A HERMENEUTIC ANALYSIS OF MAINSTREAM DENOMINATIONAL CHRISTIANS OF THE SOUTHERN UNITED STATES WHEN READING AN EXPOSITORY-NARRATIVE SCIENCE AND RELIGION TEXT

by

RHETT JEFFERSON HUTCHINS

(Under the Direction of Donna Alvermann)

ABSTRACT

This study used a hermeneutic method from the intersubjective hermeneutic paradigm to account for the ways in which science, technology, engineering, art & design, and mathematics undergraduates engage normal-science and religion content presented in an expository-narrative science and religion text. Data sources included seven participants involved in twenty-one semi-structured interviews conducted via a multiple interview approach over eight weeks. Dilthey's hermeneutic method of detailing a participant's naïve and methodic hermeneutic structured the conceptual data analysis. Inductive thematic analysis was used to analyze the participants' constructed narratives to determine interpretive and understanding strategies these participants used.

INDEX WORDS: Expository-Narrative, Literacy,
Hermeneutics, Science, STEAM, Religion

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DEDICATION

I dedicate this dissertation to my ‘nieces’, Seagan, Lucy, June, Ensley, and Rigby, and to my ‘nephew’ Sullivan. It is my hope that you each enjoy school as much as I did and that science class provides you with fantastic experiences. I continue to hope that when each of you reaches the grade where you learn about cosmology and evolution, your classes are devoid of the harshness and intolerance that plague the cooperative spirit possible between science and religion.

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TABLE OF CONTENTS

Page

CHAPTER 1

INTRODUCTION

Conversations regarding science and religion tend to bring a wide variety of facts and opinions to the table by all participating parties. Ill-conceptualized views on what exactly science and normal-science are, how they operate, and their boundaries provide a starting point for reframing the societal discussion around science and religion. Perhaps the most prominent locations where these discussions take place is in the science classroom. While there is a perceived barrier between science and religion in public discussion, the failure of science education to detail the boundaries and limitations of science, which should be taught in science classrooms, help identify a starting point for miscommunication between science and religion. Most classroom teachers are not prepared to facilitate a discussion involving science and religion and many do not consider a classroom the appropriate location due to the perceived barrier between science and religion and the issue of separation of church and state in schools. Beyond the science teachers themselves, there are other factions that object to the discussion of religion or conversation around religious connections in the science classroom. There are also members of the religious community that oppose the current science education attitude of eliminating any student discussion around religion and science in the classroom.

Science and religion are both aspects of society that directly and indirectly manifest themselves in the educational system through curriculum, instruction, and

beliefs that are brought to the classroom by teachers, students, and parents. The depth of understanding and critical reasoning of background information is important to navigating the boundaries between science and religion. From teaching experience in secondary education classrooms, it became critically apparent that a student's religious and scientific disciplines often interacted, though I was not permitted to encourage these interactions as a matter of policy. Some students' disciplinary literacies interacted smoothly and successfully while other students' disciplinary literacies did not. There were also students that had no religious and scientific interactions, but not necessarily because they were areligious or a-scientific, they did not know how to interact with them or were not aware of the boundaries or overlap within their lifeworld.

Statement of the Problem

Religion through the form of Christianity, particularly mainstream and evangelical Protestantism in the southern United States, has had an often-strenuous relationship in the public education sphere with normal-science related principles, particularly cosmological development and biological evolution. In the public classroom, religious-oriented learners are required to engage with normal-science related principles, but with little regard to how these principles dialogue with the learner's religious understanding and conceptualization, often as a result of not being aware of the limitations of how normal-science is structured. While science educators, school administrators, and legislators expect students to become proficient in 'normal' science concepts and methods, there is a limit to how classroom teachers and other educators can address the cultural and religious beliefs and concerns about 'normal' science that students may bring with them into the educational environment. The mislabeled belief

that schools should be a zone free from religious discussion because of a separation of church and state in the classroom has limited the explanatory opportunities for science educators to both clarify and inform student learners of 'normal' science content. The onus for lack of discussion and engagement between normal-science and religion does not exclusively lay on science education, though it is often the target of being the resistant side to engaging with religion.

According to numerous public opinion surveys conducted over the past two decades, there is a large discrepancy in the understanding of the relationship between denominational statements on science and science education in public classrooms and practitioners' beliefs in what they think their denominational stance to be (Gallop, 2012; Lee, Tegmark, & Chita-Tegmark, 2013; National Center for Science Education, 2012; Portrait and Demographics U.S. Landscape Survey, 2010). The majority of United States-based Christian denominations have issued statements supportive of science education instruction in 'normal' science concepts; however, the majority of individually-identified denominational/religious members support the exclusion of many 'normal' science foundational theories such as the Big Bang theory and Darwin's theory of evolution by way of natural selection (National Center for Science Education, 2012). There is a clear disconnect between denominational stance and individual religious beliefs.

Background and Rationale

When I concluded my master's degree in Natural Science Education, I knew that I wanted to seek a new direction in my studies and educational practices focused on increasing scientific literacy in classrooms. To understand my educational interest in

science and my goal of improving scientific literacy, especially in light of religious belief, it is necessary to examine how I have arrived at my present self.

I grew up in a family that was religious and in line with the dominant culture of my locality and state: we attended weekly services at a local United Methodist Church where we were members. I grew up attending Sunday school, but was never involved in the youth group or weekly activities at a young age or through primary and secondary school. In fact, church and religion were more or less confined to Sunday activities with the exception of prayer before supper. There was never an intersection of religion and science in my educational life until I was warned in high school that some of the subject material we would be taught might contradict what we may have learned outside of the school setting. Due to my predisposition to look past any potential conflict between religious beliefs and scientific understanding, I may be more susceptible to overlook what I would deem an insignificant comment, thus needing to review transcriptions with a more critical eye for conflicts.

Fast forward to the later and more recent portions of my life when I earned a degree in Biological Sciences and taught for several years in public high schools in my home state. While teaching, I encountered varying attitudes towards science from persons of different Christian faiths, but I often was unprepared for the strong negative attitudes towards the concept of biological evolution. These negative attitudes have often caused me to devalue others' religious beliefs in the classroom and suggest that students simply -though not a simple act at all- separate their religious and scientific understandings. By looking past what students value, whether I share those values or not, I cannot hope to understand how they perceive scientific knowledge.

Both as a student in the high school biology classroom and while teaching high school biology, I recall there were students who would accept what the teacher said without question, students who rejected what the teacher said because it conflicted with religion, and those that either accepted or struggled-but-engaged-with the content on a scientifically appropriate level. It is the last group that I was a part of and could always identify with; however, as part of that group as both the student and the teacher, it was off-limits to discuss what, if any, relation to our religious beliefs we encountered and how to think about them in the science classroom. For this reason, I am invested in this research and particularly interested in how I am affected by the process.

Statement of Purpose

The purpose of this study is to gain understanding of the type of interactions and/or processes that learners, specifically science, technology, engineering, art & design, or mathematics (STEAM) learners go through when engaging content of a normal-science and religion related nature. To look at these types of interactions, this study will use an expository-narrative science and religion text to help generate questions and engage in reasoning and dialogue between normal-science and religion. This study also looks at the ways in which participants interpret and understand normal-science and religion by using Dilthey's hermeneutic approach to access participants' lifeworld experiences that shape their normal-science and religion engagement.

Significance of the Problem

Continuing along the lines of using expository-narrative texts for research set forth by Norris, Guilbert, Smith, Hakimelahi, and Phillips (2005) and Avraamidou and Osborne (2009), I sought to identify the questions that a mainline Christian denomination

member might ask when reading an expository-narrative science and religion text. Since all learners and all texts are different, there will not be a definitive answer towards the interpretive interactions that a learner may experience. The potential was to see if participants that recognize the existence of a barrier and boundaries between science and religion are open to and capable of dialoguing science with religion in the absence or with an enhanced awareness of the barrier. What paths or processes, if any, may be laid out for future questions guiding instruction in science education, with a particular interest in assisting the learning of normal-science concepts for mainline Christian learners would remain to be answered, but this research will open the door to future investigation. There was no intention to limit the view of participants' interpretation processes to a hermeneutical line of theory, detailed in Chapter 2, if none was demonstrated by the research. The immediate practical results that may be seen were personal growth value within the participants, increased awareness of the constitution of normal-science, and increase in the discourse opportunities between normal-science and religion.

Research Questions

To better understand how learners navigate science and religion, this study was guided by the following encompassing research questions:

- What are the interactions or processes a mainstream denominational Christian and science, technology, engineering, arts & design, and mathematics (STEAM) learner uses to engage with an expository-narrative science and religion text?
- Based on the reading by a mainstream denominational Christian and STEAM learners when engaged with an expository-narrative science and religion text, how

can participants' interpretations of normal-science and religion be situated on a spectrum of interactions between normal-science and religion?

To examine these questions, I conducted semi-structured interviews following Seidman's (2013) multiple interview method focused on constructing an interview narrative from a reading of the expository-narrative science and religion novel *Mr. g: A Novel About the Creation* (Lightman, 2012). This study employed a hybrid framework of the historical understandings around science and religion over the last several hundred years and the real or perceived conflict existing between them. To analyze participants' experiences with normal-science and religion experiences, Dilthey's (Dilthey & Makkreel, 2010) hermeneutic method of the naïve and methodic hermeneutic will be used.

Definition of Terms

Content area reading – The acquisition of information pertaining to a content area (history, language arts, mathematics, or science) (Macklin as cited in Jones-Moore, 2011).

Content literacy – Using reading and writing skills to gain knowledge in specific (history, language arts, mathematics, or science) content area (McKenna & Robinson, 1990).

Content specific strategy – A strategy used in a specific content area for instruction related to that area; science content specific strategy is specific to science instruction (Wilkinson & Son as cited in Jones-Moore, 2011).

Expository text – Texts that are written to inform, traditionally found in textbooks and reference instruction material (Pearson & Fielding as cited in Jones-Moore, 2011).

Expository-narrative – There are four main types of text: fiction, non-fiction, argumentative, and expository. Expository-narrative text is a sub-genre of traditional informational expository text, which may utilize either non-fiction or fiction narrative to add a storytelling processes to the delivery of expository information (Avraamidou & Osborne, 2009).

Generalizable comprehension strategies – General-purpose comprehension strategies, such as summarizing, predicting, and questioning that can be used in reading and across the content areas (Hirsch, 2007).

Informational text – Texts use for information about any topic at hand (ex: science textbook, art textbook). Traditional information texts, such as textbooks or reference material are read linearly, from start to finish, or topic-by-topic using specific chapters or organization structure for content information (Duke, 2004).

Narrative text – Narrative text tell stories, both fiction and non-fiction, or experiences (non-fiction). Students identify narrative texts most easily by the presence of common literary elements (ex: theme, setting, and characters) (Avraamidou & Osborne, 2009; Duke, 2004).

Normal-science – Science is an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to discover the ways in which this information can be organized into meaningful patterns. A primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and amongst the various facts. Science is an intellectual human activity that is concerned with integrating and coordinating, in a systematic way, new

information with an existing and ever expanding reservoir of information. This integrating gives a more complete description and explanation of the natural world in which humans live. This increasing fund of information available to scientists and society is supplied from many different fields of exploration. (Gottlieb, 1997, para. 18).

Importance, Implications, and Limitations

The importance of this research for science education instruction in the nation's classrooms could range from minimal to widespread. The determining factor in reception will be the willingness of classroom teachers and curriculum specialists to implement the idea of mediation through questioning and interpretation of classroom instruction in normal-science when it meets with students' personal religious views. Based on the continued and general failing of science literacy and science content knowledge found in the general populace, especially among the geographic south, a study of this content would be of great importance in mediating and improving the general understanding of normal-science and its ability to relate to and interact with religion (Gallop, 2012; Lee, Tegmark, & Chita-Tegmark, 2013; National Center for Science Education, 2012; Pew Forum on Religion and Public Life, 2008).

The implications of my research are twofold: the immediate consequences for the participants that participated in the research and the effects that the process had on them, as well as the long term implications that the research will have on society by promoting a discourse between science and religion and how this research can ultimately influence education in science classrooms. As a researcher, the immediate effects that any research will have on participants should always be in the forefront of the design and development process. With qualitative interviewing, the possibility of encountering personal

information, particularly in the discussion of religion and the ideas of the sacred is more likely and the effects of such deep and private revelations must be considered on the overall outcome of the research process (Olsen, 2003). The privacy of individuals and the respect of their beliefs in this study was maintained through the establishment of procedures that permitted participants to opt out of any questions or the study as a whole if they felt it necessary. By providing participants with an opt-out option during the interview process, emotional distress that could be caused was potentially lessened or avoided. There is never the intention of causing distress in research, or the questioning of participants religious beliefs. However, there always remains the unknown possibility of causing such an adverse reaction.

The larger scale implication issues of what effects this research might have are dependent upon how the data gained may be used to open up the conversation between normal-science and religion. What type of method, other than increased conversation and openness to discussion, cannot be predicted from the onset. Since this study was qualitative in nature and focused on a limited number of participants that met select criteria, geography, religion, and educational field, the results are not intended to be generalizable to the larger public. The lack of generalizability does not preclude the gaining of any type of specific knowledge that could ultimately be valuable in crafting future practices or policy that could direct the furthering of normal-science content instruction or developing and not restricting the discussion of religion, specific Christianity, and normal-science.

A very specific implication warranting careful attention is that this research was not intended to reconcile normal-science and religion, nor was it intended to disengage

the two from each other with participants, a potential hazard addressed during the studies design; only to open up the potential for dialogue that exists between the two. Whether an individual takes normal-science and religion to be of the same domain or non-overlapping magisteria, as detailed by evolutionary biologist Stephen Jay Gould (1997), is not to be changed. Belief manipulation is not an aim, but to look into how individuals may use religion to make sense or garner understanding of normal-science was the limit to this research. There was no aim to cause dismissal of religious practice, conversion, or personal revelation with participants, but only to examine the questions and question process of reading an expository-narrative normal-science text. This examination, particularly the narrative generated through the final interview protocol, links to the interpretive and understanding processes of participants. There may be no theoretically describable hermeneutical process occurring within the participants when engaged with such types of texts intersecting religion and normal-science. This lack of theoretical model would not limit the research since, as Gadamer (2004b) stated; all reading is a hermeneutical act. Because of the participants' engagement with the text, there was some active process, whether it was hermeneutical, or a yet to be defined process, and a pragmatic evaluation of that engagement process that could potentially lead to the development of new policy or classroom practices. Individual learners may only be able to internally mediate religious (or spiritual) and normal-science interactions through a process that would have no measurable quantitative benefit on science literacy, but this would not be viewed in a negative light to this study; this would be value added growth for a participant. The value added growth or reflection is always capable of expressing itself through experience in relation to other life activities and can only come via

qualitative research methods. John Dewey (1998) said that experience is the goal of education; however, experience cannot be directly taught. It is through the experience that we are capable of learning and making sense of concepts, including normal-science concepts or concepts on religion. As science education and normal-science have been s prone in the past to ignoring religion, spirituality, or religious thought in conjunction with normal-science, because of the controversy that surrounds them in their historical connection, they also have ignored the experience of those individuals they are seeking to teach.

There is no definitive answer to what such work might reveal, but it is my hope that some greater understanding of a person's internal engagement between normal-science and religion can provide insight as to how future educators can encourage, instead of ignore, greater learning opportunities from the sometimes-controversial issues in their classrooms.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This review of relevant literature and the accompanying theoretical framework provides the necessary background content pertaining to investigating the research questions. In order to detail how a person might relate to science and religion, it is prudent to elaborate on how the current realms of science and religion have arrived at their present historical context in today's society. By tracing the past 150 years of science and Christian religion development, the purpose and significance of this study in addressing overall science literacy for Christian religious persons, specifically student learners, will stand out. Literature relevant to the types of texts used in science education classrooms and narrative construction will be reviewed to establish a background for reading an expository-narrative science and religion text in this study for the purpose of opening up the dialogue with the participants. It is also relevant to detail the distinctions that exist between the most well-established forms of hermeneutics and, in doing such, the linage of hermeneutics will become relevant to why I have chosen the method that is to be used and the basis for my interpretation. Lastly, two texts that are important to this study must have some details established. These texts contain subjectivities and the subjectivities that exist around the expository-narrative science and religion text that will be used and those of its author.

Literature Review

The Nature of Science and Religion

Being a quantitatively trained natural and biological scientist in the qualitative world of social science research has caused me to be acutely aware of choosing words with great care and thoughtfulness. The use of the word 'science' is one that I personally dread and try to avoid when in discussions. It is the *truth* word I rely on when determining where someone positions himself or herself in the world. When I am forced to use common vocabulary, I cringe because I know the dangers of mixing vocabularies about which John Dewey (2008) and Richard Rorty (1982) warned. To alleviate this danger, or at least lessen it, I have no issue with defining common terms where warranted due to confusion. This is something that must be done with the term 'science,' so that it is possible to go properly forward, or wherever one wishes to go in the ultimate bounds of hermeneutic direction. There is a presumed view of science in that it is epistemologically knowable and certain, something that is predictable, constant and fixed; however, while the physical sciences are actually predictable, they are not constant and fixed, they are permeable and shifting within their own paradigm. The issue here is not the debate about what constitutes 'science' between the quantitative and qualitative areas of research, but what constitutes 'science' in the general parameters of society. The definition of science that I feel best suits this application of study is that of Sheldon Gottlieb (1997) from his talk at the Harbinger symposium *Religion & Science - the Best of Enemies, the Worst of Friends*:

> Science is an intellectual activity carried on by humans that is designed to discover information about the natural world in which humans live and to

> discover the ways in which this information can be organized into meaningful patterns. A primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and amongst the various facts.
>
> Science is an intellectual human activity that is concerned with integrating and coordinating, in a systematic way, new information with an existing and ever expanding reservoir of information. This integrating gives a more complete description and explanation of the natural world in which humans live. This increasing fund of information available to scientists and society is supplied from many different fields of exploration. (para. 18)

Difficulties still abound in using this definition of science, particularly when examining the epistemological stances towards knowledge; however, those difficulties may need to be addressed on a case-by-case basis when encountered.

With a working, if tremendously iffy, definition of science provided, to define religion presents itself as an even more monumental task. I am thankful to have gone beyond mere religious self-experience and at least scratched the surface of institutionalized belief by engaging in religious study coursework that expands how to participate in the study of religion. While there is some amount of consensus on a definition of science between paradigms, there is virtually none for a definition of religion inside the religious studies community. There are definitions of religion provided by religious studies and scholars of religion and then there are definitions of religion provided by the groups that practice religion. Again, the return to vocabulary

and paradigm is extremely present in this space. Defining ‘science’ as one thing and ‘religion’ as another is virtually an insurmountable task that can appease no one and irritate all; it is the necessary evil of vocabulary. The nearest available and helpful place to view religion for the purposes of this study will be from the area of the study of religion; but not the practice of religion itself. Even here, in the study of religion, finding a widespread or encompassing definition is challenging. Èmile Durkheim defined religion as "a unified system of beliefs and practices relative to sacred things, that is to say set apart and forbidden, beliefs and practices which unite into one single moral community, called a church, all those who adhere to them" (as cited in Olsen, 2003, p. 62).

Durkheim's definition is one of the standards in the study of religion but not the only one worth noting. Wilfred Cantwell Smith stated that the term religion is a term of confusion. We do not know what it ultimately refers to since it is not clear in “precision, utility, and legitimacy” (Wilfred Cantwell Smith as cited in Olson, 2003, p. 2). Jonathan Smith went so far as to define religion as not even being anything but an academic construct: “Religion is solely the creation of the scholar’s study. It is created for the scholar’s analytic purposes by his imaginative acts of comparison and generalization. Religion has no independent existence apart from the academy” (as cited in Olson, 2003, 3). Jonathan Smith’s definition is not going to be of use here due to the relegation of religion to the academy and not society, it is also likely to be highly displeasing to those practicing religion and may serve against the interests of this study; nevertheless, it is of interest to note his contrast from other religious studies scholars. For my purposes, when used in conjunction with each other, two definitions of religion are applicable for my

study. The first is Mark Taylor's definition that helps put into perspective the uncertainty of religion. It does not mean uncertainty about religion as a set of beliefs, but uncertainty of the essence of religion:

> Religion is about a certain about. What religion is about, however, remains an (sic) obscure for it is never quite there -or is it exactly not there. Religion is about what is always slipping away. It is, therefore, impossible to grasp what religion is about -unless, perhaps, what we grasp is the impossibility of grasping. Even when we think we have it surrounded, religion eludes us. This strange slipping away is no mere disappearance but a withdrawal that allows appearance to appear. Though never here, what religion is about is not elsewhere. (as cited in Olson, 2003, p. 3)

Taylor's uncertainness about defining religion and pinning it down is the uncertainness that I believe haunts the fields of 'science' when it comes to religion. If religion cannot be pinned down, how can it meet the definition of science and be known in the same way that science wants to be epistemological? To help move into an area when we can look at science and religion on approximately the same level, I want to pull in Paul Connelly's (1996) definition of religion. Connelly provided the following definition:

> Religion originates in an attempt to represent and order beliefs, feelings, imaginings and actions that arise in response to direct experience of the sacred and the spiritual. As this attempt expands in its formulation and elaboration, it becomes a process that creates meaning for itself on a sustaining basis, in terms of both its originating experiences and its own continuing responses.

> The sacred is a mysterious manifestation of power and presence that is experienced as both primordial and transformative, inspiring awe and rapt attention. This is usually an event that represents a break or discontinuity from the ordinary, forcing a re-establishment or recalibration of perspective on the part of the experiencer, but it may also be something seemingly ordinary, repeated exposure to which gradually produces a perception of mysteriously cumulative significance out of proportion to the significance originally invested in it.
>
> The spiritual is a perception of the commonality of mindfulness in the world that shifts the boundaries between self and other, producing a sense of the union of purposes of self and other in confronting the existential questions of life, and providing a mediation of the challenge-response interaction between self and other, one and many, that underlies existential questions. (para. 5)

By using Connelly's definition of religion, I am able to separate out the sacred, which is the supernatural, from the spiritual, which is the faith aspect of religion. The sacred and supernatural are the explanation, the epistemological end to religion, while the spiritual and faith aspect is the being of religion and the ontological end of religion. This separation is needed, and by enacting it, I can now engage the sacred epistemology of religion with the epistemology of normal-science, to where there may or may not be conflict due to the use of a supernatural element in religion. The ontology of religion and the epistemology of science may interact, but are less likely to produce conflict and may indeed be even beneficial for an understanding between the two realms.

The Historical Interaction Between Science and Religion

The history of the interaction between science and religion is very long; however, it was not until the last several centuries that the interaction between them even existed. Prior to at least the late 1300s, science and religion were hardly considered to be inseparable from one another as constituting the same realm of knowledge (Barbour, 2001; Brooke, 1999; Draper, 1874; Plantinga, 2011). Science was not even considered to be the science of today. Until the Enlightenment and the time of Galileo before that, there was little contention between the field of what would become science and religion. The case of Galileo is generally seen as the first major point of contention between the two realms; however, the explanations behind the Galileo case can be seen as either a case against the conflict between science and religion as John William Draper had historically made or a case against the simple hierarchal power of the Roman Catholic Church and the papacy as John Hedley Brooke (1999) and Alvin Plantinga (2011) made.

John William Draper (1874) provided, by most accounts of historians of science, the original scathing report on what is perceived to be the historical conflict between science and religion in his *History of Conflict Between Religion and Science*. Draper set out what has been called by Brooke (1999) as the battle royal between post-Enlightenment science and the Roman Catholic Church. Draper's critique of religion is dramatically hostile towards the power yielded by the Roman Catholic Church, particularly on the doctrine of papal infallibility, almost to the point of some questioning whether or not his criticism is more anti-Catholic than anti-religious (Brooke, 1999; Plantinga, 2011). Draper (1874) went so far as to praise the influence of Protestantism on

the Enlightenment's scientific growth while showing nothing but utter disdain for the Roman Catholic Church's input:

> ...I have had little to say respecting the two great Christian confessions, the Protestant and Greek Churches. As to the latter, it has never, since the restoration of science, arrayed itself in opposition to the advancement of knowledge. On the contrary, it has always met it with welcome. It has observed a reverential attitude to truth, from whatever quarter it might come. Recognizing the apparent discrepancies between its interpretations of revealed truth and the discoveries of science, it has always expected that satisfactory explanations and reconciliations would ensue, and in this it has not been disappointed. It would have been well for modern civilization if the Roman Church had done the same. (p. 5)

> In speaking of Christianity, reference is generally made to the Roman Church, partly because its adherents compose the majority of Christendom, partly because its demands are the most pretentious, and partly because it has commonly sought to enforce those demands by the civil power. None of the Protestant Churches has ever occupied a position so imperious--none has ever had such widespread political influence. (p. 5)

Draper's conflict with the Roman Catholic Church was based largely on the reaction to the *encyclical Quanta cura* of 1864 in which the Roman Catholic Church established the doctrine of papal infallibility (Brooke, 1999). Draper interpreted the doctrine as granting the papacy authority over what knowledge is deemed true or *Truth*. While at the time,

Draper may have been correct in his views on the *encyclical Quanta cura*, as it stands today, the Roman Catholic Church under the papacies of John Paul II, Benedict XVI, and Francis have granted the widest berth to science in reference to current cosmological and evolutionary studies. John Paul II issued orders to Catholic theologians to study reconciling Catholic understandings of cosmology and evolution with their scientific counterparts taking the explanatory lead (His Holiness John Paul II, 1900; 1996). While Benedict XVI did not issue new calls for the expansion of scientific relation studies during his papacy, he neither countered nor revoked those established by John Paul II. The reigning pontiff, Pope Francis, has not engaged or directed the Vatican to issue statements regarding interpretations of worldly science activities beyond continued investigation into global climate change and is not likely to do so given the seemingly resolved nature of relations between the Catholic church and normal-science under John Paul II.

The general lack of unified leadership among Protestant churches during the 19th and 20th centuries saved them from Draper's scathing. Today, there is still no Protestant entity that rivals the scope and reach of the Roman Catholic Church; however, most Protestant denominations do take some policy stand on how they interact with science. According to the National Center for Science Education, statements supporting the teaching of science in U.S. schools regarding explanations of the natural world have been issued by the Roman Catholic Church, the United Methodist Church, Presbyterian Church - USA, the Episcopal Church, and Lutheran World Federation/Evangelical Lutheran Church in America (National Center for Science Education, 2012). Noticeably absent from this denominational support is the second largest group of denominations in

the United States, the Baptists (Southern Baptist Convention, Cooperative Baptist Fellowship, and the American Baptist Fellowship). Of the Baptists, only the Southern Baptist has issued a statement against accepting scientific explanations of the natural world. Thus on the surface analysis, the majority of Americans belong to a religious affiliation that accepts a scientific worldview (Pew Forum on Religion and Public Life, 2007). There is obviously a level of disconnect within the general American population between science and religious views, and this disconnect is often seen in the science classroom. These disconnects, apparent from my years as a high science teacher, present in the form of students being completely resistant to lessons on cosmology, evolution, and geology despite statements of agreement from denominations and affiliations with which they profess to be in association.

Classic Categorizations of the Science-Religion Interaction

What emerges from reflecting on Draper, Brooke, Plantinga, and others is that there is absolutely no singular way to characterize the relationship between science and religion. From what could be called the beginning of inquiry with the classic Greek tradition, to the dominance of Christian thought to the beginning of the Enlightenment, the relationship of the two, or one unified area between science and religion was non-divisive. Both, if they were capable of being viewed separately, complimented each other. Starting with the Galileo incident onward, Enlightenment science and religion parted ways, though members of the Christian community, both Roman Catholic and Protestant, often still performed both. During the late 19th century, any remaining illusions of a sympathetic relationship dissolved with the bitter, though not sound, verbal vitriol surrounding Darwin's development of a theory of evolution via natural selection.

For the first time, Protestantism was found in the midst of the miscommunication of ideas surrounding Darwinist evolutionary theory and what some implied to be its effects on Christianity (Brooke, 1999; Plantinga, 2011).

For the last century or so, there has not been one dominant path to chart how science and religion interact with each other. Ian Barbour (2001), in *When Science Meets Religion: Enemies, Strangers, or Partners*, put forth four of the prevalent courses: conflict, independence, dialogue, and integration. Barbour's four routes seem relatively self-explanatory in terms of their everyday language, but there are several technical details that should be laid out so that his paths can be easily understood and used as a schema for later research. Conflict is often regarded as the most likely state between science and religion (Barbour, 2001; Draper, 1874; Plantinga, 2011), especially in the current climate of perceived hostilities between biblical literalist and science; however, much of this perceived conflict is due to what Barbour attributed as increased media coverage. Conflict and strife are interesting for media, while cooperation gains minimal coverage (Barbour, 2001). Conflict has a strong history with science and religion, most notably detailed and encouraged, correctly or incorrectly, by Draper's *History of Conflict between Religion and Science* (Draper, 1874; Evans & Evans, 2008). The definitive sides in the conflict course are between scientific materialism and biblical literalism. In a more social jargon, this conflict occurs between the 'New Atheists' and Christian fundamentalists. I distinguish New Atheist from atheist in their aggressive attitudes and attack on religion. This separation is brought about by Richard Rorty (2010) where New Atheists have substituted a religious belief of science for religion. The most well-known New Atheists who gather most of the media attention are Richard Dawkins, Daniel

Dennett, and the late Christopher Hitchens. There are others such as Peter Atkins and E.O. Wilson, but they are less the public face of New Atheism, a garner much less attention, and engage in a much more civil debate of conflict with religion, particularly Christianity. The New Atheists hold that scientific materialism is the only way to attain accurate knowledge by utilizing the scientific method. Those who are scientific materialists "believe that all phenomena will eventually be explained in terms of the actions of material components, which are the only effective cause in the world" (Barbour, 2001, p. 11). Opposed to the scientific materialists in conflict are those who espouse a mindset of biblical literalism; this group is most commonly identified in the United States as Christian fundamentalist (Barbour, 2001). I want to state that I by no means equate Christian fundamentalist with Christian extremist, as they are entirely different entities. Biblical literalist and Christian fundamentalist are not mutually exclusive terms, but they both hold that scripture is inerrant throughout. Groups in the United States that adhere to biblical literalism are some of the major denominations that have not issued statements supporting science education; the Southern Baptist Convention has gone so far as to issue a counter statement in support of the teaching of creationism in the science classroom (Scientific Creationism).

Due to the perceived history of conflict by students and the general public between science and religion, it is not hard to see why parties on both sides prefer to view both of the realms as independent of each other (Barbour, 2001; Plantinga, 2011). Barbour classified the independence of science and religion as falling along two possible paths: separate domains and differing languages and functions. I understand the reasoning for both of these and there was a time where I was completely open to the idea

of science and religion being in separate domains from each other. This view was popularized by prominent evolutionary scientist Stephen J. Gould (1997) through his idea of non-overlapping magisteria (NOMA). Gould (1997) argued that both science and religion are domains unto themselves; however, they do on many occasions, bump into each other or share a boundary. Barbour (2001) elaborated on Gould's non-overlapping magisteria and made plain that "the magesterium of science covers the empirical realm: what is the universe made of [fact] and why does it work this way [theory]. The magisterium of religion extends over questions of ultimate meaning and moral value" (p. 100).

While Gould popularized the notion of non-overlapping magisteria, the National Academy of Science had already hinted at the same in 1984 when they published programs for high school biology courses noting the separation between science and religion: "Religion and science are separate and mutually exclusive realms of human thought whose presentation in the same context leads to misunderstanding of both scientific theory and religious belief" (as cited in Barbour, 2001, p. 99). The second path that Barbour created is that science and religion operate under different languages. Scientific language is for prediction and control and religious language elicits certain attitudes and encourages specific moral principles. I find that the split between these separate domains, or non-overlapping magisteria as Gould (1997) called them, and differing languages are two different classifications, but essentially the same argument in support of science and religion being independent from each other. There is a potential to say that independence promotes the separation of science and religion from having conversations with each other. This is a possibility, but I think viewing science and

religion as separate domains does not mean that they cannot communicate on a variety of issues; it is just that they do not seek the same type of understanding using the explanations of each other to justify and explain their findings and worldviews.

Although independence of science and religion does not mean they do not communicate with each other, it does not preclude the possibility that they may. When science and religion are used to inform each other outside of their own domain, Barbour (2001) said dialogue takes place. Dialogue can develop in several ways: "Dialogue may arise from the presuppositions of the scientific enterprise, or from exploring similarities between the methods of science and those of religion, or from analyzing the concepts in one field that are analogous to those in the other" (Barbour, 2001, p. 23). Science and religion do not have the same pursuits of knowledge, but that does not mean that they cannot attempt to be known in the same fashion through similar methodological considerations. Even the concept of science has changed over time. Barbour pointed to Thomas Kuhn's *The Structures of Scientific Revolutions* (1970) as changing the way science has been widely perceived from a monolithic unit to a shift in paradigms over its history. Religion, going back to its ontological nature, is not something that can be empirically tested like the epistemological knowledge of science. Religion is about beliefs and personal experiences, but scientist and theologian John Polkinghorne spent the better part of a career progressing a dialogue between the two. Polkinghorne, along with Barbour, has been one of the leaders in engaging Christian theology with science and providing well-reasoned arguments against both scientific materialists and biblical literalists. Polkinghorne (2000, 2006) said that while science cannot provide all the truths

of the universe, it can provide some of them and it is unwise for theologians and religion to either ignore or discredit the insights that science has and will continue to provide.

Polkinghorne and Barbour led from dialogue into integration as a relationship between science and religion. The distinction between the two is perhaps the most difficult to make, even by Barbour, who was ultimately unsure where dialogue actually ends and integration ultimately begins. Barbour provided three possible delineations of integration between science and religion: natural theology, theology of nature, and systematic synthesis. When science seems to lead the way towards integration with religion, Christianity or other, the result is natural theology. Natural theology is based on scientific data that finds itself in agreement with religious theology despite cultural differences (Barbour, 2001). Natural theology is not necessarily exclusive to Christianity; it is easily applied to any of the Abrahamic faiths. Natural theology should not be confused with naturalism, which is the philosophical belief that the world operates according to the laws of nature with no reference to a supernatural being or force. While natural theology starts from the scientific side of the relationship, a theology of nature starts from being based in a religious tradition that Barbour said is grounded in religious experience and historical revelation. "Theological doctrines must be consistent with scientific evidence even if they are not directly implied by current scientific theories" (Barbour, 2001, p. 31). Consistency is the key here; it is not necessary for scientific evidence to directly support the theological doctrine, just that it not counteract the doctrine. The words of Pope John Paul II have often been used to support the development of a theology of nature: "Science can purify religion from error and superstition; religion can purify science from idolatry and false absolutes. Each can draw

the other into a wider world, a world in which both can flourish" (His Holiness John Paul II, 1990, para. 29).

Different from both natural theology and theology of nature is systematic synthesis, in which science and religion work together to establish metaphysics for reflection between science and religion (Barbour, 2001). A systematic synthesis of science and religion takes place by integration of process philosophy where the components of reality are not "two kinds of enduring entity (mind/matter dualism) or one kind of enduring entity (materialism), but one kind of event with two aspects or phases" (Barbour, 2001, p. 35). In process philosophy, God is the source of all things, harking back to Thomas Aquinas's primary precepts from the *Summa Theologica* (1947); however, the process of creation is an incomplete process whereby God has created, but the creation is capable of continual self-creation. This self-creation allows for individuality and freedom with the creation that was begun. God is capable of interacting in the world but is never the sole cause of events. The events that occur are products of two things: the entity's past and its actions in the world via science and of God's via religion. Barbour (2001) made a very important claim that with process philosophy there is "never a succession of purely natural events interrupted by gaps where God alone operates" (p. 35). Barbour's statement is important because it addresses the claim of the 'God of the gap's' theory by Intelligent Design proponents, who are essentially creationists in disguise, and signifies that process philosophy remains true to the integration of science and religion and not the domination of religion over science.

Clarifying Narrative

The word ‘narrative’ is potentially confusing depending on usage. This necessitates that I detail how I mean to use it by its various definitions according to context. Traditionally, the word ‘narrative’ has referenced the style, or genre, of a story, as in a work of fiction, but narrative in qualitative research always refers to story that is produced through research, such as with interviews (Avraamidou & Osborne, 2009; Norris et al., 2005; Phillips, 1994; Seidman, 2013). Throughout my methods investigation, both ways came and went from my mind, sometimes being clearly established and at other times seeming extraordinarily vague. I did not know which meaning was to be used or if both should be used at the same time. It is possible that this narrative meaning conflict is only an issue that one would encounter if he/she experience with quantitative science research methods instead of content literacy education and qualitative methods. Norris, Guilbert, Smith, Hakimelahi, and Phillips (2005) and Avraamidou and Osborne (2009) spoke of narrative as a fictional style of literature when theorizing on the use of narrative as an explanation for scientific concepts.

Science traditionally uses expository and informational texts in the form of textbooks for the transmission of most concepts; however, these texts are often not engaging or easily accessible for K-12 students (Avraamidou & Osborne, 2005; Wellington & Osborne, 2001). Despite the preponderance of expository and informational text in science education, there also exist three other forms that are much more accessible to students: argumentative text, narrative text, and a mixture of narrative and expository text (Avraamidou & Osborne, 2005). In my classroom experience, narrative in science is either manifested through journal interviews with science

participants or science fiction. While these narratives are useful and more easily accessible to students than expository text, I have been drawn to the mixture of narrative and expository text because of its growing prominence in popularized scientific literature that attempts to "communicate elite science to non-scientists in non-technical languages and media" (Allan, 2009, p. 248). There are several texts that successfully combine narrative and exposition in a hybrid format: Bill Bryson's *A Short History of Nearly Everything* (2004), Bryson's *A Really Short History of Nearly Everything* (2009), and Alan Lightman's *Mr. g: A Novel About the Creation* (2012). Bryson covered cosmology, evolution, geology, chemistry, particle and theoretical physics, electromagnetism, biology, medicine, and astronomy, which, while done very well and easily accessible in his conversational format, is just too large a span of content to realistically cover for single usage in this study. Lightman's *Mr. g: A Novel About the Creation*, is a much shorter narrative-expository hybrid text and is written in an accessible style with Lexile analyzer scores of various passages ranging from 870L to 1250L (MetaMetrics, 2013). The Lexile scores at these levels are significant as they fall within the increased Lexile levels proposed by 2012 Common Core Standards Text Measures and place *Mr. g: A Novel About the Creation* as accessible to an audience between 8th and 12th grades (National Governs Association Center for Best Practices and the Council of Chief State School Officers, 2012).

Narrative as the Product of Method

Jerome Bruner (1986) said that there are two primary ways in which people make sense of their experiences: paradigmatic and narrative. Paradigmatic organization of experience is the logico-scientific way of organizing knowledge based on reason, while

narrative is done through story creation (Avraamidou & Osborne, 2009; Bruner, 1986). Narrative, as a method of storytelling, has a long-standing tradition throughout recorded human history of methods that society and individuals use to pass down information from one generation to the next. Stories are used as an everyday convention to pass along information; the forms differ between books, radio, movies, television, and the Internet, but the purpose of stories as a method of knowledge generation is the same (Schank & Berman, 2002). A story is a "structured, coherent retelling of an experience or a fiction account of an experience...and that in some sense, all stories can be considered didactic in nature, in that they are intended to teach or convey something to the listener" or reader (Schank & Berman, 2002, p. 228). Schank and Berman addressed my stated confusion as an outsider towards what I perceived as the dual usages of narrative, in fact to be differing sides of the same concept.

The issue of narrative as a qualitative research method is validated if understanding can be formulated through the use of narrative (King & Hoorocks, 2012; Seidman, 2013). Built on Mishler's argument, King and Hoorocks (2012) stated that through telling stories via narration, especially when prompted by qualitative interviewing, "people express their understanding of events and experiences" (Kindle loc. 4599). Narrative, either produced by qualitative interviewing or simple conversational storytelling, is a primary way of knowing that directly corresponds with how people make sense of the experiences in their lives and how they learn (Hatch & Wisniewski, 1995; King & Hoorocks, 2012; Riessman, 1993). What arises from narrative is meaningful to each individual, but is what is being told a *truthful* statement of the events and experiences that they either have observed or have heard about? King and Hoorocks,

and most social researchers, me included, must address this issue when contemplating the use of narrative. What it is reduced to is an individual's view on reality. Is one an interpretivist/constructivist or realist? Participants may not even be aware of their own theory of knowledge, but they ultimately at some level subscribe to one. Participants' narrative account of an event may not be the same as those that occur in a realist sense.

Phillips (1994), a constructivist and distinguished research professor emeritus at Stanford in philosophy methodological issues in social science research, detailed seven potential objections with narrative research, all of which should be addressed when using narrative as a portion of one's method:

- Are things like adequacy, plausibility, and an engaging plot themselves adequate criteria for judging narrative explanations or accounts? (p. 17)
- It is clear that many rival narratives can be devised to account for a given action, just as in the natural sciences, many rival hypotheses can be invented to account for any finite body of data. (p.17)
- It does seem adequate to say that such important narratives are acceptable if they have an enticing plot or if they are well-formed or coherent. The point is that a narrative can have these features and still not be true. (p. 18)
- Supporters of narrative inquiry have said that a narrative must have verisimilitude, in the sense that it must have 'the appearance of truth or reality' (Polkinghorne, 1998, p. 176). In light of the aforementioned argument, it should be clear that this will not do, because a false story can appear to be true. (p. 18)

- A person may produce a narrative that he or she genuinely believes to be true, and which he or she believes can explain some action that this person has recently performed. In other words, the narrator might not be lying. (p. 19)
- As previously mentioned, it is naive to assume that narratives are always explanatory in purpose or that they are primarily directed at giving a true account of the event or phenomena they have as their subject. (p. 20)
- Earlier in my discussion, I strove to be fair in summarizing the range or epistemological points that have been made by supporters about narratives and narrative inquiry in the educational research literature. It is striking, however, that on such an important matter -- the status of narrative as a knowledge-bearing or explanation-giving genre -- the supporting arguments turned out to be so scanty. (p. 20)

Phillips' (1994) defense for his point regarding adequacy, plausibility and plot for a narrative was to use the example of how "present day-racists convince many about the reasonableness of their narratives" (p. 17). Without sounding cynical or demeaning of his point, when it comes to relying on a racist's reasonableness to critique a method it is not an effective means of determining the truthfulness of a research method. The reasonableness of racists' narratives would be exactly what a social science research investigating the nature of racism would seek to find, thus narrative would be a useful method for research.

Phillips' second point is that there can be many narratives produced for a given action. He countered his own supposed objection saying that natural science can form many hypotheses for the same given action. Here, it seems, that he himself was not

convinced that this was an objection to narrative. Given his support for constructivism over interpretivism, he was accepting of this point of narrative as a method tool. It is also important to make the distinction that narrative is not being used to produce positivistic knowledge; it is not capable of that and would also be a contradiction to positivistic epistemology since its nature is one of objectivity over subjectivity. Phillips' third point is perhaps the easiest to understand and also the most serious for social science researchers to explore; some narratives could simply be false, if not blatant lies. Social science researchers, when using interview or narrative, must be conscious of the possibility of untruths (misleading information, fantasy, etc.) and for potential identifiers in participants' responses that are inconsistent with behaviors or prior responses (King & Hoorocks, 2012; Patton, 2001; Seidman, 2013). Phillips denounced Polkinghorne's argument of narrative verisimilitude, or the appearance of truth or reality, because even false stories can have the appearance of *truth* or reality. A social science researcher must return to the purpose of the narrative and the investigation to address this issue. If a participant produces a narrative or interview response where they honestly believe that they are stating their truth, but not objective truth, is this an issue for a social science researcher? By embracing Dilthey's naïve and methodic hermeneutic with influences from Gadamer's and the pragmatic rejections of absolute truth, I moved on to each participant's personal experience of his/her own truth. Objective truth is not the concern of interview and narrative method in an interpretivist paradigm since it is founded upon experience (Crotty, 1998). What the participant honestly believes, whether he/she realizes it is false, is the purpose of using narrative to make meaning in social science research. Whether or not the religious learner understands a science concept as

acceptance of an objectivist theory of knowledge is not what is being sought. What concerns me are the questions that participants generate and answer in this process and how those questions form their understanding of the objectivist theory of normal-science content knowledge.

Phillips' last two concerns with the use of narrative in assessing research are the easiest to address to a satisfactory conclusion. Phillips cautioned that narrative does not have to be explanatory. For my research, two narratives will be used. One, *Mr. g: A Novel About The Creation* is already generated and is an explanatory (expository) narrative as defined by Norris et al. (2005) and Avraamidou and Osborne (2009). The second narrative, produced as a result of the participant interviews according to Seidman's (2013) multiple interview approach, yielded another explanatory narrative as to how participants experience understanding of a normal-science concept from the position of a religious learner. The last of Phillips' concerns about the use of narrative was that there had not been enough research into the use of narrative as a method practice at the time of his critique. Considering that was in 1994 and during the height of the quantitative/qualitative wars, it is not surprising that a researcher of the constructivism paradigm was searching for some middle ground foothold between positivism/empiricism and interpretivism without whole-heartedly denouncing either. Twenty years later, narrative as a method practice has become more nuanced and is supported by a vast field of research, much more than can be completely covered here, but with enough foundation laid to justify the use of narrative as a research method. Continuing through the explanation and usage of narrative, Phillips' points stay relevant and energize the social

science researcher into striving for truthfulness, the qualitative research equivalent to validity.

Narrative explanation has been explored as a potential source for use in science education and thus in improving science literacy as far back as the 1950s. At the time, Nash (1950) stated that the explanation of scientific concepts through stories could assist students in "recapturing the experience of those who participated in exciting events" that involved science (p. 3). The role of narrative in explaining science has not always been favored by science educators due to the prevalence of the constructivist paradigm. Narrative can benefit science education and science literacy since one of the strengths of narrative use (explanatory literature) is that it constructs a story using interrelated sets of ideas. Science education often focuses on ideas by themselves, thus missing overarching themes that bind science concepts together (Norris et al., 2005). In using Lightman's *Mr. g: A Novel About the Creation,* written by a theoretical physicist, the large over-arching themes in cosmology, astronomy, and some hints of biological evolution are present, thus creating the big picture of the natural sciences. Important to this use of narrative (explanatory literature) in science education is the understanding of the narrative effect. According to Norris et al. (2005), narrative effect is the improvement of "memory for content, enhanced interest in learning, and greater comprehension of what is learned" (p. 552). Research in narrative usage has shown that comprehension is better in terms of understanding and retention when compared to strictly expository texts, such as standard classroom science textbooks, and that expository narrative increases the communicability of information that is presented in the texts, specifically in science-related fields (Graesser, Hauft-Smith, Cohen, & Pyles, 1980; Norris et al., 2005; Voss, Wiley, &

Sandak, 1999). From classroom experiences using selections from Bryson's *A Brief History of Nearly Everything* (2004) and Michael Pollan's *The Botany of Desire: A Plant's Eye View of the World* (2001), I can also confirm that my students, particularly the academically lower-performing students, applied themselves more successfully when using expository-narrative science texts versus expository or informational texts (Zabrucky & Moore, 1999). Zabrucky and Moore were further supported by Williams (2000) findings that students remember and comprehend content better out of narrative literature text than from textbooks. Avraamidou and Osborne (2009) found an explanation for this possible ease from Taylor (1982) because "expository texts are usually 'organized according to a hierarchical pattern of main ideas and supporting details' while narrative texts are usually 'organized according to a sequential pattern of events that follows the conventions of a story grammar'" (as cited in Avraamidou & Osborne, 2009, p. 1694). This reconnects with the difference that Bruner (1986) stated between paradigmatic and narrative ways of organizing knowledge.

When using narrative in science, one area that becomes questionable is how to appropriately address the technical language and difficult vocabulary found in scientific fields. Avraamidou and Osborne (2009) found that science has a distinctly complex grammar particular to its genre and that highly nominalized vocabulary is not particularly adaptable to the features of narrative (p. 1687). Using expository-narrative texts, especially well written ones that are scientifically accurate in their content, is the link between using narrative, traditional science fiction, and expository texts to becoming something more than just science fiction or expository non-fiction. "The gap between everyday narrative speech and scientific explanation and argumentation, he [Klein

(2006)] argues, is mediated by science literacy education through the use of various activities that combine talk and writing," said Avraamidou and Osborne (2009, p.1701). Noel Gough (1993), Australian social science researcher and environmental educator, argued as far back as 20 years ago that science education should embrace the use of narrative in assisting students in grasping scientific concepts because science fiction texts contained better representations of science than the expository textbooks used at that time. As a former high school science educator who never liked using only expository or informational texts with my applied level students, or even my college preparatory classes, having better access to expository-narrative science texts would have been highly beneficial to my students.

Contextualization of Self, Author, and Participant

Hermeneutics is the art and science of looking at a text to garner meaning. It is significant to recognize that not all texts are identified as words on a page. In hermeneutically-based research, specifically in what I will refer to as the intersubjective hermeneutic paradigm, text is not relegated to just the words on a page. I posit here that even a person may be considered a text that is to be read, interpreted, and understood. As the researcher, how I am positioned must be known to those that seek to interpret this research, beyond myself, there are also other tools in this study that must be positioned to frame this study properly. Both the text, *Mr. g: A Novel About the Creation* (2011) and the texts author, Alan Lightman, must be positioned in their contexts of relevance to this study. These positions of these three additional texts, the researcher, the novel, and the novel's author, are included in the literature review under the connection that they are

significant and contain valuable information that must be acknowledged by the studies' future readers to form their own interpretations about the research conducted.

The Researcher as a Text. As a text, I am capable of being read just like a novel. As there will be readers of this study that do not know me or my history, my lifeworld and my position need to be laid out to allow for them to be able to more fully understand the subjectivities that have framed my interpretation of the participants. The most apparent subjectivity that must be owned is that this research would not be occurring were it not for my personal interest in the subject matter (Roulston, 2010). Normal-science and religion have both played significant roles in my lifeworld experiences and are intricately interwoven throughout my being. Without addressing these particulars, my philosophical and theoretical lens being applied in this research would not be transparent.

I grew up in a family in which participation in a weekly religious service was expected. This practice was in line with the dominant culture of my locality and state: we attended weekly services at a local United Methodist Church. I grew up attending Sunday school and was confirmed into my local church at the age of 11. While involved in weekly worship, I was never involved in the youth group or weekly activities.

There was never an intersection of religion and science in my educational life until I was warned in high school that some of the subject material we would be taught might contradict what we may have learned outside of the school setting. This took place in a biology class and, while it was being taught at the honors level, the school I attended was in a very socially-conservative district. Fast forward to the later and more recent portions of my life when I earned a degree in biological sciences and taught for several years in

public high schools throughout a Southern state. While teaching, I encountered varying attitudes towards science from persons of different Christian faiths, but I often was unprepared for the strong negative attitudes towards biological evolution. These negative attitudes often caused me to devalue religious beliefs in the classroom and suggest that students simply (though not a simple act at all) separate their religious and scientific understandings. While both my students and I referred to us as Christians religiously, my mind had been opened to the ideas of the boundaries of normal-science and religion and had a greater exposure to my denominations and church positions through personal interest in denominational differences and practices. By looking past what the students valued, whether I shared those values or not, I could not hope to understand how they perceive scientific knowledge.

Due to my predisposition to look past any potential conflict between religious beliefs and scientific understanding, I may be more susceptible to overlook what I would deem an insignificant comment, thus needing to review transcriptions with a more critical eye for conflicts. This apparent openness to both scientific and religious differences must be looked at critically when analyzing transcripts and kept in the foreground of the research process and when addressing my theoretical framework.

My current church membership is with a church that is a member of the Evangelical Lutheran Church in America. While this is a distinctly different Christian denomination than the United Methodist Church in which I grew up, they do share in the practice of full communion; through full communion, both denominations accept and respect the theological differences that may exist between them and do not allow these differences to define their relationship. This idea of full communion among Christian

churches has always been present in my individual position of being open and communicative with whatever positions other individuals present.

The Novel and Author as Text. *Mr. g: A Novel About the Creation* (2012) by Alan Lightman is best classified as a fictional account of a possible creation of a universe that is written in the style of an expository-narrative text. The novel details a hypothetical explanation for the creation of a universe, not necessarily *the* Universe, that is built upon currently understood normal-science views on cosmology. Beyond dealing with an exclusively normal-science explanation of a universe, the novel presents a case for how morality, religion, and philosophy could come about through the idea of a creating entity. A key distinction in positioning the novel is that even though the character of Mr. g is recounting how or why he may have created a universe, the details of the universe are shown as being able to have originated without any explanatory entity behind them. I view this distinction as being relevant in that the novel was created in a way that could allow for either a reader who does not believe in the requirement of a supernatural creator or for one that does believe a supernatural creator is responsible for the creation of a/the universe. While the novel details normal-science principles in accurate correctness, it leaves open the interpretation of morality, religion, or philosophy and is generic enough in context to be received by a vast swath of potential readers.

Alan Lightman has authored 14 published books: seven fictional novelizations and seven non-fiction texts. Lightman has numerous normal-science research publications and holds a doctorate in theoretical physics from the California Institute of Technology. Having been an avid writer during his youth and young adult years, he began publishing popular science essays in the early 1980's appearing in *The Atlantic*

Monthly, *Nature*, *Smithsonian*, *Science*, *The New Yorker*, *World Monitor* and other widely-distributed periodicals. He has social science research publications on science education matters in *The American Scholar*, *Science*, *The Science Teacher*, and *Social Studies of Science*. In 1990, he chaired the science panel for the National Academy of Sciences Astronomy and Astrophysics Survey Committee. Lightman is currently holding a dually-appointed position at the Massachusetts Institute of Technology as professor of science and writing and as a senior lecturer in physics (Massachusetts Institute of Technology, 2014).

Theoretical Framework

Differentiation of Hermeneutic Paradigms

The origin of the term hermeneutics may be traced back to the Greek deity Hermes, who was a god and was responsible for delivering messages between the different gods and to humans. Following the actions of Hermes, hermeneutics is the practice of meaning making or interpreting. Hermes took what was given to him and gave it to another. He could also be said to have interpreted the information when relaying it from its originator to whom it was intended. There is a long history of hermeneutics for use as an interpretive aide beginning with Augustine of Hippo nearly 1700 years ago. Today the usage of the term hermeneutics is generally indicative of one of three possible paradigms: biblical hermeneutics, objective hermeneutics, and intersubjective hermeneutics (McLean, 2012; Palmer, 1969; Porter & Robinson, 2011; Reichertz, 2004, Thiselton, 2009). Each of the hermeneutic paradigms will be described for their general uses so that a better discernment may be made in understanding the diverse range of hermeneutics-based research.

Biblical Hermeneutics. The paradigm of biblical hermeneutics originated with the works of Augustine of Hippo in the 4th century and continues today as required coursework in many seminaries of Christian training. In biblical hermeneutics, or exegesis as it is more commonly referred, a sacred text needs to be interpreted as it is viewed to be divinely inspired from the Christian god. God may speak directly to an individual to inspire the formation of a sacred text, or the Holy Spirit may guide an individual to craft a text that would be deemed sacred. Biblical hermeneutics as a paradigm of hermeneutic activity has, at its core, the Bible, or other sacred text, and while maintaining this basis of its work, Biblical hermeneutics has been influenced by the developments of the other hermeneutic paradigms, particularly the intersubjective hermeneutic paradigm (Osborne, 2006; Porter & Robinson, 2011; Thiselton, 2009)

Objective Hermeneutics. The hermeneutics of the objective hermeneutics paradigm refers to what Reichertz (2004) called the "complex theoretical, methodological, and operational concepts" (p. 570) that emerged from the work of Ulrich Oevermann. Oevermann's objective hermeneutics "claims to be the fundamental method of investigation for every kind of sociological research" (Reichertz, 2004, p. 570). Objective hermeneutics of this paradigm claim that there is a singular method that is appropriate for the social sciences and attempts to do for social science research what positivism did for natural and physical science research. The guiding principles of Oevermann's objective hermeneutics are the identification and the reconstruction of the structures that form a text. Oevermann said of objective hermeneutics:

> Since objective hermeneutics, irrespective of what concrete object it has to analyze, is always primarily directed at the reconstruction of the latent sense

> structures or objective meaning structures of those expressive forms in which the object of investigation or the question under study is authentically embodied, one can require the same degree of objectivity of its findings or the assessment of their applicability as that which is taken for granted in the natural sciences. This is simply because the meaning structures which are to be reconstructed can be ascertained by means of fundamentally definable rules and mechanisms of a basic algorithmic structure in a precisely testable and complete way in a protocol that is accessible at all times. (as cited in Reichertz, 2004, pp. 571)

Oevermann's objective hermeneutics is not to be confused with Dilthey's efforts to establish an objective method of hermeneutics. For Oevermann's objective hermeneutics, there is a singular method, methodology, and philosophy present. Dilthey sought to clarify a method of hermeneutics, but not establish one unifying method meant to provide truth statements. Dilthey's hermeneutics are objective only in the sense that it first sought to provide a structure for Schleiermacher's hermeneutics. Dilthey's hermeneutics are situated in the intersubjective hermeneutic paradigm and reject the structure and totality of Oevermann's objective hermeneutics.

Intersubjective Hermeneutics. The hermeneutics of the intersubjective hermeneutic paradigm are the hermeneutics that most likely come to mind when a social science research hears the term hermeneutics and it is not in the context of Biblical hermeneutics. The intersubjective hermeneutic paradigm situates itself by pulling on the concept of intersubjectivity. Thiselton (2009) said "the interpreter of texts is not a neutral observer, on the analogy of the suppose stance of the natural scientist or empiricist. Understanding in the fullest sense demands engagement and self-involvement" (p. 8). Of

the intersubjective paradigm, Porter & Robinson (2011) claimed hermeneutics as an attempt to "question by examining closely the hidden realm of activity behind the scenes of our lives" by making explicit the presence or absence of structure (Kindle loc. 157). They went on to say, "hermeneutics is successful only to the degree that it is able to include as much of what makes us human as possible, e.g., our social, historical, linguistic, theological, and biological influences" (Porter & Robinson, 2011, Kindle loc. 166). It is the social, historical, and theological influence that this study sought access to examine in the participants. In these influences, intersubjective hermeneutics succeeds in looking upon the "inherent ambiguity and otherness that we face daily, and is used to foster a common accord when there is misunderstanding or lack of agreement" (Porter & Robinson, 2011, Kindle loc. 190).

Hermeneutics as practiced by the intersubjective paradigm does not provide a fixed meaning for any text and does not provide 'truth' as such in that the paradigm does not recognize the fixed existence of truth (Dilthey & Makkreel, 2010; Gadamer, 2004b; Porter & Robinson, 2011, Thiselton, 2009). Unlike the objective hermeneutic paradigm of Oevermann, there is no unified methodology or method in the intersubjective hermeneutic paradigm other than the acknowledgement of the presence of and in an intersubjective world. Within this intersubjective hermeneutic paradigm, there exists a multitude of hermeneutic possibilities: Schleiermacher's philological hermeneutics, Dilthey's naïve and methodic hermeneutic, Heidigger's hermeneutics as the phenomenology of *Dasien*, Gadamer's philosophical hermeneutics, Ricoeur's system of interpretive hermeneutics, and Habermas's critical hermeneutics. It is through the intersubjective hermeneutic paradigm that this study was conducted.

Hermeneutics for Interpreting Participants

In order to gain an understanding of how participants position themselves and engage normal-science and their religion, a method that produces narrative materials to investigate their individual experiences was required. The hermeneutical tradition established by Wilhelm Dilthey's line of philosophy in being able to determine the experiences of another assisted in providing a method to recreate participant experiences'. Important in this line of research is the role of the socially and historically conditioned context that does not begin to surface until hermeneutics arose out of Dilthey's contextualization of Schleiermacher's hermeneutics (Palmer, 1969).

Interpretation and understanding are the basis of hermeneutics, and up until Gadamer's efforts to reorganize them through his philosophical hermeneutics, they have undergone several conceptual changes through different philosophers. To simply say that one can use hermeneutics is to be confused, as there is not just one hermeneutics; there are three distinct hermeneutic paradigms, each with varying subdivision. Hermeneutics is an evolving philosophy, theory, and methodology, depending on what exactly one is doing and to what one is referring; however, at its most basic level, "hermeneutics refers to the many ways in which we may theorize about the nature of human interpretation, whether that means understanding books, works of art, architecture, verbal communication, or even nonverbal bodily gestures" (Porter & Robinson, 2011, Kindle loc. 152). Hermeneutics looks beyond what we see on the surface to what lies behind it to address what we think we know or understand, whether we know the structure of our understanding or the lack of the understanding (Dilthey & Makkreel, 2010; Palmer, 1969; Porter & Robinson, 2011). Porter and Robinson (2011), in their detailed history of

hermeneutics, laid out exactly what makes hermeneutics highly valuable for the realm of social science and particularly for the understanding of the perception of the relationship between science and religion:

> One of the unique claims of hermeneutics is that it goes beyond the biological, psychological, etc., because it looks at what makes all of them possible. Most importantly, hermeneutics tries to avoid reducing "understanding" to its lowest common denominator, e.g., describing it only in terms of specific neural networks working in specific electro-chemical ways within the brain. Hermeneutics is successful only to the degree that it is able to include as much of what makes us human as possible, e.g., our social, historical, linguistic, theological, and biological influences. (Kindle loc. 167)

While Porter and Robinson did not make direct reference to the natural sciences in their statement, I am going to take a bit of a liberty and extrapolate natural sciences from their inclusion of biological influences. They did not necessarily mean that hermeneutics can be used to understand the natural sciences, however, as previously stated numerous times before, since I am building a case for hermeneutics, it can be used to inform religion and theology. Although hermeneutics was initially a philosophical area and has since become a method of research, it can be applied to most subject areas. This is why one does not simply do hermeneutics. As social science researchers, we must be specific in what we mean by it and how we are going to use or do it.

For Dilthey, hermeneutics focused primarily on methods in using a naïve and methodic hermeneutic to rebuild a participants lifeworld. Under Schleiermacher, hermeneutics was seen as a way to avoid misunderstanding and through Dilthey as a way

of successfully obtaining knowledge (Dilthey & Makkreel, 2010; Palmer, 1969; Porter & Robinson, 2011). Gadamer explicitly denied hermeneutics an objective role in research, as he did not conform to the line of epistemological thought that objectivity is attainable, and even Dilthey's attempt to establish a method of hermeneutic approach, though not sought as the only method of approach, violated Gadamer's stance on objectivity. Both Schleiermacher's and Dilthey's hermeneutics attempted to lock a text into meaning, something that was unchanging depending on whomever was examining the text. Philosophical hermeneutics and normal-science are both comfortable with leaving unsolved questions; however normal-science is not comfortable with leaving open interpretation as Gadamer did with philosophical hermeneutics, thus Dilthey's hermeneutics becomes methodologically appropriate (Dilthey & Makkreel, 2010; Gadamer, 2004b; Palmer, 1969; Porter & Robinson, 2011). It is from Dilthey's hermeneutics that I frame a portion of this study.

The Dilthian hermeneutical line brought a new look to the actions of interpretation and understanding where interpretation and understanding were no longer divided into separate entities but existed as parts of the same action. Gadamer said that interpretation was a concurrent act that with understanding. According to Gadamer (2004b), "interpretation is not an occasional, post facto supplement to understanding: rather, understanding is always interpretation, and hence interpretation is the explicit form of understanding" (p. 306). Interpretation and understanding are concurrent acts. They always are present and they are always working. "To understand is not to project oneself into the text but to expose oneself to it; it is to receive a self enlarged by the appropriation of the proposed worlds which interpretation unfolds" (Ricoeur, 2005, p.

94). If interpretation and understanding were finite in their nature, then they would produce finite knowledge. Biblical hermeneutist Brian McClean (2012) summarized Gadamer's arguments in *Truth and Method* (2004b) as "all understanding is interpretation, and all interpretation takes place in the medium of a language which would allow the object to come into words and yet is at the same time the interpreter's own language" (p. 176). Beyond making philosophical hermeneutics different from previous ideas of traditional hermeneutics, and taking the path that transformed the space between the text and the interpreter, Gadamer proposed that language, the tool people use for everything at the most basic level, is what holds the key to how we understand and interpret. Habermas (2008) explained Gadamer's hermeneutics as:

> Philosophical hermeneutics is opposed to objectivistic approaches. It holds that the process of interpretation is guided by a pre-understanding that is not tested through observations of the behaviors of others like an empirical hypothesis, but is made explicit and corrected thought question and answers on the model of a dialogue with the second person. Partners in conversation move within the horizon of an already shared background understanding, even when they must first develop a shared language...the interpreter,...proceeds from the pragmatic supposition that the text to be interpreted can only have a clear meaning as the expression of a rational author....Gadamer's interpreter directs his attention simultaneously to the text and to the subject matter treated in it. One must first 'understand the content of what is said' before one can 'isolate and understand another's meaning as such.' (p. 65)

It is through language that Gadamer suggested we take a "good look, to see what is there" (Porter & Robinson, 2011, Kindle loc. 290). The distinguishing action between philosophical hermeneutics and the earlier ideas of objective hermeneutics is the use of language produced from an intersubjective world.

Questioning is what I believe was key to using Gadamer's philosophical hermeneutics successfully with the interpretations of the relationship between science and religion and the self-development of an understanding of scientifically valid interpretations of science content by a religious individual building on Dilthey's hermeneutic method. For Gadamer (2004b):

> A person who wants to understand must question what lies behind what is said. He must understand it as an answer to a question...Thus, the meaning of a sentence is relative to the question to which it is a reply, but that implies that its meaning necessarily exceeds what is said in it. (p. 363)

This simultaneous understanding and interpretation explained by Gadamer's hermeneutics and the bridge that is possible between the science text and the religious learner through Gadamer's concept of fusion of horizons would be extremely useful if not for the objective understanding of normal-science content that must be upheld for acceptance to science education standards. Gadamer (2004b) detailed this fusion of horizons as "the experience of becoming conscious simultaneously of the idiosyncratic nature of one's own perspective and the idiosyncratic nature of the perspective of text, with the result that both horizons are surpassed and exceeded" (p. 192). Jürgen Habermas (2008) who was both a supporter and critic of Gadamer's philosophic hermeneutics details the concept of fusion of horizons as:

> The presupposed objective of the world is so deeply intertwined with the intersubjectivity of reaching an understanding about something in the world that we cannot transcend this connection and escape the linguistically disclosed horizon of our intersubjectively shared lifeworld. However, this does not rule out communication across the divided between particular lifeworlds. We can reflexively transcend our respective hermeneutic starting points and reach intersubjectively shared views on disputed issues. Gadamer describes this as a 'fusion of horizons.' (p. 43)

The selection of Dilthey's hermeneutics over Gadamer's philosophical hermeneutics comes about, as philosophical hermeneutics does not hold that any text has a fixed meaning because it is situated in the tradition of each interpreter. The knowledge product of any research endeavor here will be epistemological in nature, but will certainly not be of the truth or absolutist nature of the positivists, neo-positivist, or 'science' in general. Gadamer and Dilthey do enter into an epistemological conflict here due to the nature of how each interpreted the ability of a text to be known apart from its author. Dilthey included the historical horizon of the author in his perspective, holding that the author's intent towards interpretation and understanding of content can be objectively established (Dilthey & Makkreel, 2010; Palmer, 1969). Gadamer altered the meaning of historical horizon to fit his philosophy. Dilthey's historical horizon lends better usage towards objectively identifying the content that an author puts forth in their writing. According to McClean (2012), for Gadamer, "the primary goal of hermeneutics is not the factual elucidation of the founding sense-event of a text but the discernment of practical wisdom for living in the present" (p. 196). While this reflects Gadamer's view of

hermeneutics, Dilthey's hermeneutics and its application hold that an accurate, yet perhaps not 'factual,' founding sense-event of the participant's normal-science and religion experience can be reproduced and interpreted. The ultimate benefit is that through having participants engage their normal-science and religious aspects, they may open up potential avenues for greater development in both their personal normal-science and religion understandings and experience a value growth.

A Defined Role of Religion

Through William James' work around pragmatic thought, I was led to Richard Rorty, who has a long and detailed relationship with how religion influences the lifeworld of individuals. In his earlier works, Rorty was often described by friend and fellow philosopher, Richard Bernstein (2010), to be "suffering from the God has failed syndrome" (p. 214). This was the Rorty that I was familiar with, so when I was exposed to a different relationship between normal-science, philosophy, and religion with James than I had been with Rorty, I was perplexed. For a time, I was confused as to how James saw no dispute between pragmatic (philosophy) thought and religion. James disagreed that pragmatism (philosophy) should abandon religion for empiricism, but he also felt strongly about religion without empirical philosophy. James did not see the either/or arguments as useful, nor was he particularly sympathetic to the conflict that he saw arising between science (empiricism) and religion, likely caused in part by John Draper's *History of Conflict Between Religion and Science* (1874). To James, philosophy, religion, and empirical science already have a complex relationship:

> You find an empirical philosophy that is not religious enough, and a religious philosophy that is not empirical enough for your purpose. If you look to the

> quarter where facts are most considered you find the whole tough-minded program in operation, and the 'conflict between science and religion' in full blast" (James, 1907, p. 6).

James saw that conflict resulted when the choice had to be made between empiricism and religion. To prevent the resulting conflict, which James viewed as unnecessary, he sought to maintain dialogue between normal-science and religion through philosophy. Everything to James from empiricism and philosophy to religion had its place in life, but none of these areas was absolute or above any other. He said, "Common sense is better for one sphere of life, science for another, philosophic criticism for a third; but whether either be truer absolutely, Heaven only knows" (James, 1907, p. 82). Through James's ideas, religion can maintain its place of importance in the higher-level discussions of philosophy and meaning with normal-science. For much of the next century, despite James efforts, conflict resulted, or at least the myth of conflict was more highly perpetuated, as existing between normal-science, religion, and philosophy.

Richard Rorty once sought to remove religion from the discourse as productive in higher-level dialogues. During his latter years, Rorty opened up to inviting religion back into the discourse with normal-science and philosophy, however, it was a different type of religion, a private religion that Rorty called 'weak thought' (Rorty, 2010). It was not necessarily the same institutionalized form of religion that Christianity had previously existed as and that has dominated during the past two millennia. This privatized religion could retain aspects of institutionalized religion since it was as James (1907) said, up to the individual: "You see that pragmatism can be called religious, if you allow that religion can be pluralistic or merely melioristic in type. But whether you will finally put

up with that type of religion or not is a question that only you yourself can decide" (p. 132).

Through finding James' openness to the possibilities of religion, it was a short distance to arrive at Rorty and his growing influence in returning religion into the larger discourse. Rorty, Richard Bernstein, and Hillary Putnam, are the modern 'philosophers,' though they all dislike the term, and they all carried pragmatism into the new century. Rorty, more than any of the others, has carried on James's work with religion than either Bernstein or Putnam, thus he was my selection to follow his 'conversations' with my own research. Rorty, much to the surprise of many in his community, has come around from when Bernstein diagnosed him as suffering from the 'God has failed syndrome' to being fully engaged in an open conversation with those receptive in the religious community. Thus, Rorty's philosophical and religious discussions served to greatly inform my framework by incorporating hermeneutics. To Rorty (2009), "hermeneutics is not 'another way of knowing' - 'understanding' as opposed to (predictive) 'explanation.' It is better seen as another way of coping" (p. 356). Hermeneutics is his preferred method of dialogue, which to Rorty, can make conversation possible between almost any various discourses regardless of whether or not there is some sort of matrix that already exists to bind the speakers together in some form. As long as the conversations between the discourses are ongoing, there exists the potential for agreement at best, or productive disagreement and the hope that the conversation can continue (Rorty, 2009).

Rorty and his most common religious conversation partner, Gianni Vattimo, an avowed Catholic, concurred, "hermeneutics has been the friendliest philosophy toward religion because of its critique of the idea of truth as conformity between propositions

and objects" (Rorty, Vattimo, & Zabala, 2005, p. 13). Rorty viewed the privatization of religion as being humanistic in nature, since a privatized religion no longer belongs to an institution (Rorty et al., 2005; Rorty, 2010). The return of religion to the conversation and the use of hermeneutics to inform the discourse provided Rorty's concept of 'weak thought' to become an agent for interaction. This weak thought was a response against the new atheists who had moved beyond classical atheism to not simply oppose religion, but to attack religion and the influence of religious thought upon science and empiricism (Rorty, 2010). Weak thought was Rorty's "invitation to overcome metaphysics by involving reciprocity" (Rorty et al., 2005, p. 3). Rorty's (2010) attitude towards metaphysics was not a positive one, and he once quipped, "the trouble with metaphysics is that anyone can say anything and get away with it" (p. 820). Rorty went on to say that the benefit to weak thought is that by being based on the privatization of religion and not the institutionalized form of religion, the tradition of whatever faith, in this case Christianity, can be regained between the believer and God once the power structure has been removed (Rorty et al., 2005). According to Rorty, through privatized religion, "believers and unbelievers agree to follow a policy of live and let live" (Rorty et al., 2005, p. 33). Rorty and Habermas shared the idea that non-believers need to be far more accepting of the rights of religious believers in a truly democratic society, the caveat being, that for Rorty, it must be the right to privatized view of religion through weak thought (Habermas, 2008; Rorty, 2010). Neither side has the right in a democratic society to be "contemptuous of those to whom the dispute seems pointless" (Rorty, 2010, p. 847). Rorty's idea of weak thought was a promising alternative only for faith that is not institutionalized and "adopted to political positions" (Rorty et al., 2005, p. 13).

The return of religion through weak though and the use of hermeneutics in dialogue between normal-science and religion had the purpose of opening up the discourse (Rorty et al., 2005). Scientific realism and religious fundamentalism, the positions that Barbour (2001) detailed as being the most likely to be in conflict with each other, the ones that dominate the perceived relationship between the two and garner the most media attention, had gotten completely out of hand, according to Rorty. "They are attempts to make one's own private ways of giving meaning to one's own life - a way which romanticizes one's relation to something starkly and magnificently nonhuman, something Ultimately True and Real - obligatory for the general public" (Rorty, 1999, p. 157). James likely could not have imagined that the dynamic between science and religion would have reached such a vitriol and hateful stance since his time. Bernstein (2010) said that:

> For James there is no incompatibility between taking the canons of scientific inquiry seriously and responding in depth to religious and spiritual concern. To be sure he never had much interest in the communal or institutional aspects of religion. He was indifferent to theology; it left him cold. But he was also suspicious of philosophical 'intellectualism' that failed to capture the vividness and variety of religious experience. (p. 142)

James's belief that both science (empiricism) and religion can coexist and stand together is reflected throughout Rorty's post-'God-has-failed-syndrome' that "there are no more strong philosophical reasons either to be an atheist refusing religion or to be a theist refusing science; the deconstruction of metaphysics has cleared the ground for a culture without those dualisms that have characterized our western tradition" (Rorty et al., 2005,

p. 12). Through a strong hermeneutic tradition melded with viewing of returning religion to the discourse with normal-science, I believe that valuable research can take place to allow opening up of the conversation and providing participants a place to engage their understanding of normal-science and their religious identities.

CHAPTER 3

METHODOLOGY AND DATA COLLECTION

This study was designed using Seidman's (2013) multiple interview approach, MIA, that consists of a series of three participant interviews and using Dilthey's (Dilthey & Makkreel, 2010; Palmer, 1969) hermeneutic approach for participant interaction with the expository-narrative science and religion text and Tan, Grief, Cons, Wilson, and Olver's (2009) inductive thematic coding approach for identifying interpretive strategies and content specific strategies or general comprehension strategies.

Research Questions

To better understand how learners navigate their scientific and religious literacies, this study was guided by the following research questions:

- What are the interactions or processes a mainstream denominational Christian and science, technology, engineering, arts & design, and mathematics (STEAM) learner uses to engage with an expository-narrative science and religion text?
- Based on the reading by a mainstream denominational Christian and STEAM learners when engaged with an expository-narrative science and religion text, how can participants' interpretations of normal-science and religion be situated on a spectrum of interactions between normal-science and religion?

Research Design Rationale

Seidman's (2013) multiple interview approach, detailed further in this chapter, was chosen to get at the elicitation of beliefs of participants and to produce a narrative of

experience. It also incorporated Dilthey's naïve and methodic hermeneutic to access participants' views involving normal-science content, mainstream Christian religious belief, and reading and content information understanding. A multiple interview approach, such as the one put forth by Seidman, has been used in numerous hermeneutic research efforts to produce a narrative for analysis (Freeman, 2007; McCormack, 2004; Riessman, 2008; Whitehead, 2004).

Context of Study

The selection of the southern research university as the context for this study was based on it being rated as one of the most religiously Christian public institutions in the nation (Princeton Review, 2013), it offering degrees in STEAM (science, technology, engineering, arts & design, and mathematics) fields as a traditional engineering and science research university, and it's proximity for data collection purposes. The university was also selected as the study location due to my familiarity with its science education program and its student campus ministry organizations. The interviews were conducted at the many campus ministry locations and one of the local coffee shops, depending on what was most convenient for each participant. The choice of conducting interviews in the student's native campus ministry location was done not only as a courtesy to the participant, but also to situate the participant in an environment where they would be comfortable discussing religious matters and to show respect for the individual's religious preferences.

Data Sources

Process of Selection

Participants were selected from a pool of recruited candidates identified by campus ministers. Criteria for selection included being involved with a university campus ministry association and studying in a STEAM field. Ten participants were initially to be selected, however, only seven participants volunteered to participate after three recruitment efforts. I used my connections with three campus ministries at a university to locate and recruit research participants. The campus ministries were Baptist Campus Ministry (Southern Baptist Convention affiliation), Cooperative Student Fellowship (Cooperative Baptist Fellowship affiliation), and Lutheran Campus Ministry (Evangelical Lutheran Church in America affiliation); however, only the latter two led to willing participants for the study. Participants at the listed campus ministries are not always denominationally affiliated with the supporting denomination for that ministry. For example, Cooperative Student Fellowship, though sponsored by a Baptist church in the local town that is a Cooperative Baptist Fellowship affiliated church, has a makeup of 30% Cooperative Baptist Fellowship, 20% Southern Baptist Convention, 20% other denominational Protestant (United Methodist Church, Evangelical Lutheran Church, Presbyterian Church USA, Anglican/Episcopalian), 5% Roman Catholic and 25% non-denominationally affiliated students. The selection approach used was a mixture of purposeful selection and snowball sampling, as one participant or campus minister can lead to additional participants; this was the case with the two participants from the Cooperative Student Fellowship. Participants' diversity in gender, race, ethnicity, or sexual orientation was not purposefully selected for or against. However, a balance was

preferred among participants when possible. The demographic base of the university and the campus ministries lent themselves to be composed of mostly Caucasian and non-ethnic minority participants.

Participants were selected based on the following criteria:

a) Majoring in or recent graduate (1-year) from a STEAM (science, engineering, technology, arts & design, or mathematics) program; science and mathematics education majors would have also been accepted due to taking a required minimum of non-education courses in science and mathematics related areas. One participant who was a psychology major was also selected after due consideration. The American Psychological Association (APA) considers and promotes the field of psychology as a STEAM area major, thus, for the purposes of this study, participants majoring in psychology were included.

b) Self-identification as a member of a Christian denomination or non-denominational Christian; preference was to be given to denominationally affiliated members of the Southern Baptist Convention, Presbyterian Church in America, or other identified theologically-conservative Christian denominations to account for a diverse range of participant perspectives and life histories; however, due to less than 10 participants volunteering, no preference in selection was required.

c) Openness to discussing the roles of science and religion in their personal lives, educational process, and/or reading habits.

d) Demonstrated ability to mediate between science and religion during the first interview process.

e) Willingness to read the selected novel, *Mr. g: A Novel About the Creation* (Lightman, 2012).

f) Availability for interview process over the course of a three-to-four-week period.

Participants

Participant One – Alexander. Alexander was a male participant and a senior. He was an Engineering major who participated in one of the area campus ministries. Alexander identified as Baptist, specifically from the Cooperative Baptist Fellowship. He had always been a member of the same home church, though the church changed denominational affiliations from the Southern Baptist Convention to the Cooperative Baptist Fellowship and the Alliance of Baptists during the late 1990s. Alexander attended public school in the state.

Participant Two – Brady. Brady was a female participant and a senior. She was a Pre-Med/Biological Science major who participated in one of the area campus ministries. Brady identified as Baptist, specifically from the Cooperative Baptist Fellowship. She grew up being a member of several different home churches, all Baptist varieties: Alliance of Baptist Churches, Cooperative Baptist Fellowship, and Southern Baptist Convention. Brady attended public schools and public charter schools in the state.

Participant Three – Connor. Conner was a male participant and a junior. He was an Engineering major and a student-athlete. Conner did not regularly participate in

an area campus ministry due to time constraints with athletics; however, he had attended different campus ministry events with teammates and other friends. Connor identified as Episcopalian. Conner participated actively in his youth, serving as acolyte during his teenage years at his home church. He considered himself a CE Christian as defined by his home pastor; meaning that he only attends formal church services at Christmas and Easter when he is with his family. Conner attended public schools in the state.

Participant Four – Dixon. Dixon was a male participant and a senior. He was an Engineering major and an honors student who participated in one of the area campus ministries. Dixon identified as Lutheran, specifically from the Evangelical Lutheran Church. Dixon attended a private religiously-affiliated (Presbyterian Church – USA) school and public magnet schools in the state.

Participant Five – Kyle. Kyle was a male participant and a senior. He was an Engineering major who participated in one of the area campus ministries. Kyle identified as Lutheran, specifically from the Evangelical Lutheran Church in America. Kyle attended public schools in the state. I have known Kyle since he was in middle school, but only as a member of the same congregation when I was present in the community. He volunteered to participate in the study without any prior knowledge of the researcher.

Participant Six – Marie. Marie was a female participant and a senior. She was a Veterinary Medicine major who participated in one of the area campus ministries. Marie identified as Lutheran, specifically from the Evangelical Lutheran Church. Marie was homeschooled during her elementary and middle school years and attended public school for several secondary years in the state.

Participant Seven – Marie Kathryn. Marie Kathryn was a female participant and a senior. She was a Psychology major. She did not officially participate in an area campus ministry as a member, but she had attended fellowship activities with friends. Marie Kathryn identified as Baptist, specifically from the Southern Baptist Convention. Marie Kathryn's grandfather was a Presbyterian (Presbyterian Church in America) minister. She attended public schools in the state.

Researcher Relations: Bias, Validity & Trustworthiness

Maxwell (2013) spoke to the need in qualitative research to address the relation of the researcher towards the participants and the material in question to understand the presence of bias and reactivity. The subjectivities of the research, addressed in Chapter 1 are briefly restated here. As a researcher and a member of the mainstream Christian faith community, I must acknowledge that I have a shared experience of growing up in similar faith development community to the majority of the participants. Sharing this background in both religious matters and the desire to work in a STEAM-based field has oriented me in shared circumstances with the participants. Being aware of this through virtuous subjectivity and monitoring the subjectivity and bias through a combination of understanding subjectivity, bridling, and respecting intersubjectivity aided in performing more trustworthy research (Dahlberg, Dahlberg & Nyström, 2008; Glesne, 2006; Peshkin, 1988). Peshkin (1998) argued the need for a virtuous or tamed subjectivity in that, as a researcher, what we bring with us cannot be shed nor shied away from, but should be acknowledged for what it is: influencing the way in which we see everything and always present no matter the efforts we may employ to minimize its presence. Gertz simply illustrated this point by stating "all ethnography is part philosophy and a good

deal self confession" (as cited in Peshkin, 1998, p. 20). No matter what I say about my subjects and my research, it contains what I believe and speak about myself, not just my research. Similar to embracing virtuous subjectivity is Dahlberg and Dahlberg's commitment to bridling where "we do not understand to quickly or carelessly or so that we do not attempt to make definite what is indefinite" (Vagle, Hughes, & Durbin, 2009, p. 350).

Maxwell (2013) spoke of important validity threats to qualitative research, researcher bias and reactivity. In order to address these in this study, I have used six of his eight methods detailed as strategies to strengthen validity or trustworthiness in my research. It is important to note that no strategy can guarantee the validity of the research; however, using a combination of strategies greatly reduces the validity threats to research and helps establish trustworthiness. All eight of the strategies suggested by Maxwell are not applicable to every kind of qualitative research. The six validity-reinforcing strategies suitable for this research were: intensive and long-term involvement, rich data, respondent validation, searching for discrepant evidence and negative cases, triangulation, and comparison. The two strategies that were not selected were: intervention and numbers; these were not appropriate to this study based on the goals as stated in the research questions and the use of Seidman's (2013) multiple interview approach.

The format of Seidman's (2013) multiple interview approach is a good example of Maxwell's (2013) usage of intensive and long-term involvement and the production of rich data. The multiple interview approach is designed to increase involvement with the research participants with three separate interviews spaced over a minimum of three to

four weeks; as shown below, most of the interviews for my research participants were spaced over a period of three and six weeks. This period of involvement allowed for research participants to thoughtfully engage with the novel over time. This period of long-term involvement aided in validity reinforcement through the use of rich data as ascribed to by Maxwell (2013).

Validity and trustworthiness of the data was improved through the use of the multiple interview approach where participants were provided the opportunity for respondent validation. Research participants were provided copies of interview transcripts for verification and correction of any incorrectly transcribed or potentially confusing remarks. While the interviews were subject to respondent validation, the analysis of each interview candidate was not subject to respondent validation due to the research participants' unfamiliarity with hermeneutical approaches as well as the potential critique of their religious and scientific literacy practices. The limiting of respondent validation of the analysis results from the research participants was not necessarily problematic. Following Hammersley and Atkinson's advice on validity, a participant's feedback is not any more valid then their response from the data gathered in their interviews; thus respondent validation is a useful tool for validity reinforcement but it in no way guarantees that validity or trustworthiness is ultimately achieved (as cited in Maxwell, 2013).

Maxwell's (2013) final three validity reinforcement techniques used in this study were triangulation, searching for discrepant evidence or negative cases, and comparison. Of these, discrepant evidence or negative cases and comparison are included in the presentation of the data in the following chapter where a negative case was found in the

interpretation strategies for normal-science content area reading and where comparison was used between the participants for the construction of the spectrum of interaction between religious belief and normal-science content literacy. Triangulation becomes present through the use of multiple participants and was meant to complexify understanding as opposed to confirm any one meaning.

Data Collection

Data for this research was collected via a series of three interviews with each of the participants performed over several weeks. Participants were interviewed either at their campus ministry or church location or at one of the local coffee shops available in the community. Interviews were recorded via a digital recording device. Two participants provided a written journal/log of reading at the conclusion of the interview process for additional artifact collection and this was used in analyzing their interpretive strategies and general content comprehension strategies.

Multiple Interview Approach

Seidman's (2013) multiple interview approach (MIA) uses a series of three interviews structured to produce responses that can be compiled into a singular narrative per participant. The MIA approach was designed specifically for use with phenomenological research, but is easily adaptable from a phenomenological method to a hermeneutic one due to the two theoretical frameworks close developmental histories and the desire to produce narrative responses. MIA was designed to use three interviews, spaced throughout a three-week period that consisted of separate 90-minute interviews. In order to use *Mr. g: A Novel About The Creation* (Lightman, 2012) between interviews one and two, additional time was allotted for the entire process to accommodate

participants' schedules. This is allowable under MIA's recommended procedure established by Seidman.

Table 1

Days Between Participant Interviews

Participants	Interview 1 - 2	Interview 2 - 3
Alexander	38 days	14 days
Brady	28 days	33 days
Connor	17 days	15 days
Dixon	19 days	14 days
Kyle	49 days	7 days
Marie	28 days	21 days
Marie Kathryn	33 days	36 days

MIA is based on a series of three interviews and was originally established to focus on the following areas: life history, details of experience, and reflection on meaning.

In using the MIA method, I modified the focus of two of the interviews while retaining the structure and the setup of the method. Maintaining the structure of the interviews is important to the multiple interview approach, as it is central to the reflection of the experiences in each participant's life. If the structure must be changed, under specific circumstances, it is always better to interview under less-than-ideal conditions then to not interview one particular participant or to skip an interview (Seidman, 2013). No modification of structure of the interview is desired; however, when dealing with

busy participants, it was important to be prepared for unexpected scheduling developments. Every accommodation was made to preserve the structure of a three-interview set to the point of stretching out the time frame from 3-4 weeks per interview set to 8 weeks to accommodate three of the participants.

The first interview focused on the life history of each participant and was not modified from Seidman's original purpose; but was narrowed to the life history of the participant with emphasis on the topics of interest: science, religion, and reading. What was the participant's life history involving science and religion and reading? How did the participant experience science education while attending school? Outside of the school, how was science experienced? How have religion and religious experience shaped their life experiences? How would they describe the perceived relationship between science and religion and how they would describe their own personal relationship between science and religion? These and other specific prompts were used in the first interview (see Appendix A for interview guides). The first goal of the first interview was to identify which candidates demonstrated an interaction or process when dialoguing or mediating normal-science and religion. Demonstration of interaction or process is necessary for an engagement between pre-understanding and understanding and the parts and the whole (Alversson & Sköldberg, 2000). Interview protocols for all interviews were provided (see Appendix A for interview guides). The second goal of the first interview was to reconstruct participant experiences in order to create a bridge to the other interviews (Seidman, 2013). This was particularly helpful in determining clarifying questions that were added to the second interview for participants based on the semi-structured interview format.

Interview two, focusing on the details of the experience at the current time, was the step in MIA that was modified from experience in general with the topics of science, religion, and reading to the present experience with science and religion after having read *Mr. g: A Novel About the Creation* (2012). Seidman's (2013) initial purpose with the second interview was to "concentrate on the concrete details of the participants' present lived experience in the topic area of study" (p. 21). This spirit of purpose stayed the same, but the inclusion of experience with the novel written in expository-narrative style shaped the second interview. It is important to construct interview questions and probes that avoid asking for opinions of the participants on the format of the expository-narrative text but instead to form questions that generate responses based on participants' experiences of content. Should participants include opinions on the format of expository-narrative texts, they will be accepted, and would be highly valued for input into preference over different forms of content presentation; however, opinions are not sought with Seidman's method. Of the second interview, Seidman (2013) says, "we strive, however, incompletely, to reconstruct the myriad of details of our participants' experiences" (p. 22) in reading *Mr. g: A Novel About the Creation.* By using an expository-narrative text, Seidman's goal of reconstructing the details of participants' experiences between the normal-science concepts presented through the text and their religious identity become clearer (Seidman, 2013).

The final interview, focusing on the reflection of meaning, remained completely unchanged from the standard MIA method. Participants were asked to reflect on the meaning of their experience and the meaning of their relationship between normal-science concepts, religious learning, and reading an expository-narrative science and

religion text. Meaning, as dictated by MIA, does not have to be a satisfactory or rewarding meaning. In order for participants to make sense or meaning out of their experiences, they must look at how the different influences and experiences in their lives have brought them to their present condition (Seidman, 2013). The making of meaning requires examining the past experiences shared during the first interview with the participant's interim experiences between the first and second interviews involving the expository-narrative science and religion text.

Participant interviews were initially to be transcribed after each round of the data collection period; however, this did not occur due to scheduling difficulty between participant availability and the overlapping of interview rounds (time frame provided in Table 1 of this section). Seidman argued that transcription of material during or before the interview process is complete may skew the interview protocols and questions between interviews. However, this seems counter to much of the prevailing wisdom and practice found in qualitative research (Crotty, 1998; Glesne, 2006; Patton, 2001). The scheduling difficulties between participants in maintaining Seidman's timetable for the interviews and his method of transcription brought out the inconsistency between differing qualitative researchers in terms of when transcriptions should be done. Ultimately, due to accommodating each participant's schedule and overlapping interview rounds, interviews were transcribed at the conclusion of each round. This practice allowed for each individual participant interview in each round to not overly influence the other participant interviews, since the practice of conducting interviews can influence the next interview, but allowed for the further development of interview questions for the next round of participant interviews and also for myself to re-experience the prior

interview for clarification on topics. Interviews were not structured to pertain to the previous interview in subject matter, except for interview three.

Transcribed interviews were offered to the participants to review and amend at their discretion if responses were in error or not to their held belief or opinion; no amendments by participants were returned.

Materials

Interview protocol I (see Appendix A) was geared towards the life history of the participant with questions predetermined to guide the interview process. Interview protocol II was focused on the material the participant learned or recalled through the reading of the novel, *Mr. g: A Novel About the Creation* (Lightman, 2012). Interview protocol III was focused on the generation of questions between the masterium of science and religion.

Mr. g: A Novel About the Creation was provided to all participants to read and served as the central discussion point for interviews II and III. *Mr. g: A Novel About the Creation* is an expository-narrative science text that provides content on the cosmological development and structure of the universe as well as general normal-science ideas dealing with the development of life on Earth. Cosmological development and the development of life are two of the most discussed areas of interaction between normal-science and religion. In the novel, the character of Mr. g serves as the protagonist who is responsible for the creation of his universe. He never applies the term ‘god’ to himself, nor is it applied to him in the novel except in an illusionary matter, but it is never explicitly stated by the author. Mr. g explains his creation of the universe through his understanding of science that is consistent with the currently accepted normal-science content available

and taught in public schools and universities. There is little, if any, explicit discussion of organized religion in the novel, but the implicit religious themes of organized religious philosophies are interwoven throughout the dialogue between Mr. g, his family members, the antagonists, Belhor and Baphomet.

Two participants, during the initial interview process, inquired to see if they were required to take notes or keep a journal during the reading process. While it was not in the initial study design as put forth by Seidman, the voluntary effort put forth by the participants was accepted. I purchased writing notebooks and delivered the notebooks with their copies of the novels and the understanding that they did not have to record anything in them, but if that was their normal reading practice then I would be interested in examining their written records upon conclusion of reading the novel. Both participants provided their written records at the conclusion of the interview process. These two participants used their writing notebooks for different purposes while reading the novel. These differences are examined in Chapter 4.

Data Management

I transcribed all the participants' interview data for the first two rounds. A professional transcription service was used to transcribe the third round of interviews. Upon conclusion of the transcription, all interviews were stored in qualitative research analysis software (Dedoose, 2013). Dedoose was not used for its qualitative analysis function but only for information storage, retrieval, and management.

Data Analysis

Analysis from the transcripts of participant interviews was done using Dilthey's (Dilthey & Makkreel, 2010; Palmer, 1969) hermeneutic method to examine participant

engagement with normal-science and religion content and Tan, Grief, Couns, Wilson, and Olver's (2009) inductive thematic coding for the identification of interpretive strategies and content area reading strategies or general content comprehension strategies. Dilthey's hermeneutic approach established a methodologically-sound procedure for obtaining a historical interpretation of a participant's lifeworld experiences based in the tradition of *Geisteswissenschaften* by examining the naïve and methodic hermeneutics of participants as they exist through an intersubjective world and within intersubjective hermeneutic paradigm.

Interpretive Content Area Strategies Data Analysis

In the first level of analysis in Tan et al.'s technique, individual transcripts of interview/narratives were analyzed to identify free nodes. Free nodes, as described by Bazeley (2007), do not assume any prior relationships with each other and thus are inductive in nature. By using free nodes as the basis of the coding process, there is no imposed structure onto the themes and categories that may ultimately emerge through the coding process (Bazeley, 2007). Coding via free nodes involves coding any significant piece of text that might be of importance to the participant's experience (Tan et al., 2009). Words should be taken at face value with no attempt to interpret them in any way unless similar words were also used to express an idea. "This is a relatively mechanical process and does not involve interpretation or decisions about whether two different sets of words have the same meaning" (Tan et al., 2009, p. 10). For all interviews from MIA, this coding took place after the collection and not between the interviews, as prescribed by Seidman's (2013) MIA protocol. It was, of course, important to the process to reread all transcripts multiple times to make sure that they were properly coded and that words

and ideas were not missed in the process, which improves reliability (Patton, 2001; Tan et al., 2009).

The construction of free nodes was a fairly straightforward process and proceeded without any difficulty due to taking them at face value as prescribed by Bazeley and Tan et al. The initial codebook is provided (see Appendix B). All free nodes did not translate directly into a code that was used to identify segments of data. Codes that were not directly translated into codes were interpreted based on the researcher's interpretation of the context of the interview segment. Free nodes were then grouped into inductive code categories.

In the second level of analysis, the codes that were created from level one were grouped by the establishment of inductive categories that were analyzed for sub-themes that run throughout the categories. To that point the process of analysis within Tan et al.'s method is not much different from the technique of thematic analysis (King & Hoorocks, 2012; Luborsky, 1994; Patton, 2001). Unlike level one, in level two, decisions are made about words, phrases, and ideas that have similar or nearly identical meaning. Tan et al. described this as the beginning of interpretation that is caused by the researcher's interpretation of the participants' understandings of the meaning of their words and experiences. After all interview/narratives were coded for level one, then level two analysis was done. It did not seem like the most logical choice to analyze one narrative through all three levels, or even two, and then move onto the other narratives. Doing so could have led to multiple discrepancies in how the initial levels were coded and would, thus, unduly influence the reliability of the study (Maxwell, 2013; Patton, 2001; Tan et al., 2009). The codebook (see Appendix B) contains the codes derived from

the free nodes that were entered into Dedoose. The internal code generation function of Dedoose was not used as I feel firmly that a computer algorithm cannot determine the intention of the participants when engaging in an interpretive action.

Dilthey's Hermeneutic Methodology of Analysis

Participant interviews were analyzed based on the influence of hermeneutics through Dilthey's (Dilthey & Makkreel, 2010; Palmer, 1969) hermeneutics. Recall that the third interview was focused on the making of meaning between a participant's prior normal-science and religion based experiences from the first interview and their recent experiences with *Mr. g: A Novel About the Creation*. Participants' meaning making was found during the analysis of the interviews to occur in two rough patterns that are traditional to the hermeneutic process.

According to Dilthey (Dilthey & Makkreel, 2010; Palmer, 1969), there are two types of hermeneutics at play when looking at someone else's, or one's own, interaction and interpretation of text: the naïve and methodic hermeneutic. Dilthey said the naïve hermeneutic, also known as the pragmatic hermeneutic or elementary understanding, is the day-to-day or commonplace interaction. It is essentially the surface level interaction that an observer is aware of without attention to experience or details. The simplicity of this naïve or pragmatic hermeneutic is not to be overlooked as unimportant as it is what is most easily put forth to be observed by an onlooker, or in this case, myself as the researcher. The second type, the methodic hermeneutic, also known as the historic hermeneutic or the higher form of understanding, is the hermeneutical form that must be exposed by going beyond the naïve hermeneutic. It is not that the historic hermeneutic is better than the naïve hermeneutic; it is that the historic hermeneutic is the basis, the

foundation that the naïve hermeneutic is built upon or projected from. The historic hermeneutic is methodic in its reconstruction of the lifeworld experiences of the participant so that what is projected in the naïve hermeneutic may be better understood through experience that is not immediately knowable to the observer. Because the participant, text, and the researcher are all participants in the same lifeworld, *Geist*, there is some form of shared experience that may be built upon to connect the experiences of the three so that each may understand the other (Dilthey & Makkreel, 2010; Palmer, 1969).

It is this hermeneutic level of analysis that requires the most comment in this chapter. Each participant is different. This is an obvious statement it seems, but it takes on an even more important meaning when looking at engagements between the participants and the expository-narrative text they read. No two participants engaged with the texts in the exact same manner; not that this was expected. It was quite encouraging to see that there were some similarities in specific areas of the textual engagement, but each participant arrived and departed from the text at different places. This is, hermeneutically speaking, due to the historical context and lifeworld experiences of each individual participant. While the participants were historical contemporaries of each other and also by chance, social contemporaries in some cases due to participation in the same ministries and events, they were uniquely themselves in their experiences and engagement with the texts.

Potential Anomalies

Two participants, Marie and Marie Kathryn, elicited concern about their ability to participate in the study during the first interview. Their responses during the interview

were exceptionally brief and not engaging, often accompanied by long pauses. I was concerned that I would need to discontinue their participation in the study after the initial interviews until they became excited about receiving their novels and stated that they were looking forward to reading them. This excitement did not initially ease my concern but I gave them a participation pass due to the already-reduced number of participants in the study. Nonetheless, it did give me pause. I decided to make the call on their continued participation and felt justified in this decision after the second interview, in which they discussed their initial reading of the novel. I also entertained the idea of engaging in conversational analysis of their interviews due to the long pauses and short answers; however, I ultimately decided not to do this after determining that it was unfamiliarity with the initial issues and interview process that contributed to their nervousness. This conclusion was based on communication with both participants in scheduling their second interviews as well as their own words about being initially nervous in participating in a research study. After the second interview, I confidently determined that both Marie and Marie Kathryn were demonstrating some level of engagement with the text. I also felt that both participants merited continuation because they were the least traditional STEAM area participants: Marie was a Veterinary Medicine student and Marie Kathryn was a Psychology student. If there was to be a use of expository-narrative text in science literacy efforts, these two participants most embodied the scientifically interested, yet non-normal-science literate student. Marie Kathryn was also one of the two participants to produce an artifact for engaging with the novel in her notebook. After the second interview, keeping both participants in the study was an easy and defensible decision.

CHAPTER 4

FINDINGS

This chapter presents a detailed description of the ways in which seven mainstream Christian participants read and engaged with an expository-narrative science text. These participants are presented both from an individual, reader-by-reader basis to set up their individual cases, and as a synthesized group that draws from shared interpretive and technical reading strategies. In the first section, the nature of the interview environments is presented by looking at the positionality of the participants. This section also includes a brief look at the stated positionality of the mainstream Christian denominations mentioned that related to the participants. In the second section, details of participants' engagement of normal-science and religious belief is shown. The participants' interviews are retold by looking at their interviews through the naïve and methodic hermeneutic as described by Dilthey (Dilthey & Makkreel, 2010). The third section presents the interpretive and understanding engagement strategies participants' used between normal-science content and religious belief. The final section, which concludes the chapter, returns briefly to the topic of positionality and my reflexivity. The second and third sections address the research questions:

- What are the interactions or processes a mainstream denominational Christian and science, technology, engineering, arts & design, and mathematics (STEAM) learner uses to engage with an expository-narrative science and religion text?

- Based on the reading by a mainstream denominational Christian and STEAM learners when engaged with an expository-narrative science and religion text, how can participants' interpretations of normal-science and religion be situated on a spectrum of interactions between normal-science and religion?

I present the data through a conceptualized theoretical framework of normal-science and religion as accessed through Dilthey's (Dilthey & Makkreel, 2010) objective hermeneutics of establishing participants' engagements of normal-science and religion via their naïve and methodic hermeneutics.

Positionality and the Interview Environment

"The notion of intersubjective understandings defies the possibility of cognizant subjects standing in opposition to an objectively given world" (Herborth, 2012, p. 239). I begin this section with this particular quote as a reminder that any discussion of intersubjectivity will be one-sided, at best, because there is no objective or uninterrupted data available for reporting. In order to establish the experiences of the participants in a way that was interpretable to others, the positionality of the participants needed to be more clearly established. The 'data' on their positions were solely based on that of the observation of the researcher in the study, in this case, myself. I lay out the positionality of the participants as a group and then present specific positional aspects that I believe were significant for the participants when analyzing their experiences.

With seven participants reading the same text, there were seven different readings of the text taking place during the research study. While that is a seemingly obvious statement, without observing the positionality between each participant and their reading of the novel, it could not be discussed how participants read the novel and what the

experience was like for them. The term understanding in regards to the novel must be thought of differently, not as the content understanding of the novel or what was presented in the novel in terms of contextual knowledge, but rather the participant's attitude in approaching the novel and how each treated the expository-narrative science text. I took it for granted that all the participants understood the concept of reading a novel and being able to discuss what was found within, while each participant took for granted that I was there to listen to their individual thoughts and understandings. Most of the participants knew that I self-identified as a Christian who was interested in both science and religion as research areas; however, with the exception of Kyle, none of them knew that I identified as an member of the Evangelical Lutheran Church in American (ELCA) denomination.

With respect to the participants' positions that were present during the interviews, there were several trends that were identified and have relevance to examining what occurred between the participants and myself. The first trend was what role the participant took in discussion of the text. Secondly, there was the trend of the interpersonal relationship, which was expressed between the researcher and participant. Finally, how the participant was engaging with the research process and/or the analysis of their own participation emerged. Each of these themes played out across this study, but not necessarily with each participant.

The Participants' Positionality

Each participant approached their role in this study in one of three different ways: information source, information interpreter, or information analyzer. The term information is used only to signify that I considered each of them as the source of the

data for this study, and not as a conduit for seeing if they merely understood the normal-science content knowledge and religious concepts presented in the novel. The participants served as data that were looked at hermeneutically, but with the caveat of retelling/interpreting/understanding normal-science content information objectively, as determined by Dilthey. An information source is a participant who primarily re-tells the information from the novel. An information interpreter is a participant who, in discussing the novel, thinks through the text of the novel by engaging it with prior experience. The information interpreter understands that I am not looking for a literal retelling of the novel, but instead that I am looking at what they thought about the relationship and the engagement between normal-science and religion as presented in the novel. An information analyzer is a participant who proceeds to analyze his or her own reading of the novel in a preemptive attempt to predict what I am looking for. These categories are not mutually exclusive; one participant demonstrated a change from information source to information interpreter across the scope of the interviews. This was identified as a methodological issue with this participant and previously reported.

The majority of the participants were information interpreters in their understanding of how the research process and interviews conducted. During the initial participant interview phase, Connor, Alexander, and Kyle stated that they had never engaged in a research study as a participant; however, they had participated in research through their college engineering program and through internships.

Even though the three were accustomed to doing quantitative instead of qualitative research, they were highly receptive to the feedback/dialogue aspect used in the qualitative interview structure of this research. All three were highly engaged in

conversation and often provided rich details during their interview process that served as a validity and trustworthiness check (Maxwell, 2013). Connor, Alexander, and Kyle were open to an engagement in dialogue and often would ask what my opinions were on the book or the content that we had discussed. While I did not want to unduly influence their future thinking on the text, they were cognizant that whatever I discussed would be present when they went through the reading or thought about the materials at a later point. Each of these three were interested in a mutual dialogue with me for a better understanding of all the material presented. The research process was not simply a learning and knowledge generation process for myself, but also for them.

Brady was more familiar with expository-narrative texts than any other participant, and carried that enthusiasm into her second and third interviews. Brady took the opportunity to tell me whatever she thought might relate to the questions I had asked, no matter how tangential. I interpreted this as her being comfortable with the qualitative interview process, as she was not speaking with a fast-paced stammer to get out information, but would follow up her immediate answers with additional statements and lead-ins to other lines of discussion that she associated with the original question. Brady was very comfortable taking on the role of talker and allowing me to listen and absorb what she was saying. More than the other participants in the study, even the other information interpreters, Brady expected me to know and understand what she was talking about. To Brady, I was already the expert in the interview setting in terms of both normal-science content and religion; I do not mean to say that I am an expert in either or that Brady viewed me as all-knowing, but that for her, I was informed beyond her level of understanding on the two subjects she was reading and thinking about.

Marie was also one of the participants for whom I noted an irregularity in methodology dealing with intersubjectivity in the previous chapter; however, what I perceived with Marie was a grasping of the intersubjectivity between myself and Marie as it was in a state of disconnect. With Marie, it was her unfamiliarity with the qualitative interview process and participation in research that produced the disconnect. During most of the first interview, Marie would often give very short or one-word answers to the interview questions. I would often have to rephrase the question or provide an example to get Marie to provide a more detailed answer. However, this was isolated to the first interview, as she was initially nervous about participating. During the second and third interviews, Marie would often become excited when answering a question because she was getting to share her opinion about a book with someone else. The initial reluctance to provide elaborate answers was gone once she started talking about the novel. Marie also said that she had found out that I had once been a member of the same campus ministry organization as she was a member of from the minister who helped with recruitment. Once she knew this, she no longer viewed me as an outsider, but as someone that was interested in her opinions on the matter beyond that of just a researcher. Marie's initial view of me as the researcher was skeptical, in contrast to Brady who always viewed me as an expert; it was only after Marie asked her campus minister about me and discovered that I was not an outsider to Christianity and her faith that she accepted me as someone capable of respecting, interpreting, and understanding the thoughts that she shared.

While details of the positionality of Kyle were included previously with Connor and Alexander, I found that there was more to the understanding that existed between

Kyle and myself than with any of the other participants. This undoubtedly had an effect on the way in which he presented his thoughts to me. Kyle and I were already acquainted on a very informal level. He and I were members of the same church during my time in the community when he was a middle and high school student. We did not have much interaction in church at that time. The extent of our knowledge of each other was when I volunteered to supervise the church youth group while they played video games for an afternoon, and once drove them on an outing to get ice cream. These two interactions, for which I was present but not active, were the limits of our prior interactions; however, in the interview process, it became clear that Kyle was far more comfortable around me as the researcher than any of the other participants were. Kyle did not know I was the researcher when he received the recruitment information from his campus minister. I did not feel that his participation in the research was in any way related to the fact that I was the researcher. Being familiar with me and knowing my history in the church community provided for the open and jovial communication that occurred during the interview process. With Kyle knowing that we shared the same denominational faith background, something that the other participants could not confidently pinpoint, his discussion on religious matters, which may have seemed decidedly progressive or liberal to a researcher more accustomed to traditional or evangelical Christian denominations, did not surprise to me due to our shared background.

The remaining two participants did not demonstrate an understanding of the research and interview in the same manner as the information interpreters; Marie Kathryn and Dixon were outliers in that respect, being an information reteller, and an information analyzer, respectively. The intersubjectivity that existed between Marie Kathryn and

myself, at least as I perceived it, was open, yet guarded on my end. As a researcher, I strove to bracket my personal religious beliefs and subjectivities while listening to Marie Kathryn's more traditional and evangelical interpretations of the religious content in the novel. Marie Kathryn was reluctant to discuss her views on science during the initial interview. I based this reluctance on her more limited normal-science background and knowledge from personal situations that I had seen having been a science teacher before. She likely perceived me as an authority on the normal-science content matters. As pointed out in Chapter 3, Marie Kathryn's reluctance for discussion was an initial concern during the first interview; however, in the second interview, there was no such reluctance and Marie Kathryn talked openly about her disagreements with the normal-science content. The openness in communication that Marie Kathryn offered was welcomed on my part, as it alleviated my concerns that she might not be suited for participation in the study due to not wanting to communicate openly about normal-science and religion. While I believe Marie Kathryn knew she and I did not share the same outlook on the religious content, she was appreciative that I asked for explanations of her thinking and understanding on the content and not simply questions as to why she thought the way that she did in a non-open and dialoguing manner.

Worries about openness with Dixon were detailed in Chapter 3 in terms of methodological irregularities. As stated there, during the first interview, Dixon prefaced or concluded many of his responses with statements indicating that he was communicating what he thought I wanted to hear instead of what he actually thought. We discussed in detail at the conclusion of the first interview why it would not be beneficial for him to tell me what he thought I wanted to hear, and that I only wanted to

know what he thought about the topics. I soon realized that Dixon stating what he thought I wanted to hear was his effort to engage with the text and topics, and he was self-questioning to help him remember what he wanted to talk about by putting himself in my role as the researcher. He juxtaposed himself into the role of the researcher to make sure that he was addressing everything he sought to address. Dixon was trying to close the gap between us in the study. At one point, Dixon explained that he had prior research experience working with a professor on campus, and that while he was doing quantitative research, he would find it helpful to try to assume the role, of the professor, to question what he was doing to make sure he was methodologically sound in his own research practices. Dixon was attempting to become the researcher, while being a research participant, in order to be the best research participant that he could be and to benefit the study.

Summary of Denominational Positions

In order to best situate the positions of the participants' experiences with normal-science and religion, an overview of the individual denominations that were most frequently referenced during the study will be reviewed. In order to accurately portray the beliefs and statements of each denomination, relevant statements of beliefs from their governing bodies will be drawn upon. By providing directly quoted statements of beliefs and positions from the governing religious bodies, their positions can be represented without intermediary interpretation for any readers of this study. The purpose is to provide a basis for how each participant is situated in their denominational practice of acceptance of scripture and textual use.

Cooperative Baptist Fellowship. According to the CBF:

> Many of our differences come from a different understanding and interpretation of Holy Scripture. But the difference is not at the point of the inspiration or authority of the Bible. We interpret the Bible differently, as will be seen below in our treatment of the biblical understanding of women and pastors. We also, however, have a different understanding of the nature of the Bible. We want to be biblical — especially in our view of the Bible. That means that we dare not claim less for the Bible than the Bible claims for itself. The Bible neither claims nor reveals inerrancy as a Christian teaching. Bible claims must be based on the Bible, not on human interpretations of the Bible.
>
> What should happen in colleges and seminaries is a major bone of contention between fundamentalists and moderates. Fundamentalists educate by indoctrination. They have the truth and all the truth. As they see it, their job is to pass along the truth they have. They must not change it. They are certain that their understandings of the truth are correct, complete and to be adopted by others. Moderates, too, are concerned with truth, but we do not claim a monopoly. We seek to enlarge and build upon such truth as we have. The task of education is to take the past and review it, even criticize it. We work to give our children a larger understanding of spiritual and physical reality. We know we will always live in faith; our understandings will not be complete until we get to heaven and are

> loosed from the limitations of our mortality and sin. (Cooperative Baptist Fellowship, 1991)

Episcopal Church – World Wide Anglican Community. According to the Episcopal Church:

> It is our foundation, understood through tradition and reason, containing all things necessary for salvation. Our worship is filled with Scripture from beginning to end. The Episcopal Church takes reading the Bible very seriously. Approximately 70% of the Book of Common Prayer comes directly from the Bible, and Episcopalians read more Holy Scripture in Sunday worship than almost any other denomination in Christianity.
>
> As Episcopalians, we are followers of Jesus Christ, and both our worship and our mission are in Christ's name. In Jesus, we find that the nature of God is love, and through baptism, we share in his victory over sin and death.
>
> Because the Episcopal Church welcomes many different points of view, the sermons offered during an Episcopal service may vary widely from congregation to congregation. (The Episcopal Church, 2014)

Evangelical Lutheran Church in America. According to the ELCA:

> Simply stated, the Scriptures tell about Jesus Christ. The Holy Spirit uses the Scriptures to present Jesus to all who listen to or read them. That is why Lutheran Christians say that the Scriptures are the "source and norm" of their teaching and practice. As the Gospel writer John wrote, "these things are written so that you may come to believe that Jesus is the Messiah, the Son of God, and that through believing you may have life in his name" (John 20:31).
>
> Obviously, the Scriptures that are collected into a book or Bible describe and speak about many other things — everything from the creation of the world to the world's end. Because these writings originate from a time period that spans about a thousand years and come to us in a variety of handwritten manuscripts and fragments, they have been studied carefully with all the tools of research that are available. This research continues to enrich understanding of the Scriptures and their message.
>
> Despite the diversity of viewpoints and the complexity of the many narratives contained in the Scriptures, Lutheran Christians believe that the story of God's steadfast love and mercy in Jesus is the heart and center of what the Scriptures have to say.

> Theology is a conversation. It involves speaking and listening, understanding and sharing understanding, and it consists of words written or spoken among two or more people for a specific purpose. In these conversations many questions need attention and many viewpoints are helpful. All participants have something to contribute.
>
> The ELCA is committed to fostering unity among the children of God for the sake of the world…The ELCA is committed to promoting understanding among Christians and greater unity among Christ's people. Brokenness can be healed and divisions can be overcome. To this end, the activity of ecumenical life in the ELCA is one of cooperation, facilitation, accompaniment and formation within this church, and with our ecumenical and interreligious companions. (Evangelical Lutheran Church in American, 2014)

Lutheran Church – Missouri Synod. According to the LCMS:

> We teach that the Holy Scriptures differ from all other books in the world in that they are the Word of God. They are the Word of God because the holy men of God who wrote the Scriptures wrote only that which the Holy Ghost communicated to them by inspiration, 2 Tim. 3:16; 2 Peter 1:21. We teach also that the verbal inspiration of the Scriptures is not a so-called "theological deduction," but that it is taught by direct statements of the Scriptures, 2 Tim. 3:16, John 10:35, Rom. 3:2; 1 Cor. 2:13. Since the Holy Scriptures are the Word of God, it goes without saying that they

contain no errors or contradictions, but that they are in all their parts and words the infallible truth, also in those parts which treat of historical, geographical, and other secular matters, John 10:35

We furthermore teach regarding the Holy Scriptures that they are given by God to the Christian Church for the foundation of faith, Eph. 2:20. Hence the Holy Scriptures are the sole source from which all doctrines proclaimed in the Christian Church must be taken and therefore, too, the sole rule and norm by which all teachers and doctrines must be examined and judged. — With the Confessions of our Church we teach also that the "rule of faith" (analogia fidei) according to which the Holy Scriptures are to be understood are the clear passages of the Scriptures themselves which set forth the individual doctrines. (Apology. Triglot, p. 441, Paragraph 60; Mueller, p. 684). The rule of faith is not the man-made so-called "totality of Scripture" ("Ganzes der Schrift").

We reject the doctrine which under the name of science has gained wide popularity in the Church of our day that Holy Scripture is not in all its parts the Word of God, but in part the Word of God and in part the word of man and hence does, or at least, might contain error. We reject this erroneous doctrine as horrible and blasphemous, since it flatly contradicts Christ and His holy apostles, set up men as judges over the Word of God,

and thus overthrows the foundation of the Christian Church and its faith. (The Lutheran Church - Missouri Synod, 2014)

Presbyterian Church in American. According to the PCA:

> Although the light of nature, and the works of creation and providence do so far manifest the goodness, wisdom, and power of God, as to leave men unexcusable; yet are they not sufficient to give that knowledge of God, and of His will, which is necessary unto salvation. Therefore it pleased the Lord, at sundry times, and in divers manners, to reveal Himself, and to declare that His will unto His Church; and afterwards for the better preserving and propagating of the truth, and for the more sure establishment and comfort of the Church against the corruption of the flesh, and the malice of Satan and of the world, to commit the same wholly unto writing; which makes the Holy Scripture to be most necessary; those former ways of God's revealing His will unto His people being now ceased.
>
> The authority of the Holy Scripture, for which it ought to be believed, and obeyed, depends not upon the testimony of any man, or Church; but wholly upon God (who is truth itself) the author thereof: and therefore it is to be received, because it is the Word of God.
>
> We may be moved and induced by the testimony of the Church to an high and reverent esteem of the Holy Scripture. And the heavenliness of the

matter, the efficacy of the doctrine, the majesty of the style, the consent of all the parts, the scope of the whole (which is, to give all glory to God), the full discovery it makes of the only way of man's salvation, the many other incomparable excellencies, and the entire perfection thereof, are arguments whereby it does abundantly evidence itself to be the Word of God: yet notwithstanding, our full persuasion and assurance of the infallible truth and divine authority thereof, is from the inward work of the Holy Spirit bearing witness by and with the Word in our hearts.

All things in Scripture are not alike plain in themselves, nor alike clear unto all: yet those things which are necessary to be known, believed, and observed for salvation are so clearly propounded, and opened in some place of Scripture or other, that not only the learned, but the unlearned, in a due use of the ordinary means, may attain unto a sufficient understanding of them.

The infallible rule of interpretation of Scripture is the Scripture itself: and therefore, when there is a question about the true and full sense of any Scripture (which is not manifold, but one), it must be searched and known by other places that speak more clearly.

The supreme judge by which all controversies of religion are to be determined, and all decrees of councils, opinions of ancient writers,

> doctrines of men, and private spirits, are to be examined, and in whose sentence we are to rest, can be no other but the Holy Spirit speaking in the Scripture. (Presbyterian Church in American, 2014)

Presbyterian Church (USA). According to the PC(USA):

> Some of the principles articulated by John Calvin remain at the core of Presbyterian beliefs. Among these are the sovereignty of God, the authority of the scripture, justification by grace through faith and the priesthood of all believers. What they mean is that God is the supreme authority throughout the universe. Our knowledge of God and God's purpose for humanity comes from the Bible, particularly what is revealed in the New Testament through the life of Jesus Christ. Our salvation (justification) through Jesus is God's generous gift to us and not the result of our own accomplishments. It is everyone's job — ministers and lay people alike — to share this Good News with the whole world. That is also why the Presbyterian church is governed at all levels by a combination of clergy and laity, men and women alike.
>
> Presbyterians confess their beliefs through statements that have been adopted over the years and are contained in *The Book of Confessions*. These statements reflect our understanding of God and what God expects of us at different times in history, but all are faithful to the fundamental beliefs described above. Even though we share these common beliefs, Presbyterians understand that God alone is lord of the conscience, and it is

> up to each individual to understand what these principles mean in his or her life. (Presbyterian Church (USA), 2014)

Southern Baptist Convention. According to the SBC:

> The Holy Bible was written by men divinely inspired and is God's revelation of Himself to man. It is a perfect treasure of divine instruction. It has God for its author, salvation for its end, and truth, without any mixture of error, for its matter. Therefore, all Scripture is totally true and trustworthy.
>
> There is one and only one living and true God. …The eternal triune God reveals Himself to us as Father, Son and Holy Spirit, with distinct personal attributes, but without division of nature, essence, or being.
>
> The cause of education in the Kingdom of Christ is co-ordinate with the causes of missions and general benevolence … there should be a proper balance between academic freedom and academic responsibility. …The freedom of a teacher in a Christian school, college, or seminary is limited by the pre-eminence of Jesus Christ, by the authoritative nature of the Scriptures, and by the distinct purpose for which the school exists. (Southern Baptist Convention, 2014)

United Methodist Church. According to the UMC:

> As United Methodists, we have an obligation to bear a faithful Christian witness to Jesus Christ, the living reality at the center of the Church's life and witness. To fulfill this obligation, we reflect critically on our biblical and theological inheritance, striving to express faithfully the witness we make in our own time.
>
> We say that God speaks to us through the Bible, that it's God's Word. This authority derives from three sources:
>
> - We hold that the writers of the Bible were inspired, that they were filled with God's Spirit as they wrote the truth to the best of their knowledge.
> - We hold that God was at work in the process of canonization, during which only the most faithful and useful books were adopted as Scripture.
> - We hold that the Holy Spirit works today in our thoughtful study of the Scriptures, especially as we study them together, seeking to relate the old words to life's present realities.
>
> The Bible's authority is, therefore, nothing magical. For example, we do not open the text at random to discover God's will. The

> authority of Scripture derives from the movement of God's Spirit in times past and in our reading of it today. (United Methodist Church, 2014)

The Relationship of Normal-Science and Mainstream Christianity Through Readers of an Expository-Narrative Science Text

This section presents the details of the reading of *Mr. g: A Novel About the Creation* (2012) by the seven participants, and their engagement between normal-science concepts and religious beliefs. The participants are presented in the order of my placement of them on Barbour's (2001) spectrum of engagement of normal-science and Christian religious belief interaction. By pseudonyms, the order is Dixon, Marie Kathryn, Connor, Kyle, Marie, Brady, and Alexander.

A brief review of Barbour's (2001) spectrum of engagement for normal-science and Christian religious belief is needed in order to quickly reference the position of the participants in relationship to one another. Barbour has four major classifications of engagement for normal-science and Christian belief; included are conflict, independence, dialogue, and integration, but when arranging the classifications in order to create a spectrum, I have chosen to remove independence from the spectrum, as independence would be non-interaction and thus not locatable on a spectrum for interaction. By situating independence as the non-interaction between normal-science and Christian religious belief, completely removed from the other three classifications, a spectrum from full opposition to complete integration is possible. Creating such a spectrum allows us to organize and describe different kinds of interactions between Barbour's three major categories: conflict, dialogue, and integration. Full opposition, or conflict between

normal-science and Christian religious belief exists, in the typical realm of either fundamentalist Christian belief or New Atheism (Barbour, 2001; Rorty, 2005). Moving towards the middle of the spectrum, conflict transitions into dialogue between normal-science and Christian religious belief. In dialogue, the two do not take on a role of informing each other, but rather interacting in a stance of non-combativeness. There can be an entertaining of ideas and discussion between the potential sides that does not result in competition or cooperation.

Moving past dialogue, the spectrum may be pictured as coming to a split, where two parallel tracks diverge to form two lines of integration. The two lines of integration are natural theology and theology of nature. In each line, one side takes the dominant position while the other side serves as the informer. For natural theology, normal-science is dominant and informed by Christian religious belief, but for theology of nature, Christian religious belief is dominant and informed by normal-science content. At the end of the spectrum, the two parallel lines of integration merge for a total integration between normal-science and Christian religious belief that Barbour called systematic synthesis. The order of presentation of candidates reflects the spectrum as interpreted by over the scope of the interview process: Dixon as independent, Marie Kathryn as conflict based, Connor and Kyle as independent with dialogue, Marie as dialogue, and Brady and Alexander as parallel forms of integration.

Each participant's interview experience is retold in a richly detailed manner that presents both the naïve hermeneutic and methodic hermeneutic as understood according to Dilthey (Dilthey & Makkreel, 2010). Each case is organized on a timeline from before reading the novel, their first interview, to after reading the novel, their second and third

interviews. For most participants, there was not a fundamental change in the way in which they engaged with normal-science and religion based on reading the novel. A change in the interpretive position between the before reading the novel and after the reading was not required. The purpose was to see how the participants were engaging normal-science and religion while reading an expository-narrative science and religion text and to see if they demonstrated a method of accessing normal-science content knowledge when opening up their religious identities.

Dixon. Dixon was a male participant and a senior at the university. He was an Engineering major and an honors student who participated in one of the university area campus ministries. Dixon, more than all other participants other than Kyle, had the strongest influences from science on his lifeworld history and experiences. Dixon's family members, particularly his mother and aunt, as science and mathematics professionals, provided a model for scientific and academic development for him to follow. Dixon shared that he had always exhibited a strong interest in science studies, and that his desire to do something practical led him into the field of bioengineering. Dixon took all the science that was offered at his high school; he described the range of available courses as being beneficial to his interest in science and preparing him for his college science and engineering course experiences:

> I took all of the [course]. So magnet has everything as an honors course in terms of difficulty unless there is no way to code it as an honors course. AP Physics I didn't enjoy. That was rough. That was so rough. I was telling myself....that I would never have a course that was harder then that…I was going to college and

> was like 'You are going to figure that out.' (personal communication, September 20, 2013)

Until Dixon went to a magnet school for science and mathematics in high school, he attended a religiously-affiliated private school administered by the Presbyterian Church - USA (P-USA) denomination, the traditionally liberal Presbyterian denomination. Through the religiously-affiliated private school, Dixon described his early and middle grades science education as highly positive and said that it was influential in leaving the private school to attend the magnet science and math school. Dixon was comfortable with normal-science and viewed his lifeworld mostly through his normal-science pre-understandings.

Dixon identified as Lutheran, specifically as a member of the Evangelical Lutheran Church in America (ELCA), where he grew up. Growing up in an environment surrounded by family members that were both religious and supportive of learning normal-science, Dixon recalled that he did not have any specific memories of scientific material being discussed in a religious setting but that his denomination takes a very science positive view on traditional issues where normal-science and religion may be seen as intersecting. It was not uncommon for two church members to be heard discussing normal-science related topics pertaining to news or their work. Dixon brought up the topic of evolution on his own and indicated that, from his experiences in his home church, the idea that the Earth is only 4000-6000 years old was ludicrous and not at all accepted among the people in membership. This indicated two immediate things: first, that Dixon was familiar with the concept of the evolution debate and the idea of new Earth creationism, and second, that Dixon had an understanding of the ELCA as being

progressive and supportive of science and religion interactions and positive relations. Dixon stated, "Relative to some other denominations of Christianity, I feel that Lutherans are more accepting of new views and try to merge them more than some of the others" (personal communication, September 20, 2013). These 'others' Dixon referred to are those that would "take the Bible at very face value and the Earth is 4000 years old and anyone who says otherwise is lying or they are wrong" (personal communication, September 20, 2013). He clarified that "this is not everyone in those denominations but I have seen some people say 4000 years and then they want to be a doctor or a nurse and that is something that I have a struggle with trying to figure out how they handle it [science and religion]" (personal communication, September 20, 2013). From this it became clear that Dixon saw science and religion as entities that are not in conflict with each other, from his particular denominational viewpoint of Christianity, and that he did not participate in the myth of conflict via Barbour (2001); he did, however, acknowledge that there are many Protestant Christians that do believe normal-science and religion are in conflict with each other, but he greatly disagrees with them. Dixon placed science and religion as separate fields, but he did not limit them to Gould's (1997) idea of non-overlapping magisteria. Science and religion, particularly through an individual person and their beliefs, tend to interact, however, they are not in a constant state of interaction or informing each other. Dixon specified after his reading of the novel that the novel confirmed how science and religion interacted for him:

> Just because being in the field that I am, I have had to come up with ways to.... essentially take my religious texts of the Bible and be able to say that this stay true but at the same time being a scientist and a researcher, I have to also take the

> entire breadth of literature. You can't just say, 'I agree with all of this except this'....which have been shown by the scientific method and that they are true....so I have had to come up with my own ways to justify the different aspects of the two and merge them into one. (personal communication, October 9, 2013)

This ability to interact was Dixon's pre-understanding and put him in Barbour's category of independence with the possibility to entertain dialogue. Dialogue, according to Barbour, does not have to always be positive and in mutual good feeling, but it is not in a state of constant conflict and it typically leads either a productive relation between the two realms or the open communication between the two. For Dixon, it was the open communication between normal-science and religion that was possible from his pre-understandings. However, they did not always exist due to a conscious separation he made for science and religion. This conscious separation was based on his pre-understanding of what normal-science was to be; without subjective input.

For Dixon, the novel represented the type of dialogue science and religion has the potential to achieve; this was because his viewpoints on both allowed for growth and questioning in what he believes:

> In order to call yourself a scientist you have to.....you have to be able to follow these rules but like religion you get flexibility in like what you believe cause.....different, even different denominations of Christianity have different views or different takes on something and while that is defiantly true about the scientific community as well. (personal communication, October 9, 2013)

Dixon recognized religion as presented in the novel, as being universal in terms of applying a creation story that would be able to situate itself in the Abrahamic religions, Hinduism, and Buddhist spirituality. Dixon's pre-understanding of religion was not limited to Christianity or even his personal Christian beliefs. Religion is greater than one codified religion, or even organized religion:

> Because I believe that religion is.....there is no.....there is no, religion is very much an individual thing and it is how you choose to express your belief and.....one of the….what I believe to be a basic human right is that you cannot force your beliefs on someone else or that it is wrong to force your beliefs on someone else. (personal communication, October 9, 2013)

Religion is individual; it is Rorty's (2005) weak thought on religion belonging to the individual and not to the organized religious entity.

When reading the novel, Dixon said he focused more on the religious themes and discussions than the science because he was already familiar with the majority of the normal-science being presented. His science background knowledge was sufficient to understand the normal-science related material that was presented, and he also had enough religious background content knowledge to recognize the wide religious themes presented throughout the novel. He could also apply them outside of his Lutheran (ELCA) denomination of Christianity. Normal-science that was presented aligned with his pre-understanding of normal-science and religious concepts that were presented aligned with his pre-understanding of religion, even if not with his personal religious beliefs. The science and religious content of the novel dialogue echoes what Dixon has understood from his Lutheran (ELCA) lifeworld experiences:

> I am not an expert on what the Lutheran denomination says about certain science, but I have always appreciated the messages that I have gotten in church and Sunday school and Bible school, which is more of an acceptance of whatever science is able to come up with. Yes, we can incorporate that into what we have…which goes very well with the message of this book I think. (personal communication, October 9, 2013)

Interpretive engagement with the text was difficult to determine for Dixon, as he professed understanding that the normal-science content and the religious themes that he pulled out already conformed to his religious background. His deepest engagement was his interpretation and understanding of the Void and its potential to be synonymous with the afterlife, specifically the Christian construction of Heaven. While all reading action can be attributed as a hermeneutical experience, this action was where Dixon best demonstrated moving between pre-understanding and understanding. The discussion of afterlife, or the potential for one, between Mr. g and Uncle Deva and their realm of the void led Dixon to examine his personal conception of Heaven and to pose the question of whether or not questions of religious belief are answerable at all. When pressed as to why religious questions may be unanswerable, Dixon returned to his concepts of normal-science in verifying what is answerable and not in that "there is no way to go out of this universe that we have" to investigate the question (personal communication, October 23, 2013). Dixon clarified:

> Questions about faith would be unanswerable just because I think that there are some questions out there that you can have a belief that is, that this is the answer,

> but there is no way to know in absolute terms that it is the answer. (personal communication, October 23, 2013)

Dixon pushed this view of religion questions to not just the immediate one he came to, but too much of religious or faith questions in general:

> I think that most faith questions actually, using what I call an absolute result, most faith questions do not have an absolute result just because to have the absolute result you would need to be able to talk directly to your God or your deity and that is something that I don't believes happens unless you are in heaven or in the afterlife, whatever you're calling it. Um, now I do believe that there's some questions you could be praying about and that then you could find an answer to someone else, however I would call that not an absolute answer. I would call that an answer to a prayer to something else and that's how that person interprets it, which is the answer and that while in your mind this is clearly the right way, I feel that another individual who's late evaluating your action could say no that could be interpreted somewhere else, someway else. Whereas I call the after the interaction talking directly to your deity of God would leave no room because that would be an answer directly to a question. (personal communication, October 23, 2013)

For Dixon, science took a different approach in that questions are not unanswerable, but rather they are not absolutely answerable for all of time. For Dixon, normal-science questions were exempt from this absolute answerability because science cannot "see into the future," and according to him, the nature of science dictates that the answer to the

question is a fact until it can be proven incorrect and changed (personal communication, October 23, 2013). This is consistent with the current paradigm of normal-science. For Dixon, this changing evidence prevents the absolutivity in science that is attempted at in religion; but unattainable in his opinion as stated:

> The laws of physics are called laws because they have been proven by multiple, multiple experience and they have held true to the test of times; however, even they can be overturned if someone suddenly discovered that it's a + b + c + d happens then gravity no longer exists. (personal communication, October 23, 2014)

Science and religion for Dixon did not change in their relationship upon the reading of the text; however, a notable change is not something that is always indicative of hermeneutical engagement. Hermeneutic engagement occurred for Dixon in that his understandings fit with his pre-understandings, and they continued uninterrupted for both normal-science and religion. For Dixon, science and religion maintained their independence from each other through his conscious separation of what a professional scientist should be; however, dialogue between science and religion could be afforded to each through Dixon, but not in his professional scientist identity.

Marie Kathryn. Marie Kathryn was a female participant and a senior at the university. She was a Psychology major. She did not regularly participate in an area campus ministry, mostly due to being a year-round student athlete. Occasionally, Marie Kathryn had participated in one of the larger weekly campus ministry meetings, but not on a regular or consistent basis. Marie Kathryn identified as Baptist, but was not sure of the specific Baptist denomination to which she belonged. From knowing the church that

she currently had membership with, it was determined that she was from a Southern Baptist Convention church. It was telling that Marie Kathryn did not consider Southern Baptist Convention membership important in how she identified religiously and that she was unaware of the ideological differences between the numerous Baptist conventions found in the United States. Marie Kathryn could remember growing up in Baptist churches; she recalled that her paternal grandfather was a Presbyterian minister in the Presbyterian Church in America (PCA) denomination, the more traditionally conservative Presbyterian denomination. She had a strong interest in science, specifically related to biology or medicine; however, despite her interest, she had always expressed difficulty in science related courses, including biology and anatomy, due to content details, vocabulary/technical language, and the way in which she described science content as being written. She described herself as liking science but found it generally more difficult than other content areas. She chose psychology over anatomy as her major due to her previous struggles with how science is written in textbooks and the technical vocabulary. Marie Kathryn was intrigued with psychology because it concerns the way in which people think about things and what they do about what they think. This statement by Marie Kathryn could link her to being accepting of a more interpretive viewpoint than a traditionally objectivist view. This came through in the way that she was open to thinking about adverse concepts that were against her pre-understandings, yet as will be shown, she was generally non-interpretive when it came to matters of religious fact or details. With normal-science concepts, she could envision them as her interpreting content, detailed here with the discussion of cosmic gases from the novel:

> It was just me trying to understand and convince myself that.....He did think about that stuff as being done and like certain things.....I took a lot of notes but I didn't think anything was really science mostly, it was just me disagreeing or agreeing on how like.....maybe He didn't think about that stuff but how maybe He would because it isn't really talked about in the Bible and stuff. (personal communication, October 9, 2013)

While Marie Katherine stated that she could interpret science, religious materials were always based on what she had learned previously in a religious setting and not how she could personally label interpreting them from other materials; in this case, the reading of the novel:

> Well growing up in church I learned that God took a day to create like people and then plants and the sun and the stars and stuff like that and He took like a long time to create just one universe and then didn't even know if He wanted to put anything on it and then didn't even know if He wanted to put people on it....and then didn't know if He wanted to.....it is just like a lot of Him not knowing and I don't think that God just didn't ever know what he wanted. (personal communication, October 9, 2013)

Despite her interest in science through biology and medicine, Marie Kathryn did not recall many positive moments in her science learning history; this was mostly due to the difficult nature she prescribed to science. Science was difficult and challenging, and she did not enjoy it outside of biology and medicine.

For Marie Kathryn, religion, specifically her upbringing with Southern Baptist theology, played a significant role in how science and religion existed in her lifeworld. There was a science realm and there was a religion realm, but the religion realm was more important to Marie Kathryn than the science realm in every facet of her life. There was a hierarchical importance of the religion realm over that of science realm for her. For Marie Kathryn, everything ultimately belonged to religion, or was surrounded by or brought back to her religious understanding. Religion surrounds science, but science did also have a basis for some of her understandings. What was clear is that religion and science are not two completely distinct areas. Science exists as a realm, but it is still governed by religion, or, for Marie Kathryn, and the God of her religious beliefs:

> The ideas, just like I said.....I take creation as God didn't discuss what he put into things it was just he knew what he wanted it to look like and that he had thought about it obviously but I don't feel like it was ever mentioned because that wasn't the whole idea behind him making whatever he made. And so, that is why it was hard for me to grasp it because it was science stuff involved in it, I guess. (personal communication, October 9, 2013)

Her recollections of the interactions between science and religion were predominantly negative, with normal-science and religion disagreeing on aspects of the creation of the universe, the Earth, and, particularly, the evolution of life. In each of these instances, she saw science as being opposed to her understanding and the understanding of her religious theology:

> I feel like any science class you take in high school or college evolution gets brought up, but I don't really consider that religion. It argues against religion…

> People thought that the Earth just like popped up or that stuff was put on it in no order or for any reason. (personal communication, September 6, 2013)

Her Southern Baptist-based theology, which is considered mainstream Protestant, albeit evangelical Protestant, was her basis for pre-understanding between normal-science and religion. It is where she started from, and according to herself, where her understanding of science ended if they conflict:

> None of us were there for the stories [in the Bible] so there is really no one to say that that is not right. But with science, there is (sic) all of these scientists who have made all of these documents and stuff that say things are the way they are for a reason…So I do feel that there is a yes and a no [to where they conflict]. (personal communication, September 6, 2013)

Due to this lifeworld history, Marie Kathryn's initial pre-understandings from the first interview were placed into Barbour's (2001) classification of conflict between science and religion.

After the initial interview, when it was clear that Marie Kathryn was situated in the conflict classification, I was initially concerned that she would not be suitable for the study; however, this was a very shortsighted thought. Keeping Marie Kathryn as a participant in the study because of her conflict classification was an easy methodological decision as she represented a significant portion of the American public and school-aged (secondary and undergraduate) learners within the study's regional geographic area. How Marie Kathryn engaged with the novel was a concern I had as a researcher.

However, the benefits she could potentially provide to this study or future research outweighed the cost of time in allowing her to continue in participation.

From her reading of the novel, Marie Kathryn did not think that any of the normal-science content presented had a direct connection to her personal understanding of religion. Though she knew the character of Mr. g was supposed to represent God, he did not align with her notions of the Christian God. Despite her stated disconnect, she did go ahead and make a connection to religion:

> I would try to connect it in my own way because like I said growing up in church and my idea of creation had nothing to do with science, but I would try to understand that maybe God did think about that stuff, but was never taught to me that he did. So I would try to understand that maybe he did think about what gas was going to go into this and how it was going to work. But I never thought about it or stuff like that. (personal communication, October 9, 2013)

Falling back on her pre-understanding that science and religion typically do not inform each other, at least with respect to cosmology or evolution, she attempted, and struggled, but shared her conclusion that it [cosmological creation] could have happened in the manner described by the novel, and that normal-science may have some place alongside her religious understandings. Thus, her religious and normal-science pre-understandings shifted, if only slightly, towards each other. Though Mr. g does not represent her God, the Christian God, Marie Kathryn interpreted the presentation of cosmological creation from his standpoint as being a possibility; she simply did not understand enough of the normal-science concepts to be able to connect them to any of her religious concepts about cosmological creation. For her, more than any other participant, there was a constant

swing from her original pre-understanding, to understanding, and then back to her original pre-understanding again:

> I guess I had more of an open mind to it because I knew it probably wouldn't be exactly what I believed but I felt like I am still at an age and well not really stage in my religion because I know what I believe, but I am at the age where I feel like I should be more open-minded to other ideas and stuff. I question stuff that I read and learn in church all the time and I go back and try to understand it, so why not look at it from a different view that I guess is more scientific that way.
>
> I don't feel like I will ever believe in the science part of it but I will try to with the book, when it would mention science stuff to relate it and understand how God would have actually thought of that stuff. (personal communication, October 9, 2013)

Hermeneutically, Marie Kathryn was more aware of how she was engaging with the text in terms of her pre-understanding and understanding. Due to the constant movement between where she came into the text, to where the text prompted her to consider new possibilities, and then returning back to what she knew, Marie Kathryn's engagement can best be described as spiraling circular model of understanding, which took up new normal-science content and integrated it into her religious pre-understanding. The gathering of this objective normal-science content continued to slightly shift her religious understanding; what cannot be determined is if her understanding was shifting more towards an objectivist view of normal-science, or in some direction towards a more religious understanding that incorporates acceptable normal-science facts.

For Marie Kathryn, *Mr. g: A Novel About the Creation* (2012) was a book that presented science and religion in a cooperative setting where each was presented as being useful to each other. This was not the setting of her lifeworld experiences and historical contexts prior to reading the novel. The religion that was presented was generic to her Christianity, and while it had some similar components to Christianity, it was not Christianity or any definable world religion to her; however, Marie Kathryn believed that to be the intention of the author as to appeal to a wider audience. Due to the lack of Christian specific religious discussion in the novel, Marie Kathryn stated that she did not feel that the novel presented over-arching religious themes with which she could connect. There were religious characters in the novel, but not from a religion that she recognized, including Christianity. There was only one instance where she did make religious connections directly to her Christianity. This was in the presentation of the antagonist Belhor. While recognizing that he was cast in opposition to the god-like Mr. g, Marie Kathryn framed Belhor as the embodiment of sin through temptation, a connection to her religious pre-understanding:

> He was obviously like a demon figure and this little like things that walked around with him were like demonic or whatever. So then I guess, it wasn't like one to the other but he was like both…. especially in those little things. I kept reading about them and freaking out and I was like <shudder> but then the part that made me just think of him as only being like sin was that by the end of the book I didn't think he was like either…demonic or Satan…I just thought it was sin, period. And then after he made the comment about 'you created me whenever you created the people' and stuff. And then mostly that is what made

> me think that was the way that he was like hypnotizing and stuff. (personal communication, October 9, 2013)

Marie Kathryn specifically related Belhor to the antagonist in the Book of Job, who is generally referred to as the Old Testament version of Satan in mainstream Protestant Christianity. Marie Kathryn's religious interpretations of Belhor were very much in line with her Southern Baptist upbringing and Southern Baptist theology and interpretation of Satan. This was the only instance for her where her religious pre-understandings were in line with her experience of religion as presented by the text.

Connor. Connor was a male participant and a junior at the university. He was an Engineering major and a student-athlete for a spring sport. Connor did not actively participate in an area campus ministry because of his time constraints with athletics, but he had attended large non-denominational sponsored events, about twice a year. Connor identified as Episcopalian, as this was the denomination in which he was raised. Even though he considered himself as having been raised in the Episcopal faith, his mother and father are of different denominations; his mother is Episcopalian and his father is Roman Catholic. Connor participated actively as a youth, serving as acolyte during his teenage years at his home church. At the time of the study, he considered himself a CE Christian as defined by his home pastor, meaning that he now attends formal church services only at Christmas and Easter when he is with his family. Connor stated that he was metaphorically raised in the church through being involved with his mother's activity; his life background includes interaction with many diverse populations and people of other religious faiths. This diversity while growing up led Connor to look at individuals apart from their religious faith, and to look at religious faith apart from the organized religion

that it emerges from. This view closely parallels Rorty's (2005) view 'weak thought' about religion. Religion for Connor was a personal matter. The religion of those around him mattered little in his social interactions, as supported by his infrequent interaction in collegiate religious activities despite invitations from numerous teammates. This was not due to just athletics, as he described some of his teammate friends as highly religious and frequent participants in campus religious activities.

Connor had always expressed a strong interest in mathematics, particularly in its more practical applications, leading to his pursuit in engineering. While being mathematically inspired, he was also an avid reader, but did not share a passion for writing. "Math is much more clear-cut than English and in math there is always a finite right or wrong answer. In English there is a lot more grey area and I always wanted a black and white academic endeavor," Connor stated (personal communication, September 8, 2013). His conceptualization of normal-science aligned with the definition of normal-science as selected for this study; for him, science was something that was measurable and objective. He had a strong physical sciences background and was comfortable when science presented itself in his everyday world. A casual observer, based on Dilthey's naïve hermeneutic, would expect this for someone studying engineering. Connor stated that he had a predisposition to look at most things in life from an engineering and science perspective, even using the term lens, thus being aware that he looked at most things in a particular way that is "very dependent on the lens that you are looking through and the situation that you are in" (personal communication, September 25, 2013). His lens emerged often when discussing his reading of the novel and how he encountered the religious themes that were presented.

Connor described his experiences with science from elementary school to the undergraduate level as strongly positive. For the most part, he remembered science and religion as being generally isolated from each other. Religion, through his Episcopalian raising, had an infrequent interaction with normal-science. Interactions of this nature are viewed as science/religion neutral when coded from the inductive thematic analysis. For Connor, the two sources of knowledge led separate existences, neither informing each other nor creating conflicts. Connor separated science and religion into two non-contiguous life areas, which closely resembles Gould's (1997) concepts of non-overlapping magisteria. The domains of science and religion occupy two distinct areas of knowledge and do not overlap according to Gould. To Connor, this was how they normally were presented. Science answers questions pertaining to the physical realm, and religion answers questions regarding faith matters:

> I guess you were kind of taught this through everything and I have been taught this as the kind of main difference between science and religion is that religion is a theory and it is a belief and it is passed down by word. It is things that people talk about and believe. It gives them explanations for things that they might not understand and give them hope in bad times and science is as emotional as religion is, science is just as unemotional. Science is....there is no feelings in science and no such things as hope. You have things and there are things that you don't have in science. You have Newton's Laws and you have gravity. You can....well obviously you can't touch gravity like you can touch a table but you can see an apple falling from a tree. Science is much....well religion is much more belief driven and to me science is empirical and tangible. If it is science you

> can touch it. If it is science you can see it. (personal communication, September 8, 2013)

Beyond neatly falling into alignment with non-overlapping magisteria, Connor's infrequent science and religious interactions shaped him into Barbour's (2001) categorization of independence for science and religious interactions. Connor understood science and religion to be set in their identities; this was his pre-understanding.

Prior to reading the expository-narrative science text, *Mr. g: A Novel About the Creation* (2012), Connor understood science and religion to be separate in their interactions in his lifeworld. Through his reading of the novel, Connor viewed science and religion interacting in a slightly altered ways. How he got to this altered understanding, his new interpretations and understanding, and his engagement with the novel must be detailed. Connor revealed that he was deeply engaged and interested in the novel and stated that he read the novel twice during the interview process, initially between the first and second interview, as all participants did, but then again between the second and third interview. Connor described the novel as being one that must be read not once, but several times to get at everything that is being conveyed and discussed:

> I feel like that just through talking and you mentioning things that this book, you read it once but this book could really be expanded through further research. I feel that his is the kind of book that that if you were to really analyze it and go through it, I read it as a typical reader, reading and I'm taking things in…there are ways that you can read things and I remember, the book I have read a hundred times is *The Great Gatsby*…and it is the only book that I have ever written notes in. It is like my favorite book of all time. I can read it in a day. And that is a

> book that I have gone through before as I read it two or three times, because I'm reading it and I'm interested in the story line and I want Belhor to come back and I want to see if he explains things because he is a jerk….and I'm reading it from that perspective, but as you read it again and again, you know the story and every time you read it you see deeper into it. This is a book that I feel could really expand upon two, three, four, five readings when you start to do research and you start to notice the small details.
>
> You can read this book a hundred times and find something new every times. Um...especially the second time, I mean kind of like...and the more times you read it, less is going to change every times. But there's always going to be something no matter how small a detail it is, you probably didn't pick up the first time. But that you've found a new piece of the puzzle, it uncovers another piece. So you read it, you read it a hundred times, the hundred and first time you read it, you only pick up on one new thing. But the hundred and second time you read it, because of the last thing you picked up, you pick up something else. (personal communication, October 23, 2013)

Connor saw value in continual rereading of the text and through this, he spoke of constantly acquiring new understanding between the readings. According to Connor, not all texts that he dealt with regularly required or allowed for this type of rereading or layered reading. Fiction texts that are open to interpretation, as are as many science texts, though Connor says science texts are not typically thought of as being able to be interpreted subjectively like content texts. Science and engineering textbooks allow for

one time understanding only, according to Connor, and after that, information has been mastered, there is no need or particular desire to reread them unless it is for clarification of content details.

In reading *Mr. g: A Novel About the Creation*, despite having been brought up in a mainstream Protestant Christian denomination, Connor did not apply the religion and religious themes presented in the novel to a direct Christian connotation. This can be seen as a result of his pre-understandings of religion as being more encompassing than just Christianity, and can be linked back to his mother exposing him to a diversity of faith communities. To Connor, the character of Mr. g portrays the Christian God, but according to him, Mr. g could just as well serve as a stand in for any of the 'God' portrayals of the Western Abrahamic faiths. All of Connor's religious connections when reading the novel were of a non-identifiable religious nature, typically more vague than attributable to just Christianity, but still religious in nature. He stated that he interpreted them in the historical context of his Episcopalian upbringing, but that did not make them correct, nor did it change how they were intended for interpretation. Connor stated that he believed that from the way the author, Lightman, constructed the narrative, most any interpretation of the religious connections in the novel would be okay, due to Lightman's very generalized religious tones.

Connor stated that prior to reading this novel, science and religion rarely interacted, and that when they did, it was on a fairly neutral level; they would come into contact, but not influence each other in a positive or negative way. During his two readings of the novel, Connor did not feel that science and religion really had much interaction, even though the "entire book is about it" (personal communication,

September 25, 2013). Connor stated that Mr. g created science, but that he did not create religion, which he credited to the animate matter in an effort to understand Mr. g. For Connor, the engagement of science and religion in the text came from the discussions between Mr. g, the God figure, and Belhor, the antagonist. Connor was the only participant that did not describe Belhor as the outright Satan figure from Christianity. He recalled that the reading notes at the end of the novel gave the history of the name Belhor as being linked to Satan in Judaism; Connor, however, rejected this as not being in line with his pre-understanding of Satan as popularly represented in Protestant Christian theology. To Connor, Belhor was not evil, but merely morally ambiguous. Belhor was more of the Devil's advocate in his engagements with Mr. g through conversation. Connor explicitly stated that religion does not equate morality, and that the grand discussions between Mr. g and Belhor about good and evil were about morality and not religion, applying to a much larger context then one identifiable religion:

> The good and evil discussion was just, it was never religion…It was just life.....which I guess a lot of people would view that.....like this is my view on religion because basically like they would talk about sports, I never really read the Bible and created my own opinions on religion...I could....that good and evil discussion could have really or is probably the heart of religion and things like that, but for me, the religion has always been like Gospel and at Easter and Christmas and things like that. To me the good and evil discussion is just life. It is decision making. It is morals and how people live their lives and just kind of the fabric that makes everything tick, I guess you would say. (personal communication, September 25, 2013)

> It's not a book on Christianity, it's not a book on Judaism, it's not a book on anything specific, it's just religion. And it kind of, it encompasses all religions in that this book doesn't hit on resurrection. This book doesn't ever talk about Easter, there's no ... they [inaudible 00:28:09] in this book. It hits on kind of what you could maybe classify religion as a whole as. Like if you could be completely ... I don't know what the proper term is, but basically not holding towards any specific religion and just look at them all as a whole. You'd come down to good versus evil, which is really what this book talks about. (personal communication, October 23, 2013)

To Connor, religion does have to do with morality, but morality does not have to do with religion. When science and religion interacted for Connor, they were better described as science and morality, or religious morality, interacting, which was demonstrated to him through the dialogue between Mr. g and Belhor. Coming into this study, Connor was classified using Barbour's (2001) four classifications of science and religion interaction as independent, based on his pre-understandings of science and religion as both strong but separate from each other. While I would hold that this was still primarily the case for Connor at the end of the study, he made progress towards dialogue between the two realms he held as previously independent. In terms of his engagement, Connor's may be said to be limited and cautiously engaged in normal-science and religious concepts. Normal-science pre-understanding supported normal-science content presented in his reading, and the religious characters in the novel fit into his pre-understanding from his Episcopalian upbringing, with the exception of Belhor. However, Connor expanded the

role of religious themes in the novel to pertain more to morality than organized religion or established religious practice. Normal-science and religion, at least organized religion, do not inform each other; however, normal-science and religious beliefs, including morality, may fall into dialogue about each other.

Kyle. Kyle was a male participant and a senior at the university. He was an Engineering major who participated in an area campus ministry. Kyle identified as Lutheran, specifically from the Evangelical Lutheran Church in America. As noted in the methodology section and the intersubjectivity details, I had known Kyle for several years prior to this study due to him being a youth at a church that I was a member at during my undergraduate and Master's time in the community. While I had known Kyle casually as a fellow church attendee, I would not classify our prior contact as friendship or having anything other than a casual acquaintance with each other.

Kyle had a strong background in normal-science content and influences from his lifeworld. Kyle revealed that his paternal-grandfather earned a doctorate in Engineering and that his father earned a doctorate in Genetics. Both were university professors. Science had always fit comfortably in Kyle's life. Through his father and grandfather, Kyle says he learned to appreciate and develop an interest in science and engineering at a young age. Kyle recalled enrolling in a pre-engineering program that was offered in late middle school and ran through three years of high school. In his science classes, he said that religion did not really come up that often, but there were two times where he could recall religion in science class. Religion came up in his biology class when discussing evolution, although it was not actually discussed by the teacher because "you aren't supposed to learn about religion in science class" (personal communication, September

20, 2013). This suggests that Kyle did not view normal-science and religion as having a public interaction with each other. Kyle recalled this as being neither a positive nor a negative interaction, just the non-discussion of science and religion together. Kyle attributed the makeup of the students in his class as being mostly children of faculty at the university, and as not having a strong desire to discuss science and religion together. As for Kyle, he was one of the more involved students in religious life through his church, and he did not feel like it was a topic that should be discussed in the science classroom either. Science and religion engaging together, especially in a science classroom, did not fit his pre-understanding of either science or religion or his pre-understanding of what public school should entail.

Since Kyle grew up in the same town as the university he attended, he had never changed churches as a result of moving to college. Kyle described his home church as progressive and liberal, and populated by a large amount of current and retired university professors and employees. Having been a member of this same church, I could confirm that assessment. Kyle, being fairly familiar with Lutheran theology, or that of the Evangelical Lutheran Church in America, said that Lutherans "get along pretty well" between science and religion and that "you don't really hear a lot about Lutheran's crying out against it or science" (personal communication, September 20, 2013). This getting along well with science was his interpretation of ELCA doctrine as official church position, supporting current science education standards and goals. This 'crying out against science' is what Kyle said he was most familiar with Christian fundamentalist or more theologically conservative Protestant denominations stand for, particularly when talking about teaching evolution instead of teaching creationism. 'You don't hear that'

coming from Lutherans, particularly those in his home church. This stance of not buying into the myth of conflict between science and religion is where Kyle began with his pre-understanding.

For Kyle, science and religion were separate domains, via Gould's (1997) non-overlapping magisteria. It was clear from Kyle's statements about science and religion in schools that he did not view them as interacting or having any regular ongoing dialogue, but that they were both present and significant in his worldview. Church members may discuss science, and scientists may discuss religion, as seen in his family life, but science and religion as institutions do not dialogue. For Kyle, science had a very definable area of knowledge, while religion did not have the same definable area of knowledge. Kyle described it as science being a large area that encompassed several sub-areas of knowledge like biology, astronomy, physics, etc., but religion as not as constrained because it is different for different people. For Kyle, religion was more likely to interact with science then science with religion; when they do interact, they should be open to communication with each other, as he said they are through him and those that he learned from like his father, grandfather, and fellow church members:

> I think they get along pretty well [science and religion]…. A lot of Lutherans I guess you could say aren't particularly fundamentalist. Especially when you talk about creationism. In high school we talked about like the ELCAs official stances on things. Most of it was just finding the most complicated way to say nothing at all. (personal communication, September 20, 2013)

This pre-understanding did not neatly fit into any one of Barbour's (2001) categories of interaction. It was certainly not conflict or integration, but it was also not clearly total

independence or complete open dialogue. I placed Kyle's interactions between science and religion somewhere in the vague area between independence and dialogue, where science and religion may encounter each other at some instances, but generally remain in their respective areas.

When reading the text, Kyle was very systematic in his interpretations of the novel. He divided the text into normal-science content and religious content and focused on them independently of each other. This echoed his pre-understanding of a mostly independent existence for science and religion. Kyle explicitly stated that throughout the novel, science and religion are "kind of like a separate thing" (personal communication, November 8, 2013). "Nothing here seems to contradictory to what I know about science or God" (personal communication, November 8, 2013). While science and religion did not seem to be interacting with each other, or bumping into each other as Kyle put it at one point, the novel was confirming the pre-understanding the Kyle already had in both normal-science and religion. Due to Kyle's overwhelming amount of normal-science knowledge, he found that the way in which the science content was presented in the novel met his understanding of where normal-science stands and what normal-science is:

> He describes the science in like very human terms. I think it is the author just trying to get his point across. He speaks in very, in terms of like what we understand to be true right now, but are not necessarily proven to be actually the way that the universe works. So…it makes sense in 2013 but in like 100,000 years they will have figured out that something works differently and then this book won't be relevant. (personal communication, November 8, 2013)

Dixon was the only other participant that identified normal-science as containing knowledge that changes over time; this particular point of emphasis that Kyle brought out hit on the principle that normal-science is not a fixed domain and that content knowledge that holds true at one time does not necessarily hold true in another time. For all participants, the religious content that was presented in the novel was the information to be interpreted, and would likely change. The normal-science content was factually true, and no participants other than Kyle and Dixon noted that that content had the possibility to change, regardless of their agreement with it. Science content was science content.

In terms of the novel's presentation of religious content, Kyle's understanding was in line with the traditional ELCA theology. To Kyle, the way religion was presented in the novel was not the product of God, but of the animate matter. Religion, or at least what Kyle saw as ideas pertaining to how religion is understood today in the world, is the product of Belhor's conversations with Mr. g in determining what is good and what is bad. Like Connor, Kyle also did not explicitly identify Belhor as Satan or the Devil from Christian and Abrahamic theology. Belhor was explicitly the Devil's advocate. He was not the opposite of Mr. g, but rather presented ideas that were opposite Mr. g. Kyle even incorporated Belhor into his scientific pre-understanding, where Belhor was most like the outside scientific reviewer, to likely propose the possibilities of what could or might happen, or things that may be merit consideration. This idea of religion, or as Kyle said, moral philosophy, was shared with Connor. Both Kyle and Connor, as previously mentioned, saw their pre-understanding of science and religion as being independent from each other. While both grew up in mainline Christian denominations that shared a common theological development, Episcopalian and Evangelical Lutheran specifically,

both had a view of religion as presented in the novel as being more about moral philosophy than traditional Christian theological ideas.

Marie. Marie was a female participant and a senior at the university. She was a Veterinary Medicine major who participated in one of the university area campus ministries. Marie identified as Lutheran, specifically from the Evangelical Lutheran Church in America denomination. Unlike the other participants in this study, Marie was homeschooled for a large period of her youth, up until post-secondary education. Marie noted in her homeschool environment there was not the traditional barrier to religious discussion that is present or perceived to be present in public schools around normal-science's attitude towards religion. She said she had not "really had like a lot of experience with that but definitely science people who are I guess the most...I've never heard people talk about religion in a good way in science. It is mostly about people talking sort of scornful about it" (personal communication, September 20, 2013).

Marie's interest in science originated through her love of animals at a very young age. By the time she was middle school age, she was volunteering at a local animal hospital and started working there during high school. Through her practical, hands-on experience in veterinary medicine, Marie found an interest in biology and anatomy of vertebrate animals. Science, in terms of its practical applications relating to animals, was a driving force in her learning. Due to her homeschooling, Marie had experienced very little science and religious interaction in the public educational setting. Though her homeschool was not religiously-oriented, she noted that she did not ever really learn about hotbed normal-science and religious issues like evolution or cosmology in her science instruction until she was in college: "Not so much in high school because I was

actually homeschooled in high school, so I was decently sheltered on that kind of stuff but when I did biology in college it came up sometimes" (personal communication, September 20, 2013). Marie, unlike most of the other participants, also had little recollection of science ever being talked about or brought up in her home church or other religious setting. To Marie, science and religion existed as separate entities in her younger experiences. In her lifeworld experience, they occupied separate domains that were present in very different areas of her life. They did not engage each other in any meaningful conflict or cooperative capacity that left an impression upon her. She knew that "some people are like 'in the Bible it says absolutely nothing about evolution, so it obviously doesn't exists'" but she did not "personally believe we grew from monkeys but at the same time I believe in evolution and obviously things change over time, but not everyone sees it that way" (personal communication, September 20, 2013). Evolution is a normal-scientific concept that she did not fully understand by her own admission, but through her comments on evolution, I observed she was aware of the conflict issue that exists for some people in the interaction of normal-science and religion. For Marie, the myth of conflict between science and religion also had little meaning. She knew that some people had issues resolving evolution and their religious beliefs, but she had never witnessed or experienced any conflict for herself. Through homeschooling, where science was learned, but evolution specifically was not, she recalled an absence of science as a topic of discussion in an organized religious setting. Because of this absence, is not surprising that Marie did not associate the two entities with each other. This lack of interaction placed Marie's pre-understanding of science and religious interaction at the independence level, as it was apart from even occasional conflict and

dialogue. While Connor and Kyle were also at the independence level of science and religion, theirs was the choice to keep them separated from one another. Lacking the opportunity to experience an interaction between science and religion either through exposure in schooling or topics in her religious setting, Marie did not hold either in much relevance to the other.

From her experience with the text, she drew upon her religious background and pre-understandings to make connections with the novel. The most interesting component of Marie's reading of the novel was how she attempted to integrate her pre-understanding of the Christian trinity into the trio of immortal beings presented in the novel. Throughout the second and third interviews, whenever religion was being discussed, Marie tried to interpret the characters of Mr. g, Aunt Penelope, and Uncle Deva into the Christian trinity of God the Father, God the Son being Jesus Christ, and God the Holy Spirit. The connection between Mr. g and God the Father was "obvious" as Marie put it, and though Mr. g was not the same as God the Father, and behaved quite differently than the God of Christianity that her pre-understandings held, she could "see" how he was to be interpreted with the Christian God (personal communication, October 18, 2013). Marie's pre-understanding of religion did limit her in terms of her interpretation of Mr. g as God. God was the Christian God and that was whom Marie interpreted as Mr. g; the other participants opened up Mr. g to being a God figure, the Christian God, Jewish God or Muslim God, though all Western conceptions. Marie tried to connect Uncle Deva and Aunt Penelope to being God the Holy Spirit, but she stated she did not know why she sought to do this. Later, she stated that it was Uncle Deva's preoccupation with the soul

that was given to the animate matter; however, she stated that doing this was a stretch for her because Uncle Deva did not fit into her pre-understanding of religion:

> I mean, he's like, you know, "You should give it a name" and "You should give the people souls" and stuff like that. Whereas, Mr. g sometimes is just, like, "Ah, this is cool. Look what I made and I don't really care what they're doing down there." And, uh, the uncle's more like, "Oh well, you should give them souls and let them ... you know, let them see you and stuff like that, help them out a little". (personal communication, October 18, 2013)

This stretch in moving from her religious pre-understanding to her new understanding represented an expansion of the boundary of her religious content. The presentation of Mr. g as God in the novel was similar in concept to an omnipotent God, but to Marie, that was drastically different than the pre-understanding of the attitude of God to which her religious upbringing exposed her. Mr. g was omnipotent, but he was not confident in his abilities that he was truly all knowing. Upon reflection between the second and third interview, Marie attributed this lack of confidence by Mr. g to his inexperience in not having done anything like making his creation before. Mr. g was also omniscient, like the Christian God the Father, but his omniscience did not completely come through in the novel for Marie. According to Marie, Mr. g certainly had the ability to be omniscient and be aware of anything that was occurring, but he was not, because he was unaware of Belhor's intrusions into the universe. Marie was initially puzzled as to why Mr. g was not omniscient and aware of Belhor's intrusions, but later attributed Mr. g's unawareness as not "paying attention to everything all the time" (personal communication, November 8, 2013). While Mr. g had the ability to be omniscient, such as God the Father in her

pre-understanding, Mr. g was not truly omniscient because he was pre-occupied with his new creation. This represents an expansion of interpretation and understanding for Marie. She had not previously considered that while God the Father is both omniscient and omnipotent, the universe is so vast that even for God, when new, it would have been an insurmountable effort to be aware of everything everywhere and would take time before he knew everything about everything that was in the universe.

While Marie was very focused on the religious themes and content put forth in the text, she took the normal-science content as being correct and accurate for how it was presented, because the information was outside of her science content background. The normal-science content was not outside of the ideas of her pre-understanding of normal-science, but the specifics of the content were unknown to her. Without the normal-science content background of many of the other participants, other than Marie Kathryn, Marie expressed difficulty in grasping the science content that was presented due to the way in which the novel was structured. Unlike a normal-science textbook that Marie was used to reading and encountering new science content in, the text was structured as an expository-narrative. The narrative, story-telling portion of the text, with dialogue intermixed with the normal-science content, served as a distraction for Marie during her reading:

> It isn't just straight science. It is split up with dialogue and stuff like that. I guess it is just not drilling science into your brain the whole time, but I tend to get distracted by the dialogue and I wouldn't lean as well from it as I would an actual science textbook because of the dialogue and the stuff like that. So while it was

> more interesting, I wouldn't say I learned the material as well. (personal communication, October 18, 2013)

For Marie, because she knew the novel was not material that she would be tested on like in a science course, she continued reading the novel when encountering content material that she was not confident in understanding. Not comprehending all the normal-science content did not however deter Marie from continuing on with her reading of the novel. The presentation of religious material made the novel accessible to her and provided the ability for her to continue reading through the presentation of normal-science content:

> Like I said, I would get distracted by the story and the theology stuff in it and like that but it makes it interesting to read the facts because they are just in there and it relates to the story...I wouldn't say that it hindered the informational texts, but just my memory of it because I was not focusing as much on the scientific text as I was on the overall story as a whole. Whereas in a scientific textbook, I am only focusing on the science part. So I wouldn't say that it hinders the actual material but how much I actually remember. (personal communication, October 18, 2013)

When it came to integrating the normal-science content and the religious content in the novel, Marie moved past her pre-understanding of science and religion being independent and isolated from each other. Through the novel, science and religion appeared to interact for Marie. Marie tried to interpret the new material in light of her pre-understandings of both science and religion and what she knew in support of or opposed to each other. The exact level of interaction for Marie was not assessable, as Marie never stated having the normal-science content or the religious content presented

as informing each other in their development, but acknowledged that they did interact by proximity and with the character of Mr. g bridging the two realms:

> I thought it was really cool that they way that they described the creation because I fell like there is a lot of debate of how stuff was created as if God physically went in and did everything little thing or if he kind of got it started and then let things happen naturally. I thought it was really cool how it was running on its own and the science made sense. I have always just kind of been…I haven't really had a specific opinion on if God just kind of set it to go on its own or it…I thought it was kind of interesting how they portrayed it and then back it up so that it scientifically made sense. (personal communication, October 18, 2013)

Through the reading of *Mr. g: A Novel About the Creation* (2012), Marie began with the pre-understanding that normal-science and religion were separate entities that did not interact together, as evidenced by her statements of learning science; however, as evidenced by the details discussed, specifically her engagement using religious content to drive her reading of the novel and working through the normal-science content, Marie's understanding of science and religion changed. She consciously sought to put the two together in some way, typically by using Mr. g as the place of interaction. While not at the full-fledged integration level that Barbour describes of science and religion informing each other for benefit, science and religion for Marie began to dialogue, or attempt to consciously interact science and religion together, within the confines of the novel.

Brady. Brady was a female participant and a senior at the university. She was a Pre-Med/Biological Science major who participated in one of the university area campus ministries and served in a leadership position. Brady and Alexander were members of

the same campus ministry and members of the same home church; however, Brady's membership at the church had been much shorter than Alexander's. Brady identified as Baptist, specifically from the Cooperative Baptist Fellowship affiliates. She grew up a member of several different churches, all of Baptist varieties, including the Southern Baptist Convention. Brady's home church at the time of the study, the same as Alexander's, was a member of the Cooperative Baptist Fellowship. That is the denomination she most identified with. Unlike Alexander (who will follow), Brady was not a member of her current church during its transition from the Southern Baptist Convention to the Cooperative Baptist Fellowship. When asked about the transition, Brady says that she knew the church changed affiliations in the late 1990's, but she did not know the issues behind the affiliation change, other than that her church was probably more liberal than the Southern Baptist Convention typically permitted.

Due to having changed church environments multiple times during her youth, Brady said she could not recall any specific issues of science and religion coming up in a religious setting at her churches. However, Brady specifically recalled a conflict arising between science and religion when visiting her friend's independent Baptist church. Baptist churches that identify as independent are typically more theologically conservative than those of the Southern Baptist Convention and maintain a stance of biblical literalism and theological fundamentalism. While not able to recall exactly what was said at the church, Brady described the church as "making like very negative comments about science and that made me [her] like really uncomfortable" (personal communication, September 6, 2013). This was in stark contrast to her experiences in youth group at her home church in high school, which was a Cooperative Baptist

Fellowship affiliate church. While Brady did not recall specific conversations about science, she recalled that they occurred among the youth and even with the youth leader. She described her youth group members as being liberal and outspoken, focusing on being open-minded towards all things. Science and religion were not in conflict with each other when they discussed topics like evolution. Since Brady moved frequently growing up she recalled that when she came to her current state, she was surprised about hearing that "those things [science and religion] are like mutually exclusive, and you can't be a Christian and believe in evolution" (personal communication, September 6, 2013). This view conflicted personally for Brady, who held that science and faith are not in conflict. This view that is typically shared by members of her Cooperative Baptist Fellowship church.

Growing up, Brady says she enjoyed science but was not actively engaged in science outside the school environment. During elementary school she recalled doing science fair experiments, but told me that they usually failed and were "lame" experiments developed by her parents, who were not scientifically inclined (personal communication, September 6, 2013). She recalled being in awe of fellow students who had cool experiments because their parents knew about science. It was not until high school biology where she could recall science and religion having some sort of interaction in school. The focal point of both of Brady's incidents involving science and religion interaction in the classroom was through her biology teachers. Brady took biology at a public high school and also at a public charter high school. The teachers in both biology courses took very different approaches towards the mention of science and religion together when instructing on evolution. In the public high school biology course,

Brady recalled learning about evolution but not having any sort of positive or negative discussion about religion and the scientific topic at hand. This does not mean that a discussion did not happen but that it was not significant enough to impress upon her memory a class discussion or something conflict-oriented. This lack of memory could be due to the impact the second biology teacher at the charter high school had on her as a biology upperclassman. Biology at the charter high school was what Brandy called chaotic and when it came to the topic of evolution, the class went from chaotic to a "hot mess" (personal communication, September 6, 2013). Students in her class were very opinionated on the matter and she admittedly lost her composure when debating. As she put it, it was a hostile confrontation with another student over evolution. The negativity went so far as to her recalling that she was told "you can't believe in God and evolution" (personal communication, September 6, 2013). She responded by calling the fellow student stupid. She got so mad that she said she could not articulate her point of view anymore and resorted to simply insulting the intelligence of the opposing student. This negative science and religion interaction was important when looking at Brady's later interactions between the entities in her college experiences.

During her college years, Brandy said she experienced two events where science and religion engaged each other. One was another biology course in which there was an assigned debate about if evolution and creationism should even be taught in public schools. Unlike during her charter high school biology class, this debate was structured and calm; however, it was not very beneficial in coming to any resolution between teaching the two topics. Brady described the formatting of the debate between evolution

and creationism as playing into Barbour's (2001) myth of conflict between science and religion in forcing the two to be opposed to each other:

> I mean like she is really smart but I think she is like really religious and trying to bring up the science behind creation and I kind of had an issue with that because I am like 'just let creation kind of be creation'. If you are going to believe in creationism then I feel that you should believe in it for itself and not for what some and I believe is a made up science behind it because that is not a strong argument for it. I feel like if you believe in it from a faith science side and not from an evolution side then it isn't real science. (personal communication, September 6, 2013)

Brady made an interesting distinction between creation and creationism. Creation encompasses the creation of the universe and all that is in it, while creationism is the belief not that religion can understand the event of creation, but that an entity through religion is the sole cause for creation, or that it is all that is needed to explain creation. Normal-science explanations are not necessary or opposed to all religiously Christian explanations. Following the discussion in her college class, Brady explained her own understanding of "believing in evolution, but I believe that God had a hand in evolution and that we are still in God's creation even if it came about through like a million years or millions of years...how long it ever took to get here" (personal communication, September 6, 2013). Brady was against the myth of conflict in stating that a normal-science explanation and a religious explanation can be thought of together and do not have to be in opposition.

The second event in college that was significant for Brady in terms of science and religion interactions was going to an event sponsored by several of the campus ministries, including the one in which she was a member. At this event, the now retired department chair of Biological Sciences at the university spoke about his personal lifeworld experience of incorporating his religious views with his normal-science content knowledge. While the lecture specifically included the word 'versus' to draw a crowd, again playing off the myth of conflict, Brady said the lecture was informative as to how someone who is a well-regarded research scientist can still have Christian faith and fully support evolutionary biology science. At this point, it was clear to me that Brady already dialogued science and religion and was now in the process of integrating them together. In terms of integration of science and religion, Brady slightly differed from Alexander, who was a parallel of integration and presented next in this study. Brady held her religious beliefs to be the most firm, and incorporated her normal-science content in them, forming what Barbour terms theology of natural. Brady's pre-understanding of science and religion flowed from this position of theology of natural, where her religious base took the precedence over her normal-science pre-understanding; however, this does not mean that she ignored normal-science, which would be far from the case for a position of theology of natural. She integrated normal-science into her religious pre-understandings. Her religious pre-understandings did not change so much as her normal-science pre-understandings did to form a new understanding based on her religious pre-understanding. In theology of nature, the theology from religion held a slightly significant position to Brady than the science of nature; however, the science of nature is not insignificant or of a fundamentally or epistemologically diminished significance. The

epistomolological standpoint of normal-science produces facts that are incorporated into the ontological understanding or being through Brady's beliefs in Christianity.

From her pre-understanding of theology of nature, Brady enjoyed the interplay of science and religion throughout the text. Since Brady identified as having a highly-religious content background, she took interest in how the novel was different from many of the science books, particularly science textbooks that she was more familiar with. Without having volunteered for a research study that was focusing on science and religion, which Brady had interest in, she said she would not have selected *Mr. g: A Novel About the Creation* as a text in which she would have read without it being assigned to her in a class. The form of the novel, as a narrative text, was "the only reason that I would read that science content," she stated. Had the novel been identifiably about the biological aspects of normal-science, she admitted that she might have selected the novel herself:

> I guess if it was a like a biology novel there was a chance that I would want to know about the biological concepts anyway but as far as the creation of the universe, it is interesting and exciting, but I don't really care about the science that much, so it helped me that it was in a novel. (Brady interview, October 4, 2013).

With the form of the novel and the content it presented in normal-science and religious material, Brady found it to be material that she would have enjoyed reading earlier because it was positioned at a place to interact with her pre-understandings:

> I feel like that is the whole novel. The whole thing. I mean I really liked it because…I've said this like twenty-five times but it just reconciles like actual

> science that I think is legitimate and a creator. It doesn't say like because it happened in this scientific way that is legitimate that there couldn't have been any involvement from any divine thing and it definitely still leaves a lot of question unanswered. But I guess as far as a religious person can't take a novel that someone wrote as a total answer anyway even if you tried to tie up all the loose ends, which his pretty much impossible because it is all very mysterious, but I mean, I couldn't be like…oh well he tied up all the loose ends so that is probably exactly how it happened. (personal communication, October 4, 2013)

With science and religion situated comfortably in her pre-understanding of a theology of nature, her reading significantly clarified her stance of integration between science and religion. As evidenced above, the novel reinforced her pre-understanding of religion by integrating new science content, religion and science's informing of each other, and helped her integrate them into a form that she deemed beneficial.

Alexander. Alexander was a male participant and a senior at the university. He was an Engineering major who participated in a leadership position for one of the university area campus ministries. Alexander identified as Baptist, specifically the Cooperative Baptist Fellowship affiliation. He had always been a member of the same church, though the church changed denominational affiliations from the Southern Baptist Convention to the Cooperative Baptist Fellowship and the Alliance of Baptists during the late 1990s. While Alexander recalled the transition of his church from the Southern Baptist Convention to the Cooperative Baptist Fellowship and the Alliance of Baptists, he stated that it was "a long time coming due" to the makeup of his church in terms of the occupations of many of the church elders (personal communication, September 6, 2013).

Alexander grew up in a different town than the university he attended, but referred to his home church as being made up of mostly "a bunch of fairly liberal and progressive college professors" that no longer cared for the conservative theology coming out of the Southern Baptist Convention (personal communication, September 6, 2013). Alexander remembered conversations involving science, religion and politics fairly often, and that they were always about what the other Baptists, referring to the Southern Baptist Convention, were doing to be anti-science, which disagreed with the academics in his church. Alexander, while not recalling the overall specifics about these conversations other than including evolution and creationism, said the feelings around his church were positive towards the relations or interaction between science and religion and they were beneficial to each other in terms of understanding the world. Alexander specifically stated that from his understanding, biblical literalism was heavily rejected when it came to matters involving science and religion and that an interpretive stance was taken. This pro-interpretation stance of the Bible being more 'God inspired' than 'God written' is a fundamental difference between Southern Baptist Convention churches and Cooperative Baptist Fellowship and Alliance of Baptist churches. More than other participants, Alexander can be said to have had a higher level of positive science and religion interaction due predominantly to supportive interactions in his religious environment. Interactions between science and religion outside of a religious setting, particularly in an educational setting, also support and practically reinforce this positive level of interaction.

In his educational settings, Alexander recalled being interested in science and math related endeavors from a very early age, going so far as to choosing his pre-school

because the presence of a classroom parrot exited him to learn more about animals. Alexander's early interest in science led him to focus on a various cross-section of science courses in high school, and to eventually select bioengineering as a major in college. Merging his engineering interest with his interest in biology and anatomy, Alexander wanted become a dentist and work on dental implants and associated technology. Through his time in public schools, Alexander recalled some specific instances of science and religion interacting in the classroom, with the majority of them being neutral in terms of favoring science or religion; however, there were two incidences that still stand out to him with, one negative, and the other positive. First, from his high school honors biology class, Alexander recalled the teacher prefacing the teaching of evolution as being "only a theory" and against the religious beliefs of some students in the class. By doing so, Alexander recognized that the teacher had already endorsed the idea that evolution was not deemed as scientifically significant and as accepted by the scientific community. Secondly, Alexander realized that setting evolution up as controversial allowed for some students to ignore normal-science significance and evolution and feed into what Barbour (2001) put forth as the popular image of science and religion to be in conflict with each other. The second incident that stood out to Alexander was in his AP Biology class, where he had a relatively newly-trained science teacher whom came from outside the community and immediate geographic and cultural area. This geographic and cultural difference was important to Alexander because it identified the teacher as different from other teachers more familiar with the religious culture of his community and the students at his school. This new teacher took a very brash attitude towards teaching evolution as a necessary part of the content standards and

rather than specifically addressing evolution as controversial or stigmatized, the teacher taught it as science fact. The new teacher, the outsider, taught evolution from a position of authority on the matter and did not preface evolution with any acknowledgement of religious significance. Alexander found the teacher's attitude to be "refreshing" in his approach to teaching evolution, but also found it significant that the teacher did not entertain discussions of religious beliefs or opinions on the matter from well-informed students to whom it appeared to significantly matter (personal communication, September 6, 2013). Alexander recalled the teacher specifically denying students the expression of opinion in the classroom.

While it is clear that Alexander viewed science and religion interactions in a mostly positive manner from his lifeworld experiences, he was quite conscious that not everyone else around him viewed them in the same type of relationship. Alexander was conscious that his high school biology teacher was inadvertently perpetuating the myth of science and religion being in conflict with each other, while also being aware that his later AP Biology teacher was denying students a voice in the classroom. Taking his awareness into account, and including his positive view of science and religion informing each other he could neatly find a place in Barbour's category of integration. To him, science and religion were not merely in dialogue with each other, but they had the ability to inform each other in positive ways. Of the three possible integrations of science and religion; natural theology, theology of nature, and systematic synthesis, Alexander followed most closely with natural theology, letting his pre-understanding of normal-science lead and working in religion along the way. Integration via natural theology was Alexander's pre-understanding of science and religion.

Given Alexander's pre-understanding of science and religion to be based in natural theology, it was not surprising when Alexander confessed to enjoying the text, *Mr. g: A Novel About the Creation* (2012). While reading the novel, Alexander said he found the scientific content that was presented to conform to his background knowledge and scientific pre-understanding, and that the religious themes that he connected to in the novel were in line with his own religious beliefs, even if they were less specific to his personal Christian faith and religious pre-understandings. During his reading of the novel, two of the prominent religious themes that Alexander found intriguing were the discussion of a soul that was prompted by Uncle Deva, and the general way in which the author brought together normal-science principles of cosmology and non-specific religious ideas connected to Abrahamic religions, particularly Christianity. When Alexander talked about religion from the novel, it was often about how religion was the result of the animate matter in the book, except for the soul, and the idea of a glimpse of Heaven or the Void. Religion in the novel was made by the animate matter, or people, and akin to being man-made if the beings are to represent mankind. The man-making of religion did not conflict with his pre-understanding of religion if we recall that his denomination views the Bible as 'God inspired' and not 'God written'/God-made. The concept of the soul was outside of the animate matters construction of religion according to Alexander; it was a gift from Mr. g at the request of Uncle Deva. For Alexander, the soul was one of the religious themes that he did not find normal-science able to adequately explain or understand. The soul is entirely in the religion realm and separate from science; though normal-science has the ability to explain the universe it cannot explain anything that does not pertain to the universe. Alexander approved of the way

the novel presented the soul; it confirmed his own understanding of religion, or at least organized Christianity. The novels' explanation of the origin of the soul and Alexander's understanding from his religion of the explanation of the soul, did not conflict. Rather, they complimented each other, and did so in a way that put the soul outside of normal-science, but in line with Alexander's pre-understanding that some things are not explainable by normal-science.

When reconciling the normal-science content of the novel and the religion content, Alexander found that the novel hit the right tones with a "good mixture of science and vivid descriptions" (personal communication, October 16, 2013). For Alexander, the novel was not the type of text that he believed most people would read, because they do not sit around and think of how science and religion interact with each other. However, if they did, the novel would be helpful in working it out for them:

> It kind of made….I don't think most people kind of sit around and think…I don't think I would sit down and think through that whole process if there was a void and what if there was…especially having more than one immortal person…so I think what I particularly found was how well it mixed scientific facts and justification and aspects of it with the mysterious religious or not religious but the creational aspect of it. (personal communication, October 16, 2013)

He hit on an important idea: that the novel might not hit on religion, or that for him and others, cosmology and the creation of the universe might not exactly be about religion. This viewpoint played back into Alexander's pre-understanding in natural theology. The scientific explanations were the basis for his understanding of the natural world, and his personal religious beliefs and theology could be incorporated into those scientific

explanations in a significant and meaningful way that continued to help him make sense of the natural world. To Alexander, as science and religion were already in dialogue with each other and were integrated to inform each other, he read the novel as a confirmation of this with its scientific and religious explanations:

> I mean this, the book as a whole kind of embodies that for me because it…it was kind of already a reconciliation of the two. I mean it's you know…it offered an explanation for both arising and um, of course questions that went to that. Uh, I can't think of anything else off my head but that was king of...they need to be uh…I wouldn't say they need to be but it's an interesting kind of thought experiment to try and do. Um, but I kind of feel like I had thought the whole book was, was you know that you had to sit down and has out a way that um, that you know, religion and science do co-exist. (personal communication, October 23, 2013)

Alexander, despite having a personal viewpoint of natural theology in which he had already reconciled a viewpoint between science and religion, saw that most people would also need to do the same. Whether a correct perception of most people or not, Alexander himself bought into what Barbour (2001) called the perception of conflict myth. While the novel did not change Alexander's model of interaction, it did provide elaborate detail into how he viewed science and religion, and how the novel confirmed his understandings of their interactions. This confirmation is important as compared to other participants, as their models of interaction shifted slightly from their reading of the text. With Alexander consistently moving from normal-science conceptual understandings as his pre-understanding, i.e. what he brought new ideas and concepts back to, to bringing in

religious themes and discussion that he was encountering, and then moving back to his science background, he was traveling in a nearly cyclical motion. The movement from his normal-science pre-understanding to the continual engagement of bringing in the religious connection is reminiscent of a circular hermeneutic model. For Alexander, science and religion already existed in concert with one another in natural theology; thus when the societal barrier to dialogue perpetuated by the myth of conflict was removed, Alexander could experience a dynamic engagement between normal-science and religion.

Table 2

Summary of Science and Religion Relationships

Participant	Initial	Clarified
Dixon	Independent	Independent
Marie Kathryn	Conflict	Hierarchical Integration
Connor	Independent	Independent w/ Dialogue
Kyle	Independent	Independent w/ Dialogue
Marie	Independent	Attempted Dialogue
Brady	Integration (Non-specific)	Integration (Theology of Nature)
Alexander	Integration (Non-specific)	Integration (Natural Theology)

The summary table above provides a quick reference comparison of how the participants presented their understanding between normal-science and religion during the first interview (initial) and how their understanding presented itself through the second and third interview (clarified). The presentation or clarification of their understanding does not, in itself, indicate a change in the way in which the participant viewed or views the interaction between normal-science and religion. The second and

third interviews allowed the participants to elaborate and demonstrate how they viewed or engaged normal-science and religion with each other, if they did. For most participants, there was not a fundamental change in the way in which they engaged with normal-science and religion through the text; the purpose was to see where the participants were in engaging normal-science and religion in an expository-narrative science and religion text and to see if they were capable of doing so in a way that showed they could access normal-science content knowledge.

Using Barbour's (2001) categorization of interactions is useful in identifying where a participant is in their engagement of normal-science and religion, not if they are engaging correctly or incorrectly, and understanding how that categorization of engagement may pertain to how they identify, interpret, and understand normal-science content presented through an expository-narrative science and religion text. Two participants, Marie Kathryn and Marie, may have altered their categorization based on the level of clarification change that I interpreted between their first interview and the reading of the novel; however, this could have also been due to being able to fully interpret their pre-reading positionality due to the hesitation and reserved engagement during the first interview. Briefly restated, there was tension between Marie Kathryn, Marie, and myself during their initial interviews that accounted for the increased clarification that occurred on their categorization after second and third interviews. The increase in intersubjective harmony allowed for better communication, and for me as the researcher to more clearly interpret what they were communicating to me with their experiences in science and religion.

Demonstration of Participants' Engagement of Science and Religion

The previous sections detailed the interview experiences of the participants and categorized each based on Barbour's (2001) classifications of science and religious interactions. Only two participants, Marie Kathryn and Marie, had their classifications significantly shift based on my interpretations of their experience reading *Mr. g: A Novel About the Creation* (2012) between the first and the third interviews. Gadamer stated that every reader has a hermeneutical experience when reading; however, it is often not possible for an observer to view another's hermeneutical experience. Based on Dilthey's objective hermeneutic and use of the naïve and methodic hermeneutic understanding, the participants' interpretive experiences were laid out. Each participant engaged in some level of hermeneutic activity as detailed through the examples pulled from the interview transcripts. Not detailed in the previous sections were the techniques or strategies used to identify where an interpretive action emerged and when it had taken place for the participant. Due to the nature of the interviews being conducted after reading the novel, pinpointing when a hermeneutical action took place during the reading is speculative at best. However, analysis of the transcripts shows that it did indeed occur for each participant at some point during the process of reading the novel and being interviewed.

Text segments that were coded for identification with a strategy of interpretation, understanding or engagement between science and religion for participants are provided (see Appendix D).

Using Tan et al.'s (2009) analytic technique of identifying significant texts, and establishment of codes to generate inductive themes, significant themes running through the interviews became apparent for strategies of engagement with science and religion.

Major themes that were identified through the study were: places of interaction, notions of normal-science, morality and religious morality, interpretative and understanding strategies, and strategies when reading expository-narrative science and religion texts. Specific to answering the research questions, three areas became evident: how participants experience science and religion, interpretative and understanding strategies, and strategies when reading expository-narrative science and religion texts. The remaining three themes, places of interaction, notions of normal-science, and morality and religious morality, are pivotal in the grand overarching understanding of normal-science and religious interactions for each participant in how they experienced them throughout their lives. How participants experienced science and religion as interpreted through the naïve and methodic hermeneutic was previously detailed in the last section (Dilthey & Makkreel, 2010).

To demonstrate Tan et al.'s (2009) analytic method that arrived at the theme of interpretative and understanding strategies, the initial codes (see Appendix B) and the sub-codes (Appendix C) for this theme are provided. The excerpts are taken from the second and third interviews, in which participants were asked to talk about their reading of the novel in relation to understanding normal-science and religion, and how normal-science and religion were presented as interacting or interacted for them during their reading. Inductive coding was carried out following the methods described by Beazley (2007), King & Hoorocks (2012), Luborsky (1994), Patton (2001), and Tan, et al. (2009).

With the sub-codes identified for different strategies, the division between interpretative and understanding strategies and technical reading strategies for expository-narrative science and religion texts became visible. In this section, the sub-

codes that pertain to interpretation or understanding strategies are explained; the other sub-codes related to technical reading strategies are not presented here, due to their being uncovered and relation to goals not established through the research questions. They will likely be informing future research with expository-narrative texts that will be presented in Chapter 5. Text sub-coded as adaptation, bracketing, compatibility, compromise, dialogue, extrapolation, fore-thought, layered, questioning, self-questioning of beliefs, and speculation lent themselves to compilation under the theme of interpretation or understanding strategies when engaging normal-science and religion. Textual mentions for selections of several coded strategies are provided (see Appendix D) and are listed by code.

The most common interpretive and understanding strategy that was used by every participant at some point was the act of questioning. The questioning strategy should not be understood as the participants asking questions about the specific content knowledge, science, religious, or other information that was presented. This questioning strategy is questioning what one concept or idea that was presented had to do with another concept. For example, what does a concept from science have to do with a concept from religion, or what does a concept from religion have to do with science? Similarly, the questioning strategy was used to further ruminate on a specific religious concept within a broader religious concept. A common shared occurrence of questioning regarded the antagonist character Belhor: "Why is he not being more evil than this?" was asked directly by Marie and is similar to questions posed by Connor, Kyle, Brady, and Alexander (personal communication, November 8, 2013). These participants asked this question due to disconnect between their religious pre-understandings of who the character Belhor was

meant to represent, or projected to represent, in the novel: a Christian understanding of Satan. As the Satan character, Belhor was to be understood as inherently evil; however, participants Marie, Connor, Kyle, Brady, and Alexander all described Belhor as being more in line with the idea of the Devil's advocate. He was not directly evil in that he did not have evil actions or deliberately evil intentions. Their questioning acts were aimed at their pre-understanding and, more often than not, towards their religious pre-understandings, not their normal-science pre-understandings.

The interpretive and understanding act of questioning pre-understandings, especially with regards to the participants' religious pre-understandings, was a continual act characteristic of the participants' attempts to interpret the presentation of the five main characters in the novel: Mr. g, Aunt Penelope, Uncle Deva, Belhor, and Baphomet. With all the participants coming from a Christian background, all had pre-understandings of their God, Satan, and the devil. Every participant identified Mr. g as the God character and with the exception of Marie Kathryn and Marie, who only accepted Mr. g as intended to be the God character. Although Marie Kathryn and Marie did not see much of their God in Mr. g, they knew that the intention of the author was to have them view Mr. g as similar to their God.

The significant difference in religious pre-understandings between the novel and the participants as a whole was the characterization of Belhor and his associate Baphomet. Depending on religious content knowledge of the participants, their understanding of Belhor and Baphomet ranged from Satan, the Devil, God's antagonist in the Book of Job, Mephistopheles, or just the bad guys. Based on my interpretation of the novel and the pre-understandings that I have gathered through my religious studies, an

objectivist understanding of Belhor is best represented as God's antagonist from the Old Testament Book of Job. In Job, the unnamed antagonist was the tempter but not action-taker. The role of action-taker, or outright evildoer, is Baphomet, a devil/demon, but not necessarily the Devil. Only the participants with the most well-developed experiences in studying their Christianity connected Belhor and Baphomet this way. Marie Kathryn expressed the most literal theological understandings, and Brady, the most developed progressive theological understandings.

The characters of Aunt Penelope and Uncle Deva were the most difficult for all the participants to understand based on their Christian religious pre-understanding. Most did not have the religious content knowledge needed to associate Aunt Penelope and Uncle Deva with a non-Abrahamic faith religious concept. The Abrahamic faiths view divinity as monotheistic, including the Christian trinity, while the major non-Abrahamic faiths, Hinduism and Buddhism, either have a diverse pantheon or none at all. Dixon, Connor, and Alexander assumed that Aunt Penelope and Uncle Deva, based partially on Deva's name as Indian in origin and being married to Penelope, had at least a tangential connection to Buddhism and Hinduism in regards to their divinity.

Similar to a strategy of questioning their pre-understandings of religion was the strategy of self-questioning their religious beliefs. There is a fine difference between these two strategies that I seek to make. The questioning of religious pre-understandings can deal with religion in its entirety, or how the participant generally understands Christian theology. The self-questioning of religious beliefs is about a participant posing the question to their own self and their individual religious beliefs, not necessarily those that most directly align with their denominational beliefs or theology as a group of

Christians. At times, a strategy of self-questioning appeared through the participants, but it was often disregarded for looking at what the novel had to say about religion in a larger context and not for the individual reader. Brady engaged the novel's religious themes directly with her own self and demonstrated self-questioning of her religious beliefs often when projecting between Mr. g and her Christian pre-understanding of God:

> I guess I kept, like, asking myself, like how does this create or character align with my own God and then, like if this novel is true, like- which it's not claiming to be true, like- if this was literally how it goes like how does that change how I feel about God or like religion and like, yeah, how- how different is this from my- my own view of God and that just kind of stuff. (personal communication, November 8, 2013)

For Brady, the strategy of self-questioning of her pre-understandings never involved scientific 'belief' or understanding, only religious pre-understanding. I use the word 'belief' here for understanding, though it is against normal-science concepts and is a contradiction to the stated normal-science fact that does not require belief, to not confuse scientific understanding with an understanding strategy.

Several strategies presented themselves when participants engaged their pre-understandings of both science and religion together with the content presented in the novel for interpretation. These strategies can take different forms through words like extrapolation, adaptation, compatibility, or forethought, but they all involve placing the participants' understandings of normal-science and religion in proximity to each other. Due to this proximity and the sharing of a space, which is similar to Gadamer's (2004b) fusion of horizons where two concepts interact, change in perspective or understanding of

the participant's pre-understandings in either religion or science resulted in a compromise of understanding with most participants. All participants, except Dixon, held some sort of interaction between science and religion. In this interaction, compromise takes place between science and religion. The participant's understanding from reading and thinking over the text slightly shifts a pre-understanding that was held in science or religion. For scientific pre-understanding, the participants universally accepted what was presented in the novel as normal-science content fact. This acceptance was based on their pre-understanding of how normal-science operated to their epistemological understanding, where normal-science presents facts and is not biased; this was, of course, based on their education in STEAM areas, and was not subject to my own epistemological and ontological interpretations of correctness. When new scientific content knowledge was presented, it was accepted whether the participants conceptually understood the normal-science behind the content concept or not. In Marie Kathryn's case she 'believed' in the correctness of normal-science from a normal-science viewpoint even if it did not correspond with her religious viewpoints; normal-science was fact, even if it was incorrect for her. For the other participants normal-science fact was normal-science fact. Interpretation of normal-science was not on their metaphorical discussion table; it is what it is. When normal-science and religion were compared with each other, this is where compromise took place in some form for participants.

When an interpretive and understanding strategy of compromise was completed by a participant in their reading of the text, it would emerge in how they each fit into Barbour's classifications of relating normal-science to religion. Aside from Dixon, there was a conscious effort by participants to interact or attempt to interact normal-science

and religion together. Dixon made a conscious effort to keep science and religion apart from each other by bracketing, a term familiar to both phenomenology and hermeneutics to isolate subjectivity; however, he stated that even when bracketing, because he did not want them to interact, he would "have had to come up with my [his] own ways to justify the different aspects of the two and merge them into one" (personal communication, October 9, 2013). While Dixon liked to professionally isolate science and religion from each other, in his own personal situation he would compromise to justify his religious belief scientifically. Dixon presented a duality of identities that he consciously tried to keep isolated from one another when engaging science and religion. The separation that Dixon embodied did not present itself as strongly in the other participants, and thus led to the use of compromise between pre-understandings. The farther along Barbour's spectrum from conflict to integration, the more common an act of compromise to interact science and religion is.

Marie Kathryn demonstrated the fewest interpretive or understanding acts of compromise when engaging science and religion together. Given the hierarchical integration between religion and science, religion always precedes normal-science content fact in importance. While Marie Kathryn accepted that normal-science fact was factual for normal-science, it would never triumph religious fact. She could compromise only as far as accepting that the normal-science fact was indeed scientific fact, but if it did not equate to her pre-understanding of religion, then it was not incorporated into her understandings. Marie Kathryn would compromise in considering the normal-science fact, or even a religious concept that did not correspond to her pre-understanding, but it would not be integrated into her understanding: "If I could kind of see my side of it I

guess then I would try to do that while I was reading as opposed to just like skimming over and thinking 'I don't believe that'" (personal communication, November 15, 2013).

Brady also performed a compromise strategy of interpretation and understanding in her readings, but she did so at a significantly different level than Marie Kathryn. Comparing them shows their differing positions on Barbour's spectrum with regards to their interactions of science and religion. While Marie Kathryn merged normal-science and religion in a hierarchical integration with religion vastly superseding normal-science, Brady integrated normal-science and religion via theology of nature with a much higher rate of compromise, in accordance with her religious pre-understanding. This higher rate of compromise does not mean that Brady was or is more likely to compromise her religious pre-understanding, but that her religious pre-understandings were based more towards being open to compromise when integrating normal-science into them. With a religious and scientifically integrated pre-understanding of theology of nature, Brady's religious pre-understandings did not view normal-science concepts that did not fully correspond to her religious pre-understandings as inherently conflicting. Thus, she sought to find a space of interaction where there was a point of integration between the normal-science concept and her religious pre-understanding. This act of incorporation was a compromise to both religion and normal-science, but in a manner supported by her pre-understandings and was not destructive to either religion or science understanding. Alexander, the other participant to show integration, did so in the reverse, but not opposed to, Brady by flipping his pre-understandings to have science integrate religion via natural theology. If a participant were to equally integrate normal-science and religion through process philosophy, they would achieve what Barbour (2001) terms

complete systematic synthesis. It is possible that if Dixon removed his conscious separating of science and religion, he may fall on this part of the spectrum in his way of engaging science and religion. It was his pre-understanding that a scientist should remove their subjectivity that had limited him thus far from attaining that position.

Interpretation Accessible through Participants Journal Keeping

During the initial interview, Connor and Marie Kathryn inquired if they were required to keep a written journal of their reading during the research process. As detailed in Chapter 3, this was not initially in the research method but was considered to be a way in which these two participants would normally go about their reading. While not required of any participants, Connor and Marie Kathryn were provided with journals so that they could record any additional experience that they wished to share. Three participants ultimately end up using writing as a way to engage interpretively with the text that was provided them: Connor, Marie Kathryn, and Marie. Connor and Marie Kathryn were the two participants that used notebooks to write down material during their reading of the text; by contrast, Marie did not use a notebook to write down her notes, but appeared to write directly in the text, *Mr. g: A Novel About the Creation* (2012). During the third interview, Marie routinely flipped through her copy of the novel to pages and notes that she had annotated or recorded for recollection. Because the book was given to the participants, I was not able to further analyze her notes. Connor and Marie Kathryn, the participants that used notebooks to take their notes, provided me with the notebooks at the conclusion of the interview process to keep as artifacts for review. While both Connor and Marie Kathryn kept a notebook during their reading of the text, they both used their notebook to different ends. Connor's notebook was full of page

numbers with short annotations pertaining some information found on that page. The annotations were not complete thoughts or opinions, but a simple summary of the statements to which they related.

Marie Kathryn's notebook differed dramatically from Connor's in that her notebook functioned as a reading journal. In the journal, Marie Kathryn moved between interpretive and understanding strategies and a general reading strategy; due to this, I have chosen to include report this data as pertaining to an additional strategy that Marie Kathryn used to interpret normal-science and religion. Marie Kathryn's notebook was a look into her engagement with the content of the novel and can also be seen as an interpretive and understanding strategy. Through her comments, she engaged with the religious material that is found in the novel. The strategy of using the notebook was not about reading the expository-narrative science text, but about engaging Marie Kathryn's pre-understanding on normal-science and religion, and the material presented in the text. As recalled from the prior section discussing Marie Kathryn's lifeworld experience of normal-science and religion, she had the pre-understanding of Barbour's (2001) idea of conflict between science and religion. The first entries of her notebook helped to identify the conflict aspect between normal-science concepts and Marie Kathryn's religious beliefs. She stated that it is "too much like the idea of evolution" and that she "doesn't agree with [the Big Bang], I think God knew exactly what Earth would work like and where it would go before he made it" (personal artifact, November 15, 2013). Following the entries through Marie Kathryn's notebook, it was possible to see how her disagreement with the concepts of religion and science that Lightman put forth could cause conflict to increase for her. However, this was not the case that occurred or came

forth in the third interview with Marie Kathryn. Marie Kathryn's content discrepancies occurred between her religious content views and those presented by Lightman; with regards to the normal-science content presented in the novel, Marie Kathryn did not comment on it beyond the idea that it may be correct, but she did not have the background content knowledge to know if it was or not for normal-science. This lack of normal-science background content knowledge becomes important in the next set of strategies presented.

A Final Word - My Subjectivity and the Research

Before this research process commenced with the participant interviews, I can confidently recall that I would not have imagined how much more complex and interesting a topic it would turn out to be for myself as the researcher and from looking at my positional reflexivity (Mabeth, 2001). This research is essentially aimed at helping students who share a similar schooling experience in the science education classroom as I did. As someone who was passionate about science, yet a member of a progressive faith community, I was often told by outsiders, both normal-science adherents that were typically a-religious or religious traditionalists and evangelicals, that I was wrong or incorrect when it came to matters of normal-science and religion being capable of having any sort of productive relationship. I was caught in the midst of Barbour's (2001) myth of conflict. While I expected conflict going into the research, I did not realize the diversity in both normal-science and differing types of Christian religious interpretation. This diversity provides a potential bridge that balances interpretive diversity and conflict with commonality. This complexity has implications for so much of what we do in school and will be examined in the next chapter. It is my goal that

others can use this research or other forms of reflection to challenge the myth of an inherent essentialist conflict between normal-science and religion. I have learned more than expected--the key to opening up my perspective. From my epistemological standpoint, objectivity serves as another potential myth, but I should strive for methodological validity and reliability in analysis for the sake of those who do not share the same epistemological and ontological understandings.

The use of Dilthey's objective hermeneutics to uncover and explore participants' naïve and methodic hermeneutic engagements and trappings of the world served as a valuable method in taking on an objectively epistemological field of normal-science and seeking to view how it interacts with a more ontologically oriented realm of religion. If this practice of examining the naïve and methodic hermeneutic becomes possible, then investigating these incredibly rich participants and their experiences will be worth the time invested in the process.

CHAPTER 5

IMPLICATIONS FOR SOCIETY, PRACTICE, POLICY, AND RESEARCH

As stated in the opening chapter of this dissertation, the purpose of this study was to gain understanding of the types of interactions and/or processes that learners, specifically in science, technology, engineering, art & design, or mathematics (STEAM), go through when engaging normal-science and religion content. Using data derived from a multiple interview approach about each participant's readings of the expository-narrative science text *Mr. g: A Novel About the Creation* (Lightman, 2012), it was possible to assess participants' interpretation and understanding regarding their interactions of normal-science content and religion. Given what was learned from the data, I will suggest how my findings can be used for multiple purposes: encouraging societal discourse, informing classroom practice, informing science education policy, and guiding future research into expository-narrative text. More specifically, I will first discuss how society will benefit from a more engaged discourse between normal-science and religion. Second, I will discuss how general classroom practice can be influenced an opening of dialogue with normal-science. Third, I will discuss how science education policy might benefit from being more open to students' religious connections in the science education classroom. In the final section, I will examine how this line of research, using expository-narrative science texts, can be further developed to benefit both classroom practice and science education policy, as well as be used to continue the

productive engagement of normal-science content and mainstream Protestant Christian beliefs.

Before suggesting any implications that this research may propose, I would note that this multiple interview approach study only applied to seven STEAM undergraduates at the specific university. Any claims or generalizations are only immediately applicable to these seven participants and not the research institution that they attend, nor are their views generalizable to the entirety of the denominations of which they are members. Despite these limitations, insights may be drawn from their experiences with engaging normal-science, religion, and expository-narrative science and religion texts.

Societal Implications and Why They Matters

Most simply put, the societal implications for this study show that there is a want for individuals who are engaged with both normal-science and religion to have the opportunity for participation in public discourse between the two areas and with other members of the public. Since the Enlightenment and the emergence of what is best described as modern normal-science, there has been a continuous attempt at dialogue between science and religion between interested parties from both entities as well as those persons associated in the margins of either practice. While there have been philosophical attempts to keep normal-science and religion, particularly in the form of Christianity, in discourse with each other, most notably through James, Habermas, Barbour, Rorty, there have also been more publically successful efforts to disrupt or eliminate discourse between normal-science and religion. The myth of conflict has been kept alive and active by the efforts of Richard Dawkins, Christopher Hitchens, Kenneth Ham, and Pat Robertson. While multiple mainstream Protestant denominations and the

Catholic Church have put forth a valiant effort to encourage discourse between normal-science and religion, even supporting and promoting education in normal-science in science education classrooms, normal-science and science education opts to maintain a significance distance from cooperative religious supporters. The efforts of moderate forces in Christianity alone are not capable of combating the myth of conflict without the support of normal-science and science education, which seem reluctant to provide it.

The insight was gained from this research study is that most of the participants did not come in with an understanding of the paradigmatic nature of science. The majority of participants did not recognize that normal-science changes over time and goes through paradigm shifts, as described by Kuhn (1970) and has been affirmed by the majority of the normal-science community. Even though the participants were STEAM learners, with a background in and collegiate level exposure to normal-science, four of the seven participants failed to acknowledge the continually shifting boundaries of normal-science. I cannot say that they did not recognize the boundaries of science or religion, only that most of them failed to recognize the ability for both science and religion to have malleable boundaries. If STEAM area learners are not being taught to recognize the boundaries of normal-science, than science education must be held to a level of responsibility for the myth of conflict between science and religion just as much as religious fundamentalism or new atheism must. By increasing boundary recognition, the opportunities to engage in discourse at these boundaries increase. Otherwise, the discussion of science and religion would only be taking place within science or religion and a true discourse with the two would not be occurring. A failure to have this discourse is a detriment to science, religion, and society as a whole. Confining an open discourse

to science and religion in the larger society, or the classroom, would also be just as detrimental. When we seek to limit the potential of the new generation of ideas, we seek to limit the ways in which we as a species go about interpreting, understanding, and explaining both our physical and social worlds.

Based on the supporting evidence provided by the detailed cases of the seven researcher participants, all of whom are STEAM area learners and with, at a minimum, a background in either physical or biological science, there is an argument to be made that dialogue between normal-science and religion is wanted in their lifeworld. The reality of their educational upbringing is that they did not have the opportunities for these types of discussions or had not seen them taking place in society. Despite not having prior in-depth experiences with this type of discourse, these participants wanted it and demonstrated significant engagement and enjoyment from participation in the discourse.

Implications for Classroom Practice

This study has implications for multiple types of classrooms. The science education classroom is where policy meets teaching and learning. Under that distinction, I will first discuss implications for the science education classroom separately from the implications for science education policy, which will follow in the next major section. I will consider literacy practices in content area classrooms in terms of reading interpretations and implications to literacy views as a whole with regards to disciplinary literacy practices.

Broad Content Area Classroom Implications Based on Interpretive Reading and Religious Literacy

Participants from my study expressed their feelings during the first interview about their middle and secondary science classroom experiences, in which religion was intentionally discouraged from discussion or accessed in terms of seeking understanding of normal-science content. In a recently related study, Skerrett (2013) observed ninth grade students from the southwestern United States who identified as Christian. These students, who were from a variety of Protestant denominations or Catholic, were observed to see how their religious identities enabled them in their reading classroom. In this case, the reading teacher was not prepared for students' religious literacies to come through. This was similar to other studies that have found that teachers, particularly those in science education, do not know how to deal with engaging students' religious literacies or identities due to questions about the constitutionality of religion in public schools (Noddings, 2008; Rosenblith & Bailey, 2008; Skerrett, 2013).

While I chose participants who were post-secondary due to my concerns about their ability to articulate both their normal-science content understanding and their religious beliefs, Skerrett (2013) showed that ninth grade students were comfortable with engaging their religious identities in their classrooms. The experiences that my participants enjoyed while engaging normal-science content knowledge with their religious literacies, in an expository-narrative science text, is echoed. Science education has traditionally resisted the presence of religion in the science classroom, and as a science educator, I once shared this belief. Looking at the current practice of many science educators I have to ask: What are the benefits produced by the practice of

ignoring a student's religion and how they engage their religion with science? I answer: none. Why not considering engaging a student's struggle with conceptualizing normal-science content and religion instead of ignoring their struggle?

While English-Language Arts teachers are traditionally prepared to encourage students' interpretation of fiction texts as well as to critically read non-fiction texts, science teachers typically receive a minimum level of training regarding reading and literacy instruction. Any instruction that they receive is likely to be labeled as content area literacy instruction. Interpretive reading is not the historical purview of science education teachers, but if students are to be encouraged to access their religious identities and literacies to better engage normal-science content, then science education teachers must be able identify the interpretive strategies with which their students are reading. As a former science educator, I found that the most difficult style of interpretation my students demonstrated—one that I immediately registered as being highly suspect when attempting to understand objectively defined normal-science content—was a style that took into account aspects of biblical literalism. The literacy practice of American evangelical Biblicism has recently been established as a legitimate literacy practice by identifying and exploring its uses with its practitioners (Juzwik, 2014). The acceptance of American evangelical Biblicism as a literacy practice has significant implications to my study and the science classroom. It is an interpretive strategy that some Christian students might be expected to employ, particularly those from more traditionally conservative denominations such as the Southern Baptist Convention, Presbyterian Church in America, and the Lutheran Church – Missouri Synod.

Crapanzano (2000) explained biblical literalism as a cultural literacy practice that impacts the way in which its practitioners interpret Biblical texts and use them as a lens through which they view the world. While my study did not focus exclusively on Christian participants who would likely be identified as American evangelical Biblicists, it did not preclude the possibility that someone who practices some form of biblical literalism could be a participant. In point of fact, Marie Kathryn established her interpretation strategies on a hierarchical relationship between religion and normal-science that included reliance on biblical literalism. Because an individual is an evangelical Christian does not mean that they practice American evangelical Biblicism (Juzwik, 2014). Most evangelical Christians do not follow the strict definition of biblical literalism. This was ultimately displayed in Marie Kathryn, who was still open to some interpretation between normal-science and religion; that is, she did not conform her readings to align to an absolute biblical literalist interpretation.

The interpretation strategies that the participants demonstrated were wide ranging. Despite participants' being able to use a variety of interpretation strategies, the Common Core State Standards (CCSS) in literacy do not cover such a breadth of possibilities for interpreting content area texts. Instead, the CCSS pertaining to literacy in the content areas promote a close reading of written texts, which is essentially a form of literalism (Juzwik, 2014; National Governs Association Center for Best Practices and the Council of Chief State School Officers, 2012). Performance-based reading, where interpretive reading is encouraged with narrative or expository-narrative texts, is not covered in the CCSS. The promotion of literalism by the CCSS restricts the possibilities of expanding the types of text materials at best, and the interpretation of materials at worst. I may

seem antagonistic toward the use of literalism, however this is not the case. I am opposed to the restriction of reading to only literalism as an interpretation form. I do not view literalism as a reading literacy with an inherent moral value. There is a practical application to a literal reading of a text, particularly in science education to identify and extract normal-science content knowledge. As a science and a literacy educator, I see a place for pause and concern where science educators may be opposed to a literal reading of non-science texts, but favor this strategy in the context of science texts. Placing value on one type of content text over another is certainly not an unheard of practice, particularly when labeling texts as non-scientific by the objectivistic science community. Despite this inherent hypocrisy, there is a place for science educators to draw a line in how normal-science content should be interpreted inside a classroom for assessment purposes. All educators, but especially science educators who find it contradictory to their objective understanding of normal-science, must face the challenge of accepting the literacy practices that their students present and build upon them. This task can be accomplished through respecting students' literacy practices and not dismissing them, for example, not ignoring or deeming incorrect a literacy practice as restrictive as American evangelical Biblicism is to normal-science.

Reading of an Expository-Narrative Science Text for Science Classroom Benefit

The implications my study data have for classroom practice are widespread and encompassing. This is especially poignant when examining the participant reading strategies uncovered through the interviewing process, and the quality of engagement that participant readers reported towards the reading experience with an expository-narrative science and religion text. Due to the limited size of the participant population in the

study, there are no strategies that can be deemed universal in a hypothetical science classroom, because the participants were purposefully selected to represent a specific category of learner, STEAM and mainstream Protestant. The strategies employed by my participants point to issues that are presently found in science classrooms, such as comprehension difficulties with expository and informational science texts.

Participants' reading strategies that were displayed throughout their readings of *Mr. g: A Novel About the Creation* (Lightman, 2012), can best be understood by examining them in relation to studies on reading strategies that I had not accessed before my study began. The reason for not accessing these studies was not neglect during the initial literature review but from not knowing the direction in the type of strategies that participants would be employing when using an expository-narrative science and religion text. Content area reading and strategies for fluency and comprehension in reading are not unfamiliar, but there is only limited research on expository-narrative texts, science and religion based notwithstanding, being used and none known that detail strategies students' use while reading from them (Avraamidou & Osborne, 2009; Macklin, 1978; Zabrucky & Moore, 1999).

Generalizable reading strategies and discipline-specific reading strategies that pertain to science, history, language arts or mathematics both presented themselves in participants' readings of the expository-narrative science text. By demonstrating these two strategies in their reading, my participants' showed that generalizable reading strategies and discipline-specific reading strategies can be transitioned from reading narrative and fiction texts from ELA settings to expository-narrative texts in science classes. This is important for those students who expressed difficulty in reading

traditional expository or informational science texts because they could not transfer or access their skill set.

Science students' comprehension of science texts is often hindered by a lack of understanding of technical language or vocabulary (Avraamidou & Osborne, 2009). A generalizable comprehension reading strategy may be used to determine context of a sentence or to determine the meaning of a particularly technical vocabulary; however, this type of strategy may not be efficient in science literature due to the abundance of technical jargon found in a single sentence. In this instance, a student may need to call upon a content area or discipline-specific strategy. Equipped with the technical vocabulary of science, particularly biology or anatomy, a strategy of dissecting a word based upon the Latin or Greek structure of the word could be helpful.

As generalizable reading strategies are the most common and least specific in terms of their applicability to a specific area of reading, the strategies that participants put forth that are applicable to the reading of *Mr. g: A Novel About the Creation* (2012), but not necessarily the comprehension of normal-science content which was presented in the novel but not in an explanatory way.

Another major implication for classroom practice is the perception of reading an expository-narrative science and religion text. Every participant was unfamiliar with the concept of an expository-narrative text to convey normal-science content or religion information. This unfamiliarity was later clarified as a result of being unfamiliar with the term expository-narrative and not from never having read an expository-narrative text previously. Four participants subsequently discovered they had previous experience reading an expository-narrative science text. All participants shared views of expository-

narrative text as being different from the traditional informational or expository text they have read in terms of the general readability, lack of overly technical vocabulary, and the presentation of normal-science content facts through narrative story. These findings are consistent with the existing research on expository-narrative texts and why students have had a positive reception to reading them (Avraamidou & Osborne, 2009; Zabrucky & Moore, 1999). All participants were highly receptive to reading an expository-narrative science and religion text, especially one that was written in a way that enabled them to think about normal-science content facts and discuss religious ideas that they likely would not have thought to discuss in relation to normal-science. However, three participants noted that had it not been for normal-science content knowledge gained through the usage of informational and expository texts during their education, they would not have had as successful an experience with this expository-narrative science text. The obvious implication for science classrooms here is that while expository-narrative texts have their utility, they should not be used strictly at the expense of replacing informational or expository texts altogether. Making expository-narrative texts more available in all classroom types encourages reader dialogue and interpretation and should be a policy priority for educators.

Incorporating a Reformed View of Disciplinary Literacy

For much of the last 30 years in literacy education, there has been an ongoing discussion involving the opposing views of literacy and literacies as historically applied by Brian Street (1993), Brian Green (1988), and Philip Gough (1995). Currently, the idea that every imaginable practice has a unique literacy component has reached almost untold proportions in the argument for specific disciplinary instruction (Alvermann & Moje,

2013). Incorporating Alvermann & Moje's argument for a more encompassing model of literacy, one that draws on the multiple discipline exposures students encounter in their formal education and the larger and more numerous groups of identities (communities, ethnicities, families, peer groups, pop culture, etc.), over that of the historical reader-text-activity-context literacy mode, this research can emphasize the importance of the participants' positionality in influencing their engagement practices. Individual literacies, such as science literacy or religion literacy can come together in a way that is better understood through Alvermann & Moje's model for classroom teachers to produce a more encompassing learning environment which benefits student engagement in multiple areas, hopefully including normal-science and religion.

Implications for Science Education Policy

Outside of the instructional practices of science teachers in their own classrooms, science education policy stands in the area between where normal-science and religion are most engaged through teachers, school administrators, district officials, and state, national, or private science organizations interested in science education policy. Science education and religion are never far from the national forefront of attention due to the myth of conflict being continually perpetuated via the media, whether intentional or not (Barbour, 2001). Throughout state legislatures across the nation, normal-science education is constantly challenged for not allowing the instruction of the non-scientific theories of creationism or Intelligent Design. Proponents on both sides, those that want to teach biblically-literal creationism and Intelligent Design and those opposed to any reference of religion in public schools, the New Atheist, square off as if they are the only two sides in the debate on policy-making involving science education standards. These

two contingents make up only the smallest proportion of stakeholders in science education policy, yet they dominate the perceived discussions due to the myth of conflict.

There are other stakeholders in the science education policy debate involving normal-science and religion: teachers, parents, students, and the non-fundamentalist policy proponents and researchers who are found in both the religious and normal-science fields. The proponents of an informed science education policy that no longer disregards the views and values of a religious upbringing, at least a non-fundamentalist religious upbringing that seeks to work with normal-science content, should no longer be dismissed on the basis of science for science's sake in the classroom. In no other content area are students expected to abandon their religious background or their experiences for the sake of learning or to simply avoid the discussion of religion as is exhibited when learning normal-science content. Based on my own personal experience in teaching, many teachers ask or expect students to bracket their religious viewpoints for the sake of instruction, a practice that I view as only a marginally acceptable. Similarly, many teachers ignore the teaching of evolution because they do not want or know how to handle religious viewpoints, are told not to engage in any discussion of religion in the science classroom, or flat out dismiss students' legitimately held and non-hostilely presented religious viewpoints. Any or all of these behaviors on the part of teachers simply perpetuate the myth of conflict between science and religion.

Many teachers of science recognize that it is not culturally beneficial to have students taught science in a way that does not address religious and philosophical beliefs (Matthews, 1996). During my experiences with science education programs in my undergraduate and graduate studies, I was never exposed to research pointing at these

beliefs, possibly because I was being trained in science education and such research was counter to views on normal-science. Even so, I could have stated that I knew what the results would be based on my time spent teaching in public schools with religiously-oriented students. In these settings, religion was not to be discussed, and for this reason, students felt ignored or not valued in their interpretations. It was not beneficial to students in their religious education to have science presented in a way that was denigrated or distorted to promote religious belief (Poole, 1996). It was found that, as is the case with the general population, there is a diversity of views present on science and religion in graduate science education students, including those who have teaching experience. Graduate students, several of whom were teachers, were more open to conceptual changes in their understandings of science and religion, just like the participants in my study (Loving & Foster, 1999). While many may struggle with engaging science and religion, they were open to the concept and ultimately found a beneficial experience. Changing science education policy to include the training of science teachers such that they incorporate engagement and interpretation strategies for normal-science content over absolute acceptance of normal-science fact would be a way to benefit students. Providing professional development to in-service teachers on interpretation and engagement will assist in removing the disturbing trend in science classrooms of shutting down discussion involving religion.

Even with the calls for engagement of religious understanding and scientific understanding in students' science education, there is no evidence that the direct instruction in biblical theories of creationism or Intelligent Design are being called for by literacy researchers, science educators, or myself. The practice of 'teaching the

controversy' is a counter strategy science education policy has employed as a way to put creationism to rest due to there not being a method for scientifically teaching the theory of creationism or Intelligent Design. The idea for proponents who embrace the 'teaching the controversy' method is that it would doom the idea of teaching creationism when students come to 'learn' that normal-science is correct and belief in creationism, or biblical literalism is incorrect. An editorial piece in the *American Biology Teacher* called for a direct confrontation between creationism and evolution in the science classroom, believing this would ultimately triumph evolution over creationism (Simon, 2013). I view it doing no such thing for science education policy, and feel it would only serve to even further perpetuate the myth of conflict between the two ideas. The proposed 'teaching the controversy' in this manner does little beyond close off opportunities for productive engagement with Christian student learners who would favor a productive discussion, as demonstrated by the experiences of the students in this study who found greater interest in normal-science understanding through an engagement of discussion. Several mainstream Christian denominations in the nation promote science education instruction as understood according to normal-science fact, but they also continue to see the importance of religious understanding in students' lives (National Center for Science Education, 2012). This support for a scientifically-relevant education in cosmology and evolution is expressed by a number of Christian church positions from the United Methodist Church, the Lutheran World Federation/Evangelical Lutheran Church in America, Episcopal Church American, Presbyterian Church – USA, and the Roman Catholic Church. The United Methodist Church, which stands against the instruction of creationism and Intelligent Design in science education, issued a statement expressing

this dual ability to understand the world: "…the church has the responsibility to teach theology and raise these questions. Secular culture has the responsibility to teach science and we don't believe creationism and intelligent design qualify as science" (as cited in Bathija, 2008, 6).

My research can inform science education by making clear that a development of dialogue for the science education classroom needs to take place, but that it does not have to promote the instruction of creationism and Intelligent Design. This policy reform should also not hinder the religious understanding and expression of those students for whom religion is a valuable part of their life experience and framework for understanding their world, including their scientific understanding of the natural world. By using expository-narrative texts as supplemental reading materials in science education classrooms, the options for bridging possible gaps between religious or non-scientific engagement with normal-science content become achievable for science educators in a way that can respect the religious identities of their students. When students are permitted to engage their religious identities in the classroom or in academic understanding with normal-science content, they engage in an active form of learning, and have demonstrated enjoyment of this learning (Skerrett, 2013).

Implications for Future Research in Expository-Narrative Texts

The implications for future research involving science and religion relations among STEAM and non-STEAM learners, as well as with using expository-narrative texts are vast and just beginning. Beyond this research, Avraamidou and Osborne's (2009), and Zabrucky and Moore's (1999) research involving science area learning and expository-narrative texts, there is a sizable gap in research into where expository-

narrative texts can be incorporated into all classrooms. This research was built upon the base that was established with using expository-narrative texts by Avraamidou and Osborne in science classrooms and this study was aimed outside of the K-12 educational spectrum in terms of participants. To that end, the immediate growth of this research into the K-12 classroom, specifically to the secondary education level, to expand expository-narrative text usage in the science education classroom is, for me, the most logical next step. The issue does arise, specifically in public schools, as to how to properly address the role of religion being discussed in the classroom. To this end, research could be directed solely to usage of expository-narrative texts and to seek any insight into to students' perceptions, interactions, and understandings of where science and religion may encounter the other. Several researchers have encountered a varying degree of uncertainty when encouraging classroom teachers to engage in religious-based research efforts in a secular setting. While they have determined that it is constitutionally permitted, the concerns of administrators and teachers must be thoroughly addressed to explain the potential benefits that students may experience from a successful result (Noddings, 2008; Rosenblith & Bailey, 2008; Skerrett, 2013).

This research would be interesting to myself, particularly if school administrators can be convinced of the benefits of research in student engagement with texts not correlated to testing and achievement scores. An issue here is that this goal is not directly compatible with the current Common Core State Standards (CCSS) being implemented virtually nationwide. The reading engagement favored by the CCSS is a careful and focused reading of the text that results in literalism (Juzwik, 2014). While reading engagement in content areas is not found under the CCSS, even pertaining to literacy in

science, reading content area literature is specifically accounted for and mandated in a significant quantity through the current Georgia Performance Standards (GPS) as they pertain to science and all content areas: "Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas" (Georgia Department of Education, 2008). By following the mandated GPS to have students read a minimum of 25 grade-level appropriate books across a variety of disciplines, how students engage with texts hermeneutically may become a research-justified position with receptive administrators and classroom teachers.

Future research with students reading grade appropriate levels of an expository-narrative text, particularly in science classrooms, while examining the strategies they employ for interpretation and comprehension of content could further trace the development of students' interpretation and accessing of normal-science content. Currently, there is not a lower developmentally-appropriate level of *Mr. g: A Novel About the Creation* (2012) available that I would have personally used outside of a secondary level setting. There are two other sets of leveled expository-narrative texts that I have encountered that would be possible for use across middle and secondary science classes: *The Omnivore's Dilemma – A Natural History of Four Meals* (Pollan, 2007) and *The Omnivore's Dilemma – The Secrets Behind What You Eat, Young Reader's Edition* (Pollan, 2009) or *A Short History of Nearly Everything* (Bryson, 2004) and *A Really Short History of Nearly Everything* (Bryson, 2009). I have used *The Omnivore's Dilemma – A Natural History of Four Meals* when teaching Applied Biology to struggling secondary science content students. This was not done as a research study or

to look at how they engaged with the text but as an effort to meet the schools leisure-reading requirement. Furthering research in expository-narrative texts using these two texts is a highly probable endeavor for myself, particularly with the *A Short History of Nearly Everything/A Really Short History of Nearly Everything.* This text can allow for religious interpretations when covering the expansive scope of normal-science content that is presented.

Conclusion

The future for research in all the areas that this study has engaged is virtually unlimited. While this scope may sound cliché, it is not when engaging in research from a hermeneutical perspective, be it 'objective,' phenomenological, philosophical, and critical or any sort of hybridization. The only true limit to research in these areas comes from being closed to the possibilities that progress has not yet been fulfilled and that we have reached the limits of what we may do and how we may know. The public and often exploited conflict between normal-science content and religious beliefs, particularly Christianity, is a myth. Allowing religious people to see their relationship with science without just seeing religion or just science encourages engagement; the same may be said for allowing science-inclined people to see a relationship with religion without just seeing religion or just science. STEAM area educated students who are also professing and practicing mainstream Protestant Christians show the myth of conflict to be unsubstantiated except in the view of fundamentalist Christians and the New Atheist movement. For college STEAM area learners coming from a diverse group of mainstream Protestant denominations, engaging thoughtfully with normal-science content and their religious beliefs was not a practice that was fundamentally difficult for them.

They were already accustomed to some limited form of engagement, but given the opportunity to purposefully engage the two focus areas, they excelled in identifying and understanding normal-science content in light of their respective religious ideologies. They also showed that through engagement of normal-science and religious beliefs, their personal attitudes towards the two were capable of evolving away from perceived conflict and towards an area of mutual existence, cooperation, or integration. While there may be hesitation in the public education sector to embrace the encouraging of interaction between normal-science content and the beliefs of mainstream Protestant Christians, this study has shown by using literature respectful to religion, in the form of expository-narrative texts, that convey normal-science content knowledge through a religious themed story, discussion, dialogue, and individual value growth is an attainable outcome. Boundaries may often be more mentally challenging to overcome than physically challenging. When individuals and society are so accustomed to seeing science and religion in conflict with each other, they disengage from interaction, often with one or both because they do not want to be involved. Other individuals disengage to one area or the other. The ultimate result is that the disengagement can promote dogmatic views in both areas that prevent progress and development of new knowledge in both areas by stalling the ever-constant shift in paradigms in thought. If this study has the potential to restart a stalled engagement in any participant or reader, then it has been a success.

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APPENDIX A

INTERVIEW GUIDES

Interview 1: Life History for Science, Religion, and Reading

1. What is your STEAM area or college major?
    A. Describe how you chose this concentration?
    B. What experiences growing up lead you in this direction?
    C. When did you have an idea that this was the area you wanted to study?
        i. Did you ever change your desire to study in this area or a non-STEAM area?
            a) What area did you change too, or were thinking of changing too?
            b) Why did you decided for or against this?
2. What does the term normal-science mean to you?
    A. What was your school experience with learning science?
    B. What classes did you take in science that you enjoyed?
    C. What were some of the reasons you enjoyed these science classes?
    D. Describe any religiously oriented reasons that you may have enjoyed these classes?
3. How would you describe your religious affiliation?
    A. How long have you been a member of your current denomination?
    B. How does your denomination relate to normal science?

i. Are there conflicts?

C. What religious activities did you participate in growing up?

i. Was there ever any mention of science or can you think of any experience from the activities that might have included science or science discussion?

D. What religious activities do you participate in presently?

i. How frequently do you participate in these activities?

ii. Does science ever get discussed during the activities?

a. If so, in what ways?

4. Please talk about any instances where science and religion interacted in your educational life?

A. Perhaps in a science classroom (biology or physics).

5. What are your reading habits?

A. What types of materials do you typically read?

B. What is your primary purpose for reading (work, school, pleasure, etc.)?

C. Describe your reading habits in science?

i. What was the last science related book you read?

ii. Have you ever read a non-textbook science text?

a. If so, what can you recall about it that affected your reading experience?

D. Describe your reading habits in religion?

i. How often do you read the Bible?

a. What version do you primarily read?

ii. Why do you prefer this version/style of the Bible to the others?

E. What do you like/dislike about the way you read or the way both science and religion are written?

Interview 2: *Mr. g: A Novel About the Creation*

1. Describe your reading of the novel?
    A. How long did it take you to read the novel?
    B. How much could you read in a sitting?
    C. Did you find yourself ever re-reading sections?
        i. Which sections?
2. Describe any science content information learned or confirmed from reading the novel?
    A. Did this content have any connection with religious material?
    B. If so, which content?
3. How did the reading the novel compare to a reading of a general science textbook?
4. How was it different from a general science textbook?
    A. Describe how the novel's form helped or hindered you from experiencing the content material?
5. Describe the interaction between science and religion in the novel?
    A. How did the interaction between science and religion conform to your worldview of science and religion?
    B. Where there periods where there was any discrepancy between your worldview of science and religion and that of the novels?
    C. How did the interaction between science and religion conform to your understanding of the views on science of your denominations official position?

6. Describe the position of Mr. g in terms of the character's religious content?
7. Describe the position of Mr g. in the terms of the character's normal-science content?
8. Describe Aunt Penelope? What is her role? What are her religious connotations? What are her scientific connotations?
9. Describe Uncle Deva?
10. Describe Belhor?
11. Describe Baphomet?
12. Were there any specific sections or quotations that were particularly memorable or stood out to you?
13. What, if anything, did you like about the novel?
14. What, if anything, did you dislike about the novel?

Interview 3: Internal Questioning and the Making of Meaning

1. Describe Mr. g? What is your understanding of the character? How does the character relate to or understand religion? How does the character relate to or understand science?
2. Describe Aunt Penelope? What is your understanding of the character? How does the character relate to or understand religion? How does the character relate to or understand science?
3. Describe Uncle Deva? What is your understanding of the character? How does the character relate to or understand religion? How does the character relate to or understand science?
4. Describe Belhor? What is your understanding of the character? How does the character relate to or understand religion? How does the character relate to or understand science?
5. Describe Baphomet? What is your understanding of the character? How does the character relate to or understand religion? How does the character relate to or understand science?
6. Recall from reading the novel any interaction(s) you can describe between science and religion.
7. Recall some of the questions that you asked yourself during the reading of the novel?
8. When reading the novel, what interactions, processes or questions helped you understand religious aspects of the novel?

9. When reading the novel, what interactions, processes or questions helped you understand the normal science aspects of the novel?
10. What sort of questions did you generate when reading the novel and moving between the science and religious realms? (Ex: What? Why? How? Questions)
11. Were any questions specific in dialoging between normal science and religion?

APPENDIX B

INITIAL LIST OF CODES

(In Alphabetical Order)

Belief

Conflict

Content

Cosmology

Creationism

Denomination

Discrepancy

Evolution

Fundamentalist

God

Good vs Evil

Intelligent Design

Interpretation

Learned

Lens

Morality

Non-religious

Non-scientific

Perspective

Reading

Religion

School

Science

Science/Religion Interaction

Strategy

Teacher

Text

Understanding

APPENDIX C

LIST OF SUB-CODES FOR CODE

(In Alphabetical Order)

Strategy: adaptation (interpretive)

Strategy: annotate (technical)

Strategy: argument (technical)

Strategy: authorial authority (technical)

Strategy: bracketing (interpretive)

Strategy: compatibility (interpretive)

Strategy: compromise (interpretive)

Strategy: decoding (technical)

Strategy: dialogue (interpretive)

Strategy: division of content (technical)

Strategy: extrapolation (interpretive)

Strategy: fore-thought (interpretive)

Strategy: ignore (technical)

Strategy: layered (interpretive)

Strategy: moving on (technical)

Strategy: multiple reading (technical)

Strategy: notes (technical)

Strategy: questioning (interpretive & technical)

Strategy: reference material (technical)

Strategy: re-reading (technical)

Strategy: self-questioning of belief (interpretive)

Strategy: speculation (interpretive)

APPENDIX D

INTERVIEW EXCERPTS FOR INTERPRETIVE AND UNDERSTANDING STRATEGIES AND SUB-CODE LABEL

Strategy: questioning

"Um, I don't really remember off the top of my head. I know I wrote a lot down but…."

Strategy: questioning

"Why is he not being more evil than this?"

Strategy: compromise

"When it was more towards religion I would try to relate it more towards religion. If I could kind of see my side of it I guess then I would try to do that while I was reading as opposed to just like skimming over and thinking "I don't believe that".

Strategy: adaptation

"So but if it was like close enough or not really close enough but if that was something that I could say, "Hey, I see how this goes with what I already believe…."

Strategy: extrapolation

"…I'd like to think about who they could possibly be."

Strategy: layered

"…any level of intelligence, beyond I would say like a 5th grader, someone with like a working brain, could read this and gain something from it at like any level. Someone with a PhD in physics and a college student taking random classes, just like anyone who can read…"

Strategy: fore-thought

"…you're having a discussion with the problem in that you're looking at each step, you're going step by step, like you have a question in your mind how something is done, you have an explanation for you, you have a solution, there are side notes on it." ~

Strategy: bracketing

"…I have had to come up with ways to…essentially take my religious texts of the Bible and be able to say that this is true but at the same time beanie a scientist and a researcher I have to also take the entire breadth of literature because you can't just say 'I agree with all of this except this.'"

Strategy: compatibility

"I have had to come up with my own ways to justify the different aspects of the two and merge them into one."

Strategy: compatibility

"I was trying to figure out whatever is going on there. Um, kind of what the significance of all of these characters were."

Strategy: dialogue

"Oh well yeah, I mean this, the book as a whole kind of embodies that for me because it…it was kind of already a reconciliation of the two. I mean it's you know….it offered an explanation for both arising and um, of course questions that went to that. "

Strategy: speculation

"I wondered if they were going to bring that up ever um, for one….I wasn't sure they're going to have Mr. g create religion itself which ended up not happening."

Strategy: self-questioning of belief

"I guess I kept, like, asking myself, like how does this create or character align with my own God and then, like if this novel is true, like- which it's not claiming to be true, like- if this was literally how it goes like how does that change how I feel about God or like religion and like, yeah, how- how different is this from my- my own view of God and that just kind of stuff."