveries of others, but she is repurposing, repackaging, and envisioning them in a new fashion that allows for the creative minds of others to apply scientific knowledge to new purposes, thereby being engineers and innovators. This application process is what made Marcet's work distinctive, in terms of the work being done by both male and female popularizers of science in her day. Marcet did not have to adhere to gentleman-scientists standards like Davy, Darwin, or Beddoes, but she did not have to adhere to literary standards, like Edgeworth, either. Marcet's outsider status as a Swiss married woman in London gave her the protection and ability to compose *Conversations on Chemistry* without entering into the socio-cultural debate of who the new frontier of scientific knowledge belonged to. Because Marcet positioned herself thus in order to draw attention to the scientific education of others to her work, especially those who would not be considered part of the classification of gentlemen-scientists by society, she opened scientific knowledge to anyone so that anyone could take advantage of it by bestowing it with new application through using scientific knowledge to inspire new engineering ideas.

A few years later, Harriet Martineau follows in Marcet's footsteps, boldly positing that "great men must have their hewers of wood and drawers of water, and scientific discoveries must be followed by those who will popularize their discoveries. When the woodman finds it necessary to explain that the forest is not of his planting, I *may* begin to particularize my obligations to Smith and Malthus, and others of their high order" (Martineau 143). Martineau's bold critique showed that, with Marcet's texts already in circulation, she was able to enter the scientific discourse community with palpable aplomb. Martineau's and Marcet's works attest that they were perfectly capable of understanding and synthesizing scientific works in a methodical and systematic way. Martineau's comment that she may consider acknowledging her forefathers in economic thought when the woodman admits that he did not plant the trees he harvests is a claim to female intellectual thoroughness and credibility.

In light of this gendered scientific language, female opportunity to shape scientific language was denied the chance by the Continental scientific work in the Enlightenment that eradicated the opportunity for multiplicity in scientific language, thereby polarizing the genders along a preference for more male scientific language. Female authors of scientific experiments and scientific knowledge retrieved their voice through their own explanations of scientific discourse, explanations that brought with them new means of seeing the world. Women brought to science new methods of scientific education for both children and adults, as women sought to explain science in new ways that would be accessible to many. Women played a vital role in the greater scientific community as translators, illustrators, interpreters, and popularizers of science. Women, like Marcet, were critical to the advancement of the culture at this time because Marcet's target audience was women. This eventually paved the way for female scientists to be appreciated for their knowledge and insight, rather than just their ability to write about the sciences.

Marcet worked alongside Maria Edgeworth and Harriet Martineau and others who saw value in popularizing and disseminating the new scientific knowledge. David Knight's 1986 article "Accomplishment or Dogma: Chemistry in the Introductory Works of Jane Marcet and Samuel Parkes" considers Marcet's work as favorable, if not preferable in its clarity, to Parkes's work. Samuel Parkes was Marcet's contemporary and attempted the same feat as Marcet, but Parkes's own work echoed back to Erasmus Darwin's poetry in *Temple of Nature* in the sense that it was limiting as it was denigrating to those individuals who did not understand the material; yet, his work was not as widely popular as Marcet's. Parkes's *Chemical Catechism* was originally published in 1806, which is the first year that Marcet's was published under her own name.[56] As Parkes was a general manufacturing chemist from Haggerstone, near Shoreditch, in London,[57] he quantified his expertise first on his manufacturing activities; and then by 1816 in his thirteenth edition, he embellished his name with his affiliations to professional and learned bodies, listed at twenty-eight different recognition bodies by 1822. Parkes's incentive to write was spurred on initially by his daughter's interest in her father's profession. He compiled a manuscript for her use alone and used the style of a Catholic catechism in order to outline each of the topics, but never published it until Marcet's work gained fame in 1805 and enjoyed another rapid edition in 1806.

Because of his position in society as a man and as an actively practicing chemist, Parkes received an overall favorable review from *The Gentleman's Magazine* that echoed the importance of chemical studies to the wealth and progress of a manufacturing nation, like Britain at the time: "We are particularly pleased with the perusal of the 'Chemical Catechism,' which is calculated to afford not only information and amusement to

[56] D. Knight's "Accomplishment or Dogma: Chemistry in the Introductory Works of Jane Marcet and Samuel Parkes" in *Ambix* (1986), 33: 94-98, which compares it favorably to Marcet's works, ultimately claiming the two as equals, where I read Marcet as more tailored to a broader audience and thus more successful.

[57] Noted in the advertisement of Samuel Parkes's Chemical Manufacture (1808) from the third edition of *Chemical Catechism*.

scholars and the gentleman, but by its simplicity and perspicuity, to yield instruction to the enquiring mechanick and unlettered artizan . . . . The volume contains such a mass of curious matter as cannot fail to engage the attention of those who are entirely unacquainted with the Science" (Anonymous, *Gentleman's Magazine* 227-28). Other favorable reviews soon followed, but only ever questioning his genre choice of the catechism, which at this time would not have had Catholic undertones to it, but did possess a more religious note. Perhaps, because Parkes participated in the work that would allow others to see God in the works of science, his work could not accomplish the same democratizing effect that Marcet's work did, partially because Parkes entertained a much more narrow audience of individuals who wished to become chemists. These religious undertones did make Parkes's books a favorite among Nonconformist, Dissenting, and other Protestant schools that were becoming *en vogue* throughout the late eighteenth and early nineteenth centuries. The additional factor that Parkes was a man also assisted his publications and spurred on his editions, as they were meant to be sold as chemistry textbooks for the future chemist. Both authors enjoyed multiple editions, but Marcet's *Conversations* has been recognized as more welcoming to all audiences. Although both were sold as textbooks that popularized chemistry, Marcet's work aimed at popularizing science, whereas Parkes's did not; therefore, Marcet's popularity spread throughout the entire society, and Parkes's work only grew in popularity among a narrow audience of individuals who were already committed to becoming chemists. Marcet reached out to other individuals who wanted to learn, as she did, about the wonders of the world that could be explained via chemistry.

HOW MARCET EDUCATED HERSELF IN ORDER TO OPEN ACCESS TO EDUCATION

Marcet explains that the textbook *Conversations on Chemistry* was precipitated from her own experiences. In her preface, she explains that “frequent opportunities having afterwards occurred of conversing with a friend on the subject of chemistry, and of repeating a variety of experiments, she became better acquainted with the principles of that science, and began to feel highly interested in its pursuit” (Marcet, “Preface”). She found that, when she originally began attending public experimental lectures and discussing those same scientific concepts with others and conducting a variety of simple experiments (both of which we can assume involved her chemist husband in some fashion), then her understanding on the subject grew exponentially. When she next attended Davy’s public lectures at the Royal Institution, she could follow them far better than her peers in the audience.

This was then, her impetus to write, as “there are but few women who have access to this mode of instruction [Davy’s public lectures at the Royal Institution and a husband who could provide additional conversation]; and as the author was not acquainted with any book that could prove a substitute for it, she thought that it might be useful to beginners, as well as satisfactory to herself, to trace the steps by which she had acquired her little stock of chemical knowledge, and to record in the form of dialogue, those ideas which she had first derived from conversation” (Marcet, “Preface”). Marcet’s insistence that her knowledge was valuable and that conversation was the form to share it in spurred her forward. Marcet’s acknowledgement that “but few women have access to this mode of instruction” solicits a Wollstonecraftian response, as if inquiring why women should not have access to the information that is available to learn. Given the nature of scientific societies at the time, the status quo meant to keep science in the purview of gentlemen-scientists by further separating and making elite the structures that sought to keep their interpretations in place. However, Marcet's "in" — so to speak — was the simplicity of her preface and the accessibility of her conversations that progressed her work and helped the public better receive her discussions, making it beloved by experts and nonexperts alike for its ability to help others learn about chemistry in an accessible fashion. Marcet's simple, straight-forward dialog allowed her to insist that she learned chemistry through conversation with others and therefore imply that so should everyone else. Marcet's interest in science and her efforts to compose an accessible presentation of science invited women to join in the pursuit of scientific knowledge and to become innovators themselves.

MARCET'S CONVERSATIONAL GENRE

Her choice of genre is not as unusual as it may appear to a modern reader, for many textbooks of the eighteenth and nineteenth centuries were written as dialogues, as if to simulate the male tutor and pupil relationship that was popular in the sixteenth century and reflected Plato's presentation of the Socratic dialogues from the fifth century BCE. In the context of polite culture in the eighteenth and nineteenth centuries, the word "conversation" evoked not so much what is transmitted, but rather the art of transmitting information, referring more to the social skills that come with talking about the information instead of the education itself. For example, in the Romantic Age, the word itself was commonly used to describe a "manner of conducting oneself in the world or in society; behaviour, mode or course of life" or even an "interchange of thoughts and words," as Boswell notes in his distinction from *The Life of Samuel Johnson* that "we had *talk* enough, but no *conversation*; there was nothing *discussed*" (OED, "Conversation-6"; OED, "Conversation-7a"; Boswell, III., 449). Additionally, Coleridge's "conversation poems" detail particular life experiences that are of value to the reader, leading to the poet's own examination of nature and the role of poetry (Norton 424-26). Richard Holmes, Rosemary Ashton, and Adam Sisman comment on one of Coleridge's poems, *Frost at Midnight*, for its remarkable ability to be "intricately structured," a "delightful conversation poem," and "perhaps the most beautiful of Coleridge's 'conversation poems,'" respectively (Holmes 183; Ashton 134; Sisman 219). Just as these poems are held together by an unifying conversation or theme, Marcet's growing knowledge of science is what unifies these dialogues as beneficial to both the author and reader. Thus, to ruminate on Boswell's distinction between "talk" and "conversation," it becomes apparently that if knowledge is essential for conversation, then the use of the correct words and turns-of-phrase becomes even more indicative of social status; in other words, whatever is discussed must be discussed properly in order to deem it conversation. The art of conversation, and the popular turn of conversation toward the sciences,[58] made knowledge of both popular and emerging sciences useful topics of conversation.

Looking back, Bernard le Bovier de Fontanelle's 1686 attempt to popularize science in *Entretiens sur la pluralité des mondes* addressed his philosophical system from himself a Marquis to a lady. This lady was not of his own class either, which is unusual.

[58] For more on the popular turn toward science in the Romantic Age, see Wilda C. Anderson's *Between the Library and the Laboratory: The Language of Chemistry in Eighteenth-Century France*. Baltimore: Johns Hopkins UP, 1984; Jan Golinski's *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820*. Cambridge: Cambridge UP, 1992; and Ann B. Shteir's *Cultivating Women, Cultivating Science*. Baltimore: The Johns Hopkins UP, 1996.

Through a fictional conversation, not so much because women were his primary audience, but rather because a woman's education would have been more representative of the knowledge possessed by the general reading public, he attempted to reach the general reading public as his audience, whom he addressed as his intended audience in the preface, but they could not understand why this type of specialized knowledge was worthwhile to them. Public reception of his text reduces it to a clear claim on natural science as a public science. Clearly, however, La Vopa's text still presents the need for a specialized community who can produce, generate, and determine the contours of public knowledge so that the public will be able to understand the knowledge's significance. This woman, as Anthony La Vopa states, demarcates the "invisible social boundaries" between specialized and general learning, because due to the education, gender, and class differences, Fontanelle, the implied narrator and elite gentleman-scientist himself,[59] acted as gatekeeper to hold back knowledge from the lady to elevate his own status and knowledge (La Vopa 64). Whether or not Fontanelle intended to show knowledge held back from the lady because of her class or her gender, it is clear that La Vopa used Fontanelle to endorse the necessity for an elite gentleman-scientist community that could become the purveyors of knowledge and understanding for the rest of the general public.

Yet, in the Romantic Age, the use of "conversations" as medium for the distribution of knowledge meant that Marcet was perceived through many unique lenses developed by the culture around her. Marcet's use of the term "conversations" has a lineage in very different ideologies, shown here through a select few: Hannah More, Frances Burney, and Maria Edgeworth. Hannah More's 1777 *Essays on Various*

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[59] My phrase.

Subjects's chapter entitled "Thoughts on Conversation" and "Conversation" from her 1799 *Strictures on the modern System of Female Education* developed a theory of conversation that used conversation to enforce conservative gender roles for women, where women were cast in the role of good, attentive, eager listeners who only spoke out on moral causes. Within that restrictive sphere, More conceded a limited role for women in society, in an attempt to gain greater education opportunities for women. More emphasized the constraints on women's speech and writing, making the powerful argument that the role of listening in conversation is essential to conversation, which it is, but reading More in light of her more subversive contemporaries, it is clear that More had created a role for women that only bestowed them with the power to listen to others.

Cecilia's conversations throughout Frances Burney's *Cecilia* are one of the most fascinating elements of the novel. In Burney's work, the reader comes to experience and understand the development and refinement of reasoned reflective thought, as expressed in conversation with others. Cecilia transforms from a woman reliant upon society's strictures to inform her actions into an independent woman in thought and consideration, with the ability to converse on her own behalf. This evolutionary process exposes to the process that all humans go through as they struggle to develop into their own through the modes of conversation that occur around them. Burney allowed the reader to experience, conversation by conversation a change that was subtle and even sometimes showed Cecilia slipping backwards into irrationality with each step; but overall, this was a change that was perceptible and indeed powerful in the transformation of Cecilia as a conversationalist over the action of the novel. The conversation that occurs at Mr. Monckton's house is one of the first many-voiced Mr. Monckton attempts to convince

Cecilia "'to neglect old friends, and to court new acquaintance, though perhaps not yet avowedly delivered as a precept from parents to children, is nevertheless so universally recommended by example, that those who act differently, incur general censure for affecting singularity'" (Burney 14). Chameleon-like, Mr. Monckton's acceptance in society makes the reader question the good that arises out of conforming to the society's conversations and opinions at any given moment. Mr. Monckton is both accepted and rejected by his own society because he has to be an individual enforcer of the society's bounds, which makes him both part of and separate from the system of society.

A more generally accepted man of society, Mr. Belfield believes that it is possible for Cecilia to be original and new, but is merely mistaken and misguided by her desired to be "'guided by the light of [her] own understanding;'" rather than guided by the society into becoming her own person (Burney 14). Mr. Belfield's opinions seem to share the intellectual similarities with Mr. Monckton that nothing can be done outside the realm of society's approved actions. Immediately, Mr. Monckton adds "'And such (. . .) at first setting out in life, is the intention of every one. The closet reasoned is always refined in his sentiments, and always confident in his virtue; but when he mixes with the world, when he thinks less and acts more, he soon finds the necessity of accommodating himself to such customs as are already received, and of pursuing quietly the track that is already marked out'" (Burney 17). Cecilia, if read through traditional scholarship of her many actions and gift-giving and generosity, has made the mistake that Mr. Monckton warns her is possible when the individual acts more than she thinks and has thus become simply a follower in the well-worn path of life and has not forged her own course.

A glimpse of one conversation is not enough for Burney to demonstrate her argument; instead, this novel weaves the reader into a series of conversations on the subject of Cecilia. The power of Burney's authorial choice of words and language is evident in the shared experience of change and in the first-hand observation of how to bring forth such a transformation through the exploration of the presentation of self to others. This formative conversation continues in Mr. Monckton's sitting room until Cecilia's guardian, Mr. Harrel, whisks her away when their description of the darkness of society becomes too serious. But Cecilia's boldness of personality shines through her language as she boldly proclaims as she leaves that "'If (. . .) I felt no more sorrow in quitting my friends, than I feel terror in venturing to London, with how light a heart should I make the journey!'" (Burney 19). Cecilia's last retort shows the reader that Cecilia is not one to be intimidated by persuasive and individuals who believe themselves correct in all matters (Daughtery 90). Cecilia makes herself a candidate for "affecting singularity" in the novel and bringing the characters out of their close-minded attitudes, as Mr. Monckton so negatively put it.

The discourse formed in the character of Cecilia carries with it the ideologies of other characters within the novel and this exchange with Mr. Monckton and Mr. Belfield is one of the first to pique the interest of the reader in Cecilia's new life in society. The way Cecilia's words, actions, and phrasings are framed within the novel echo the lives they are simultaneously leading through the other characters of the story. This double-voicing helps to illuminate where Cecilia deviates and agrees with the dominant culture within the novel as she becomes a singular entity. Cecilia is not yet ready or comfortable with the normalcies of society. She wants "private meetings and friendly intercourse," but “the endless succession of diversions, the continual rotation of assemblies, the numerousness of splendid engagements” prevent the settling of the mind and the development of sustained human contact with common individuals in order to truly develop a sense of self and place the opinions of others in one’s mind (Burney 131).

In the epistolary novel *Cecilia*, conversation provides a site for the exploration of the adaptability of Cecilia’s character and the borrowing of others’ language, thereby creating a ripple effect through Cecilia’s thought process, knowledge, and understanding of her world. Burney shows the reader how Cecilia’s sense of self develops through the many diverse conversations she has throughout the novel. As a small child will mimic back what they have heard from an adult conversation, Burney wrote the character of Cecilia in order to exhibit the development of independent thought through the power of conversation. Therefore, with Burney’s works in mind, it is likely that Marcet would have approached conversation as a form through which scientific discussions could be broached.

Next, Maria Edgeworth, a friend of Marcet, breaks down some of More’s strictures in her 1795 *Letters for Literary Ladies*, where she parodies males’ rhetorical manuals and females’ conduct literature in order to playfully advise women to influence and manipulate men through speech, argument, and performativity. Additionally, she wrote of chemistry:

> “Chemistry is a science particularly suited to women, suited to their talents and to their situation. Chemistry is not a science of parade, it affords occupation and infinite variety, it demands no bodily strength, it can be pursued in retirement; there is no danger of its inflaming the imagination, because the mind is intent upon realities. The knowledge that is acquired is exact; and the pleasure of the pursuit is a sufficient reward for the labour.” (Edgeworth, *Letters*, 194).

Edgeworth's literary career on the whole endorses conversation as a necessary means to convey valuable information from woman to woman and also from woman to man or woman to society. This level of import on the need to converse publicly shows the rhetorical choice of Marcet's use of conversation in her textbook is incredibly useful to note. Edgeworth remarked upon Marcet's *Conversations on Chemistry*, saying "Mrs. Marcet never goes one point beyond what she can vouch for in truth" (Edgeworth, *Letters*, 203). It was particularly important for women writers to show themselves and endorse each other as serious disseminators of scientific knowledge. This seriousness was also shown in the genre used by Marcet to accomplish her task.

MARCET'S PERFORMATIVE EXPERIMENT GENRE

Exhibited in the diverse applications of conversation in literature at the time, Marcet's use of the conversational nature of the genre can be read as much more nuanced and lofty in its educative purpose than the experimental nature of Marcet's *Conversations on Chemistry*.[60] The Romantic Age was enchanted by the desire for knowledge and the willingness to do anything to achieve it, especially self-experimentation; therefore, it makes sense that Marcet would turn toward experimentation to present knowledge through demonstrable activities. In the 1755 preface to the *Discourse on the Origins and Foundations of Inequality among Men,* Jean-Jacques Rousseau asked: "What experiments would be necessary to achieve knowledge of natural man? And what are the means for making these experiments in the midst of society?" (12). While complicated by Rousseau's assumption that man had forsaken his natural state, such questions capture

[60] For more on the genre of experimental writing, see Charles Bazerman's *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*.

the central difficulty in sciences at the moment of their emergence into the public sphere and how to determine the basis for access to this information for all humans.

Owing to the experimental nature of science, during this time period when the risks were not yet realized and there were not yet safe ways to test on others, the best way to make advances in scientific knowledge, as is evidenced by the behaviors of several experimental explorers, was to experiment on one's self, like Descartes, Lyell, Lamarck, Coleridge, de Quincey.[61] Coleridge admitted in an 1803 letter that he has performed "a multitude of little experiments on my own sensations, & on my senses — and some of these (too often repeated)" (Coleridge 2:731). These "little experiments" that Coleridge referenced in his notebooks detail his experiences with different drugs, especially laudanum, and how he had read "in a medical Journal . . . [about the] rubbing in of Laudanum, at the same time taking a dose internally — It acted like a charm. like a miracle!" (Coleridge 2:730). This quest for knowledge was so palpable in the Romantic Age that it seemed every literate individual sought to discover new knowledge for themselves. Therefore, it is not surprising that Marcet's book became so popular to a wide array of audiences for its practical, experimental value.

Marcet's *Conversations on Chemistry* served to educate a wide audience through the value of "showing, not telling" the scientific knowledge that was accessible to them through experimentation and careful observation. Practical science offered a means for Marcet to discuss what scientific marvels she herself had witnessed, connect it to various applications, and teach it to others. The ability for knowledge to be gained through

[61] For more on self-experimentation in the Romantic Age, see Stefano Poggi and Maurizio Bossi's edited collection *Romanticism in Science: Science in Europe, 1790-1840*. (Boston: Boston University Press, 1994).

experimentation showed that only systematic observation, through the scientific method and free from all prejudices, could increase the spread and awareness of knowledge. Marcet is unique because she saw that this type of knowledge was learned best through personal, first-hand experimentation; thus, her entire written discourse educates through demonstration of replicable scientific experiments.

In the eighteenth century, the dependence on experimental philosophy to determine the validity of scientific knowledge became more closely linked to the specific apparatus that was used to gain that knowledge. For example, any optics expert at the time had nothing to rival John Herschel's great forty foot telescope that was used to discover the sixth and seventh moons of Saturn; thus, it was just as much the work that went into making Herschel's telescope as it was his scientific knowledge that made the discovery. So while no one could make the same discovery as Herschel with a much less powerful telescope, there was still the idea that one could participate in and see what those scientists saw. This meant there was also a commercial market for the novelty items that were used in experimental science of the day. These novelties made science more accessible and ready-made for others to perform joining in the scientific pursuits of Herschel, Davy, or Priestley.

Marcet's knowledge and experimental experience came from Humphry Davy's public lectures on chemistry. Davy was a popular personality of the day and his eclectic politics, which kept him from siding too much with one political camp, gave him the freedom to express and act on his bold attitudes about women. In a culture that expected women to stay home and saw little reason to educate them, Davy encouraged women to join his audience and advocated for their study in the sciences. He followed up this belief with action; for on more than one occasion, he allowed Jane Marcet to adapt materials from his lectures for her popular *Conversations on Chemistry*.

Davy's lectures took place in a performative space, as the Royal Institution's Albemarle House possessed a great magisterial lecture hall and boasted some of the best acoustics in London. Davy addressed his audience from a table in that hall, setting the table with some of the most intriguing and strange instruments of science so as to attract the audience to the experimental nature of his work by encouraging them to "ooo" and "aww" over the crucibles, scales, and pneumatic troughs. Behind him, the door to the laboratory itself stood ajar, revealing great furnaces, shelves of chemical vials, and electrical apparatus of all sorts. For the audience, it was an impressive stage with equally impressive props. For as Jan Golinski noted in *Science as Public Culture*, Davy "presented most strongly to the popular observation of the attributes of genius;" and to this end of gaining a public reputation as an observably respected scientist, his demonstrations and use of the lab established Davy's "acceptance among his audience that the powers of nature were indeed Davy's to command" (Golinski, *Science* 195, 200). Clearly, Davy's lectures were a kind of proto-performance art, because he sought to bring attention to the work he was doing in new and fascinating ways; and as a result, they captured not only the Romantic audience's intellectual attention, but also their imaginations. Davy's lectures brought to mind the power of speculation about the world around us through the demonstrable work of the experiment.

Yet Anne Mellor cites Davy as the model for the "bad scientist" in *Frankenstein*.[62] The passage Mellor refers to when making this claim is from Davy's "A Discourse introductory to a Course of Lectures on Chemistry, Delivered in the Theatre of the Royal Institution, on the 21st of January, 1802" that states:

> Science, has given to [man] an acquaintance with the different relations of the parts of the external world; and more than that, it has bestowed upon him powers which may be almost creative; which have enabled him to modify and change the beings surrounding him, and by his experiments to interrogate nature with power, not simply as a scholar, passive and seeking only to understand her operations, but rather as a master, active with his own instruments. (Davy 319)

Naturally, because of the lofty claims inherent in this subject matter, this passage of Davy's has gotten a lot of attention over the years because many scholars read the statement about interrogating nature as misogynist, likely because it is not as well-known that Davy's life represented a large, lifelong pattern of supporting women's intellectual activities, beginning with his sisters and mother and expanding out to the community. In fact, Davy encouraged women to join his audience and advocated their study of mathematics and science. He followed up this belief with action; for on more than one occasion, he very generously allowed Jane Marcet to adapt materials from his lectures for her popular textbook for girls. Davy consistently claimed that he "worshipped [nature as] poet, philosopher, and sage" not as a male figure or gentleman-scientist (J. Davy, *Memoir*, I:14). Evidence of Davy's respectful and loving relationship with his mother and sisters lends biographical support toward believing that these expressions were genuine. Moreover, he believed that "the true political maxim is, that the good of the whole

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[62] For more on Mellor's work on *Frankenstein*, see "*Frankenstein*: A Feminist Critique of Science" in *One Culture: Essays in Science and Literature*, Ed. George Levine and Alan Rauch (Madison: U of Wisconsin P, 1987): 287-312.

community is the good of every individual"; and, he pointedly included women in that community as much and as often as he could (J. Davy, *Memoir*, I:16). Davy truly believed that men and women could use science to make society more productive and to help each individual find personal happiness, escape pain, amuse themselves, and make a good and honorable living. Davy's discourses and career are a reminder that the proliferation of British interest in science indirectly spurred the professionalization of English intellectuals in both science and the arts.

Yet their emotional and aesthetic interests captured an audience's attention in ways that few other performances of the day could. George Gordon, Lord Byron's first work, *Childe Harold's Pilgrimage*, described the history, appearance, and historical context of the places that Byron visited on his Continental tour became a success because it reflected his own life. Byron states in the preface:

> A fictitious character is introduced for the sake of giving some connexion to the piece; which, however, [makes] no pretension to regularity. It has been suggested to me by friends, on whose opinions I set a high value, that in this fictitious character, 'Childe Harold', I may incur the suspicion of having intended some real personage: this I beg leave, once and for all, to disclaim — Harold is the child of imagination. (Byron 19)

Byron's written work showed that we can discern a fairly direct line of descent between the public's experience and construction of the "Davian man of philosophical genius" and the common individual fascinated by science (Ross 257). The people around Davy and Byron wanted to believe that the person who most closely resembled the character they wrote about in their texts was indeed the author, thereby creating a bit of celebrity and excess attention. David Miller notes that Davy's job as President of the Royal Society was not so much carrying out his own plans, but staving off the advances of others who wanted to close off and confine the work of science to experts (Miller 23). Miller explains that he reads Davy's letters as a conscious struggle between what was requested of him by existing members of the Royal Society and what was in the best interest of his profession.[63] Davy longed to create a time when "the great whole of society should be ultimately connected together by means of knowledge and the useful arts" and thus he campaigned his whole life to educate his entire society about science (Davy, *Works* II:323).[64] Davy somehow walked the line between these two divergent public personas because, as president of the Royal Institution, he was charged with closing off the scientific disciplines to nonexperts, even though he did his best to sidestep politics and avoid the socio-economic political factors that threatened his position and that of his friends on both sides of the issue. Davy was supposed to use his position in the Royal Institution to promote exclusivity, but in reality, he did the exact opposite: Davy embraced the speculative and practical aspects of scientific pursuits, as well as all individuals who were involved in the quest.

MARCET'S INCLUSIVE FORM OF SCIENTFIC EDUCATION

Marcet's work brought scientific knowledge to the masses in new ways that everyone and anyone was given the potential to understand. This work, in of itself, was intriguing, as concurrently Lavoisier and his British counterparts, James Keir and Joseph Priestley, were attempting to refine language to become the "instrument" to be used in

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[63] For additional information of Davy's work to limit and expand the scientific community, see David Miller's "Between Hostile Camps: Sir Humphry Davy's Presidency of the Royal Society of London, 1820-1827" in the *British Journal for the History of Science* 16 (1983): 1-47.

[64] Davy's "public spirit was manifest in his goal of making England the premier scientific force in Europe and in his efforts to alleviate rural poverty by popularizing 'agricultural chemistry.' It was also evident in his invention of the miners' lamp, a device that saved many lives, and for which he refused to take any monetary compensation" (Ross 184).

the construction of a demonstrative discourse (Golinski, *Making* 118). Lavoisier was in favor of building upon the preexisting nomenclature of an analytical language that would discipline its users to understand chemistry from Lavoisier's perspective. He proposed: "A well-formed language, a language in which one will bring about a necessary and even prompt revolution in the manner of teaching . . .. [Others] will have either to reject the nomenclature, or else to follow irresistibly the route that it will have marked out" (qtd. Anderson 177). This type of elitism was hated strongly by Priestley and Keir, both Lunar Society members. They preferred science to remain as part of the common, accessible language of all that would foster an egalitarian scientific community; for as Priestley noted, "we cannot speak the language of the new Nomenclature, without thinking as its authors do" (qtd. Golinski, *Science* 246). Ultimately, the British scientists adopted Lavoisier's system, tailoring their expectations of a perfect system to make themselves content and compatible with the French scientist's.

The same factors that made word choice and specificity necessary in the modern age were also present in the scientific communications of the Romantic Age, as they were determining how to share scientific advances with the public. In a seminal article on the hermeneutics of science that closely analyzes the work of Romantic scientists, Gyorgy Markus states that any communications between experts and members of the public should be highly scrutinized (Markus 19-29). Scientists have always been called on to justify their work to the masses, and the ways that meaning is constructed through these interchanges stems from the use of metaphor to communicate more complex scientific ideas. The Aristotelian notion of metaphor as the carrying over of a word from its original application to a new object of reference is used by Golinski to describe how scientific language may be taken up by lay communities. He notes that terms such as "'affinity,' 'hysteria,' 'evolution,' 'entropy,' 'relativity,' and many others are said to have originally been coined with quite precise applications within technical discourses but to have subsequently been appropriated for more general – presumably less precise – usage among nonexperts" (Golinski, *Making* 122). This connection of metaphor to introduce complex topics to a more generalist audience presents a problem because it assumes the existence of a bounded scientific community, which is exactly what Davy was trying to prevent in the scientific societies of London. Ross notes that Davy's work inspired him to keep the definition of "scientist" open to anyone who wished to participate and did not want to restrict the field to only those who had the wealth, financial privilege, or status to participate (Ross 233). Thus, Marcet's *Conversations on Chemistry* participated in the same activity as Davy's public lectures, striving to keep science open and accessible to all, by restraining from using technical language that was not adequately explained and contextualized.

CLOSE READING OF *CONVERSATIONS*

Jane Marcet's *Conversations on Chemistry* participated in the overall work to revolutionize to whom and how science was taught in the nineteenth century. Her book was initially published anonymously, to avoid any negative reception that would have resulted from her female authorship. Her book explained chemistry to women and children, the intended audience as outlined in the Preface, in illustrations and suggested experiments. The text dramatized great moments in science in a delightful Socratic dialogue of a female teacher, Mrs. B., and her two female pupils, an older one named Emily, who was more accepting of science as truth, and Caroline, the younger, much more curious sister, who, in her sister's words, was "an inquisitive little creature" with too many questions and an unbridled desire to learn as much as possible (Marcet 3). Marcet does not include much about who these girls are, but there are a few details that help shape the reader's perception of them. Emily and Caroline wear muslin dresses, which is commented on when they discuss the chemical nature of acid after Caroline spills acid on her gown burning a hole right through it; Caroline's father has a lead mine in Yorkshire, which is discussed while conversing on metals; and Mrs. B. is adamant about preventing them from breathing nitrous oxide during their copper experiment (Marcet 197, 130, 9). Marcet points out in the preface that she made Emily and Caroline quick, intelligent students in order to keep the dialogue moving forward and so as to only entertain brief, useful tangents. This dialogue that these girls share with Mrs. B. pursues a passion for truth and never sacrifices a fact for effect in her construction of the textbook.

The twenty-three conversations always strive to address the simplicity of the scientific knowledge first, then progress to more complex aspects of chemistry. This format mimics perfectly the chemical nature of the world. After discoursing and engaging in Socratic dialogue with Emily and Caroline about the simple chemistry, Mrs. B. moves on to discuss the constitution of more complicated reactions and particles, following a natural order of progressively more complicated subjects with correlating experiments until the particles that have been the subject of discussion are compounds that are part of more recognizable household mixtures or garner some degree of relatability to Emily, Caroline, and the reader.

In true Romantic style, Marcet always lets the imagination have center stage in every situation. Mrs. B., Emily, and Caroline make the most wonderful discoveries through their expansive journey toward better scientific understanding through conversations and experiments. Mrs. B. leads the girls as they perform experiments that were tailor-made to fit the chemistry-based conversation that the text uses as its backbone, and these scenes are depicted in the sixteen woodcut illustrations of the book, with notes about how the experiment was conducted. Marcet's contribution to science in the Romantic Age was her advocacy to teach chemistry to beginners by experimental demonstration, in a time period when the value of this was not fully recognized. This advocacy did not go unnoticed because the importance of democratizing science during this time period gave birth to the performance of scientific knowledge or the necessity to learn science in its basic forms.

Historians of science, like Greg Myers, point out that certain classics of science, like Lyell's *Principles of Geology*, "could be read and discussed by the general educated upper-class public of [the Romantic Age]" (Myers, "Jane Marcet's *Conversations on Chemistry*," 43). Historically speaking in literary studies, Myers suggests that "there has been less attention to the . . . genres that developed to present science to the public . . . . Popularizations are still too often treated as a defective translation of a primary text" (Myers, "Jane Marcet's *Conversations on Chemistry*," 43). Jane Marcet's work fell into this categorization of accessible, popularized accounts of science, which were only flawed in the same way that other scientific texts of the day were. The reach of scientific knowledge was not expansive enough to provide a thorough account of chemistry, but that did not prevent scientists from conversing among each other on those issues. Thus, there was no reason that the general public should not have been informed and able to read such information as well, as amateur scientists or nonscientists alike.

Myers notes that *Conversations on Chemistry* was written for the context that was presented in the textbook: a place in the home "where science is part of a program of self-improvement for the daughters of the middle classes" (Myers, "Jane Marcet's *Conversations on Chemistry*," 46). However, the text was popular far beyond the intended audience implied by the text itself. Myers notes that "the book was read by college students and by working-class self-improvers, most famously Michael Faraday, who was led by it to Humphry Davy and his own career in science" (Myers, "Jane Marcet's *Conversations on Chemistry*," 46). The popularity of the text among a general public audience is surprising because the text was specifically designed for young women and takes the shape of conversations between a science teacher, who is referred to as Mrs. B, and two very bright and quick-witted teenaged girls, Emily and Caroline. The form of this text is crucial to the forum it created for its readers. This text and all of Marcet's others are serious textbooks with strong theoretical structure and experimental consideration; texts that created a space for women to do chemistry. Marcet's contribution to education and genre of the textbook may be her advocacy of teaching the more recent advancements in chemistry to beginners through experimental demonstration.

In fact, her fifth London edition of 1817 stated that she "endeavoured to give an account of the principal discoveries which have been made within the last four years in Chemical Science . . . and of various important applications, such as gas-lights and the miner's lamp" (Marcet, "5th London Edition Preface"). Later, in the eighth London edition of 1832, she introduces the "late discoveries on Electro-Magnetism, and the doctrine of Definite Proportions," thereby making her text current while still natural and unaffected by the popularity of her text (Marcet, "8^{th} London Edition Preface"). Marcet worked to keep her textbook current and reflective of the current intellectual scene, as it digressed from inclusivity of other discipline's experts and vaguely interpreted nonexperts.

The twenty-three conversations of Mrs. B., Emily, and Caroline explored the discoveries of Luigi Galvani, the Italian physician, physicist, and biologist; Alessandro Volta, the Italian physicist and chemist; Benjamin Franklin, the American polymath; Benjamin Thompson, Count Rumford, the American-born British physicist; Joseph Priestley, the British chemist; Hans Christian Oersted, the Danish physicist; Jöns Jacob Berzelius, the Swiss chemist; Claude Louis Berthollet, the French chemist; Henry Cavendish, the British chemist; Joseph Black, the Scottish physician and chemist; William Hyde Wollaston, the English chemist and physicist; Humphry Davy, the British chemist; and Antoine Lavoisier, the French physician and chemist. This wide swath of international scientists showed that Marcet's Swiss heritage did not limit her to British science and the same national quest for British success that confined other science popularizers of her age.

Her preface in the 1806 second edition states that she attempted to reach females at the state of their current education because she knew that female "education is seldom calculated to prepare their minds for the abstract ideas, or scientific language" (Marcet iii). Therefore, the language that she chose signifies her attempt to make the increasingly more complex scientific language clear for her intended audience of young girls, an attempt that actually made her textbook popular among a wide variety of readers. Compared to her own education in Switzerland with her brothers and sisters, Marcet thought the English state of female education was so poor that Marcet prefaced her own introductory work, which was meant to introduce even the most young and inexperienced audience with chemistry, with the disclaimer that she believed female education may not have prepared her readership for encountering her own assumedly very accessible text. Yet Marcet justifies her choice by stating that "in the course of these conversations, remarks are often introduced, which appear much too acute for the young pupils, for whom they are supposed to be made. Of this fault the author is fully aware. But in order to avoid it, it would have been necessary either to omit a variety of useful illustrations, or to submit to such minute explanations and frequent repetition, as would have rendered the work much less suited to its purpose" (Marcet iv). Marcet's awareness of the poor female education system in England most likely stems from her own education alongside her siblings in her Anglo-Genevan home. Marcet's refusal to break down the principles of chemistry to their atomically indivisible components comes with the insistence that her work will be much better understood if the reader works through it; as Marcet notes, "for its various parts are so connected with each other as to form an uninterrupted chain of facts and reasonings, which will appear sufficiently clear and consistent to those only who may have patience to go through the whole work" (Marcet iv). Presenting her textbook not as twenty-three individual conversations, but as a complete introduction to chemistry allowed Marcet to open up science, not as something that would make for an interesting tidbit to parrot out at a party to garner social status, but rather as means to access a foundational understanding of the world around us. Marcet clearly believed that everyone should have a basic knowledge of science in order to understand better the world and that a few coveted tidbits of knowledge did not constitute a functioning constellation of knowledge.

Marcet felt “encouraged by the establishment of those public institutions, open to both sexes, for the dissemination of philosophical knowledge, which clearly prove, that the general opinion no longer excludes women from an acquaintance with the elements of science” (Marcet iv). Marcet’s sentiment that her readers had “previously acquired some slight knowledge of natural philosophy” comes from the public ideal that everyone should understand some bit of science because it “appears very desirable” in public spheres (Marcet v). Therefore, it can be assumed that Marcet sought to build on her reader’s scientific knowledge by giving the next building blocks to figure it out themselves, according to the scientific method, which is why Mrs. B. begins the first conversation by stating that the nature of their conversation will be on “another branch of science . . . CHEMISTRY” (Marcet 1).

Caroline begins very distrustful of chemistry, as she wants to be entertained by science and “those sciences that exhibit nature on a grand scale” are just much more fascinating to her (Marcet 1). Mrs. B. realizes that Caroline’s narrow perception of chemistry comes from knowledge simply of the apothecary’s shop, which is simply what she knows and has access to as a young girl and which Mrs. B. explains is only a branch of chemistry called pharmacy and reserved for the last conversation as it “properly belongs to professional men” (Marcet 2). Chemistry has the ability to offer “an interest on the common occurrences of life” and will “enlarge the sphere of her ideas, and render the contemplation of Nature a source of delightful instruction” (Marcet 2). In Mrs. B.’s character, Marcet develops a character much like her own that is overtly fascinated by the way the world works and in awe of the understanding accessible through scientific knowledge.

After a brief diversion to distinguish “modern chemists” from “Alchymists” and mechanics, Mrs. B. explains that chemistry can also help reduce the strain of labor on humans and that chemical advancements can prove beneficial to society, giving the pursuit of scientific knowledge a humanistic quality. In fact, Marcet explains that, in the thirty years before *Conversations on Chemistry*’s publication, chemistry “has experienced an entire revolution . . . since it became a regular science” (Marcet 4). The development that chemistry underwent through the last thirty years was more or less percolated by Humphry Davy and the other members of smaller scientific collectives like the Lunar Society of Birmingham. These small groups of scientists contributed significantly to what has been deemed the “Second Scientific Revolution” that prompted the specialization of scientists into individual unique disciplines.

While at times tedious, Marcet’s conversations are characterized by her dedication to accuracy, precision, intellectual honesty, and are founded from her copious notes on the most recent developments in science. Her notes stemmed from her own observations that she made while attending lectures and through her abundant correspondence with scientists of her day to verify her explanations. On the whole, the conversations are meant to instill in the reader a very basic consideration of some of the more complex aspects of chemistry through its fundamental progress. Each conversation allows for meditation not only on the subject of chemistry, but also on its applications and social implications for the broader culture. The practical nature of the conversations is what keeps them closely tied to Marcet’s overall project, which is to educate others on the topic of science so that scientific knowledge could aid them in their personal and professional growth, rather than hinder them. Together, the experiments speak to the value of knowledge as power in the public sphere; and especially scientific knowledge, because it can be presented as more complex, can be used to gain power over others, without their consent, such as in the example of Lady Delacour and Harriet Freke in *Belinda*. Scientific knowledge can be easily understood, as long as it is accompanied by rationality, such as is displayed by Mrs. B. with nitric acid and copper. The first experiment that Mrs. B. does for the girls is to pour nitric acid on copper, which is, visually, a pretty impressive reaction. Producing upon first contact a fizzy solution, the orange-brown nitrogen dioxide gas separates from the copper nitrate. An oddly toxic reaction to those who would be standing close by, which is why Mrs. B. states that the nitric acid is "contained in this glass," due to what Mrs. B. calls "strong attraction," "every particle of the copper will combine with a particle of acid, and together they will form a new body, totally different from either the copper or the acid" (Marcet 7). While this is a simple idea, it does have value because the solid copper does trade places with the hydrogen atom in the nitric acid's molecular structure, giving the product copper nitrate that is a blue-green aqueous solution, water, and nitrogen dioxide. While neither Marcet, nor anyone else in her time period, has access to the scientific knowledge that would explain this whole reaction, she does instruct the girls to look at the blue copper nitrate and consider how "totally different this compound is from either of its ingredients" (Marcet 7). And while there is no time for a time-lapse in the dialogue, Mrs. B. produces a specimen of the copper nitrate once it has cooled and crystalized.

Later on, the trio considers the properties of metal and how they can be used to plate other metals by suspending the copper atoms in solution and allowing them to deposit on the blade. This practical purpose of this experiment is what Marcet hinges most of the conversation on through the first experiment because it allows her to break down the difference between what she calls "chemical attraction, and the attraction of cohesion, or of aggregation" (Marcet 6). Marcet uses the character of Mrs. B. to explain the difference clearly with a poignant example of the composition of bread. Mrs. B. states:

> "The attraction of cohesion exists only between particles of the *same* nature, whether simple or compound; thus it unites the particles of a piece of metal which is a simple substance, and likewise the particles of a loaf of bread which is a compound. The attraction of composition, on the contrary, unites and maintains in a state of combination particles of a *dissimilar* nature; it is this power that forms each of the compound particles of which bread consists; and it is by the attraction of cohesion that all these particles are connected into a single mass." (Marcet 6-7).

In clear and concise wording, with attention to details so that the reader cannot mistake one form of attraction for the other, Marcet uses Mrs. B. as the sage teacher to inform the reader and EmilyIt is clear to the reader that this experiment has value to convey knowledge through the constructed metaphor for how decomposition works through the clarification of the separate and distinct ingredients that go into bread, and the crumbs of bread not as decomposed parts of the bread, but rather as mechanically divided pieces of loaf of bread, which is a new substance that is constituent of its parts. Marcet's use of metaphors and everyday examples makes it easier for the individual to attend Davy's public lectures and thereby make Marcet's work resonate with the expert work of Davy and the Royal Institution.

In a description of the experiment's cause for the reaction, Caroline and Emily approve of this "striking . . . example of chemical attraction" (Marcet 8). Mrs. B. takes note of Emily's use of the word "attraction" to explain how that term was only a recent introduction to chemistry's jargon as a substitute for the older term of "affinity," which "originated in the vague notion that chemical combinations depend upon a certain resemblance, or relationship, between particles that are disposed to unite" (Marcet 8). Obviously, this is wrong because there are magnetic properties of an atom that can make it respond to changes in a magnetic field, but there is more to reactions than just an atomic desire to be with similar particles. Caroline also makes the argument that fewer, more precise terms is preferable to a "variety of terms to express the same meaning" (Marcet 8). This argument that Mrs. B., Caroline, and Emily share parallels Davy's work because he wanted to keep the scientific field and its terminology simple and approachable for all audiences.[65]

Being young girls, Emily and Caroline share a great deal of the explanatory work of the text. They consider the terminology with wit and clarity, seemingly possessing a working knowledge of chemistry at times and an innocently naïve attitude at others. This variation does not allow Emily and Caroline to become much more than static characters throughout the dialogue, as their purpose adapts to the situation. However, Emily and Caroline are diverse thinkers, as they tend to operate like little adults in their conversations with Mrs. B., which is in keeping with other children's writers of the time such as Maria Edgeworth and Richard Edgeworth as well as Anna Letitia Barbauld and John Aikin or even Hannah More. When Mrs. B. posits a negation to something she just

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[65] However, this work was also complicated by advancements in science as the increasing amount of available knowledge made it necessary for a variety of terms to become mainstream within the field.

taught them, it is the girls who speak up for the correct perception, clarifying in the first experiment the difference between mechanical division and atomic decomposition. These parts do seem repetitive, but they clarify why and to whom Marcet addressed her text. She wanted to introduce chemistry to those who did not understand it, in a thoroughly convincing way so as to create no doubt about the material she taught.

Mrs. B. herself even encourages the girls: “Reflect a little, and I think you will discover the reason of it” or “With a little reflection, I dare say, you would have explained it yourself” (Marcet 57, 59). This type of optimism allows the girls to participate as equals in the conversation, as Mrs. B. exudes the necessary confidence that not only the girls, but also her readers understand the scientific material at hand. Mrs. B.’s instructions to “observe the difference” and “reflect a little” (Marcet 59, 57). These instructions, at times, make the scientific knowledge and conclusions of the conversations out to be obvious to the reader and the girls if they only paid better attention and considered what they had already learned. Thus, because Marcet expects her conclusions to become so obvious to her readers and the girls, it can also be concluded that Marcet was participating in a publication that served to make science more elite and bounded to a particular audience of individuals, like Michael Faraday, who were already predisposed by rationality to understand. Marcet works with her gentlemen scientist counterparts to encourage the natural turn toward appreciating rationality for its role in intellectualism.

Thus, at times when Mrs. B., Emily, and Caroline’s over-explanations can be read as oversimplifications of complex ideas, it becomes difficult to separate out the simplicity from what is the heart of the matter, in terms of educating the individual. In order to explain atomic bonding to the girls, Emily thinks of two good friends who are then interrupted by a third new friend that each of them like better; thus, in this new friend group, the friendship shared between the two friends has to be "disunited" to include the third (Marcet 9). This explanation takes place through the character of Emily, not Mrs. B., in order to convey the youth behind that type of sentiment. However, this moment works to get young readers involved in the pursuit of science and thinking rationally in order to prepare them for the future. This form works to relate to multiple individuals' concerns through the reduction of the idea to a form that even a child can understand and connect with. No matter the topic, when explaining a topic as if it is for a child, then the person for whom the knowledge is second-nature at that point will think back to themselves at that age and provide an explanation based on youth being the excuse for not yet understanding the complexities of science. This type of explanation is the perfect way to get anyone interested in science because of what the Royal Institution, against Davy's will, did to add elite complexity to science on the whole makes the activity of science more complicated than it needed to be. The increasingly complex and exclusionary practices of the scientific community have attracted only a certain type of person, rather than a variety of intelligences, thereby singling out science to be only thought of by people who already think like the elite players who already had an established stake in the game.

In order to address more complex scientific knowledge, the gentlemen-scientists are exhibited as experts, not only in their possession of knowledge but also in their mode of thought. The more complex lessons begin by dropping names of more recent scientific explorers to justify the beauty of the current state of science. Dr. John Herschel the astronomer is considered next, as the girls with Mrs. B. see how light is refracted through a prism (Marcet 11-13). Much of this experiment is simply Caroline's imagination running free to make vague connections between her bits of scientific knowledge, thinking that with one experiment done she can then advance to the forefront of chemistry and participate in making new discoveries. However, Mrs. B. reins Caroline in to prevent her from jumping to conclusions. Caroline's excitement in the second experiment is a bit unbridled as she ascertains the origins of the telescope by first questioning: "Did not a child lead the way to the discovery of telescopes?" (Marcet 12). But there is not an answer on the subject as Emily interjects to keep them on topic. This play back and forth between the imagination and practicality, acted out by Caroline and Emily respectively, keeps the dialogue lively and clear.

The other conversations are just as fascinating. For within their conversations, they consider the connections between light and heat; each of the elements of oxygen, nitrogen, hydrogen, sulphur [sulfur], phosphorus, carbone [carbon]; the categories of the periodic table that had its early essence in the nineteenth century with metals, alkalies [alkalis], and earths, which Marcet uses as a term for oxidized compounds like lime, silex [silica oxide], alumine [aluminum oxide], and magnesia [magnesium oxide] (Marcet 65-180). Each of these discussions provides Marcet the concrete means to discuss the characteristics that each of these elements and compounds possess. Oxygen and nitrogen are how she frames the topic of gases and vapors, explaining how they are essential to combustion and respiration in everyday life; this also gives her the opportunity to show how a water bath can be used to collect gases when they are released from a reaction. By letting the girls see the way that each of the elements interacts with their daily lives, Marcet provides a framework from which the girls can continue to build and expand their knowledge. This is an educating moment, because instead of simply talking at them, Marcet uses Mrs. B. as a tool to help the girls understand the information themselves. Ultimately, this makes *Conversations on Chemistry* unreadable as a “textbook” because this format makes it difficult to simply find an answer to a question. The entire text must be consumed in order to gain any knowledge on the subject of chemistry. In order to show this more clearly, I will examine the complexity of hydrogen from Caroline’s question: “Is it possible that water should be a combination of two gasses, and that one of them should be imflammable air? It must be a most extraordinary gas, that will produce both fire and water!” (Marcet 83). Hydrogen is the element that allows Marcet stage a conversation between Mrs. B. and the girls on the topic of water through the water cycle, especially when Mrs. B. uses Antoine Lavoisier’s apparatus to display the formation of water through the addition of heat to the reaction; however, she does not stop there, but rather she also includes a fairly detailed description of how hydrogen gas can allow a candle to burn and a hot air balloon to rise. While questioning water’s composition, Caroline stumbles upon a more complex situation than she initially realized. Thus, Mrs. B. decides to address Caroline’s question, which could have had just a simple answer of “yes,” with a full sixteen page discussion with two experiments for the reader. This demonstrates Marcet’s commitment to educating her audience not just by affirming their perceptions of chemistry, but on modifying and thoroughly explaining how they should approach chemistry. Marcet’s work, while outdated, really strove to change how her readers understood the role of chemistry in the natural world and in their own lives.

Ultimately, while the subject matter of *Conversations on Chemistry* is outdated, the form of Socratic Dialogue, the conversation time given to each participant, and the inclusive experiments all work together in creating a successful means for each individual to learn and expand his or her knowledge, encourage the reader to try learning something new. Marcet was urged on in her work by her husband, Alexander Marcet, her family, and the Genevan elite. Saba Bahar's work and excellent research makes it apparent that the Genevan elite wanted to cultivate a post-revolutionary world where all citizens would be interested in science and scientific education would be a central tenet of a new education system. Bahar's article suggests that Marcet participated in the democratizing activity of using a recourse to science in order "to establish moral and political authority" (Bahar 29). Bahar argues that Marcet participated in a larger didactic project to educate the working classes about science in all its colors: botany, natural philosophy, mineralogy, etc. The French Revolution gave scientists the space to work out a new social role for science. This opportunity created factions among the scientific communities. Against the work of Marcet and Davy, revolutionary scientists wanted to appease their patrician intellectual patrons and insisted that, while chemistry must maintain a public and visible role because of its relevance to everyday life, there must be clear boundaries between professional and general appreciation of chemistry's knowledge and applications. These boundaries were unclearly delineated at best because Marcet was a Swiss-born woman, from a highly-educated banking family,[66] who became interested in chemistry through her Genevan husband's associations with the Royal Institution and her own attendance of Humphry Davy's public lectures. After the French Revolution, polymaths and bright individuals across the Channel stayed connected

[66] Saba Bahar provides a marvelous explanation of what Swiss and Genevan would have meant at the time, see Bahar 30-34.

through a network dedicated to promoting useful knowledge and offering its knowledge as a means to avoid the omnipresent political unrest.

Bahar states that the intellectual differences between Swiss and Genevan families would have produced an authentically meritocratic family life for Marcet's children. The French Revolution sparked the need to justify the intellectual backing behind the natural social differences and moral superiority that hallmarked those of the patrician elite and bourgeoisie. By playing a role in influencing how knowledge would be disseminated, the elite classes that existed before the French Revolution could still have legislative and moral authority through the regulation of public knowledge. Marcet herself was a member of the elite, bourgeoisie class, which meant that her work to disseminate scientific knowledge to the reading public was also a political work that did not operate within the proscribed bounds of the gentleman-scientists or that of the British national. Marcet's unique political status, as a Swiss woman married to a Genevan national who both lived, worked, and raised their children in London, gave her the ability to open up science to others. Working and living as part of the bourgeoisie class gave her access to learn chemistry and attend Davy's lectures, but her revolutionary attitudes that she and her husband espoused led her to educate others, because she appreciated her own education so much that she wanted to educate others.

CONCLUSION

The Romantic Age saw the application of new types of technical equipment or machinery that would be developed for a particular activity or purpose. These apparatuses to forge new disciplinary programs of research and student interaction, including both scientific apparatus as well as genre apparatus, as a form of collective notes or variant readings that could inform the reader of a printed text, that could provide a means of introducing beginners to the general scientific practices and inducting new practitioners into the disciplined work practices required of them by opening up extensive possibilities inherent in the sciences that we ready for exploration. The more people who participated in the conversations of science the easier and more accessible scientific knowledge would become over the years. Popularizing science is an usual field for discourse analysis, like this, simply because it is defined by what it is not. Popularization, like the activity Marcet engaged in, includes only texts about science that are not addressed to other scientists. To make a modern comparison, an author's essay for *Popular Mechanics* should not also appear in *IEEE*, although a different piece from the same author may appear without scrutiny. I engage with this field of study to determine how the audience changes the author's portrayal of the written product and how we can improve the communication of scientific knowledge through a better understanding of the use of language.[67] Jane Marcet's work bear witness to the belief that girls, like their brothers, should keep pace with up-to-date natural and human sciences. Conversations, with all individuals included and about the culturally-significant subject matter at hand, is what defined the Romantic Age as unique and clarified the expansive access to knowledge that was valued by a community that at first resisted, then gave in to the

[67] This interest stems from Greg Myers's work to improve teaching of languages for academic purposes, Jeanne Fahnestock's rhetorical aim to relate scientific discourse to other discourses, Richard Whitley's relational study of science and society, Roger Cooter and Stephen Pumfrey's determination of how to fit science within public culture, and the work done by scientists themselves to figure out what they are conveying and how they are communicating it, as evidenced in Robin Dunbar's individual work throughout the late 1980s and early 1990s.

looming presence of specialization that sought to make books like Jane Marcet's *Conversations on Chemistry* obsolete.

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