

Making Evolutionists and Creationists: The Causes and Consequences
of Evolution Education in Tennessee, 2009-2012

By

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Dissertation

Submitted to the Faculty of the
Graduate School of Vanderbilt University

In partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

in

Anthropology

August, 2016

Nashville, Tennessee

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To my wonderful spouse Lauren, who believed in me when I had given up

and

To my son Darwin, who doesn't know a life in which his dad isn't working on his dissertation

ACKNOWLEDGEMENTS

This dissertation would not have been possible without research grants from the National Science Foundation and a writing grant and mentorship from the Spencer Foundation. Crucial support came also from the Department of Anthropology at Vanderbilt University during the final year of writing, which enabled me to complete the task. In particular, I want to acknowledge the efforts of Tiffiny Tung in securing for me a fellowship that enabled me to move back to Nashville and focus on writing my dissertation.

I am grateful to everyone who have contributed their time to help carry out this research, including the many fellow graduate students who helped me to complete interviews with students: Jeffrey Shenton, Werner Hertzog, Monte Talley, Danielle Kurin, Jonathan Attridge, Beck Conway, Lauren Stavish, John Saba and Kathryn DeTore. Furthermore, the willingness of people throughout Tennessee to talk to me was, of course, absolutely essential to its completion. I thank the participating school districts, the office staff and teachers who spent extra time on busy school days to make sure that the interviews could be done. I also thank the pastors and people in the pews at the countless churches I attended during the course of this research.

No one has given more time and support than members of my family. Though they did not understand what I was doing with my life for the past decade, both of my parents have nevertheless encouraged me to keep working at it. More notably, my spouse Lauren, who has been very much aware of my doings, having been there through all of the highs and lows of the journey, has been even more encouraging. When I met her I was about to give up on graduate school. Her energy, optimism, brilliance and love inspires me always to do more and do better.

I want to thank the graduate writing group in the Anthropology Department for helping me to stay on task during the writing process, setting goals and keeping me accountable to them. I can only hope to find such encouragement and advice in the future as I continue in my career.

Finally, I have to acknowledge the support of my advisor Norbert Ross for encouraging me to pursue this project, and for taking the time to help me develop it at each step along the way. His help in securing initial funding and providing feedback on grant proposals was invaluable.

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Introduction

The following dissertation concerns a topic that has mostly evaded anthropological scrutiny until recently—the controversy over teaching evolution in public schools. Verily, this topic is anything but neglected in the media, where it attracts a great deal of interest, and in other disciplines such as science education research and history, not to mention philosophy and theology. Indeed, so much has been written about controversies surrounding the teaching of evolution in schools that the reader is justified in asking what, if anything, anthropology has to add. I believe that it offers a great deal. Most of what has been written on evolution and creation has been focused on ideas and beliefs, taking the social situation as background to what people believe and whether those beliefs are compatible. I am trained as a cognitive anthropologist, heir to a sub-discipline that has focused on what people think since the middle of the 20th Century. My perspective on this issue does not entirely ignore ideas and beliefs, but it does look beyond them to activities. As an anthropologist, I can also draw on a rich history of insights about what people do, based on more than a century of ethnographic research carried out throughout the world.

In order to understand evolution and creationism, I drew on theories of rituals and other religious practices, and I used these theories to understand both opponents and advocates of evolution education. I will argue in the dissertation that it is impossible to understand the controversy without attention to everyday practice, and to what people are accomplishing as they engage in daily activities in the classroom and elsewhere. Rather than assign agency to the creationist or evolutionist beliefs of various actors, I treat what people assert (i.e. beliefs) as taking shape through practice. This perspective reveals problems with past strategies for “handling” the controversy.

Furthermore, an analysis of the topic itself stands to contribute much to anthropology. Though very few anthropologists have conducted serious study on the topic of teaching evolution, many have weighed into the wider debate. Given that one of the four major fields of anthropology—bioanthropology—is concerned almost entirely with human evolution, it should not be surprising which side of the debate the discipline lands within. The discipline’s flagship professional organization, the American Anthropological Association, has officially stated its support for teaching evolution and opposition to creationism in schools (Scott et al. 2000). In the AAA statement, anthropologists are encouraged to:

...use their knowledge both of evolution and of human social and cultural systems to assist communities in which evolution and creationism have become contentious.

Anthropologists should help the public and public officials understand that good science education requires that evolution be presented in the same manner as other well-supported scientific theories, without special qualifications or disclaimers...(Scott et al. 2000)

Such support is qualified somewhat by the recognition, noted explicitly in the AAA statement, that people have the right “to hold diverse religious beliefs, including those who reject evolution as matters of theology or faith.” However, the statement is unequivocal on the point that, “Such beliefs should not be presented as science” (Scott et al. 2000).

The position of AAA itself echoes a “solution” to the debate over teaching evolution generally credited to the late biologist and public scholar Stephen Jay Gould. Gould argued that science and religion constitute two different “magisteria,” which need not conflict because they

answer different kinds of questions about reality. According to this argument, science is concerned with answering “how” questions, which involve specific details of proximate and material causality. Religion, by contrast, answers “why” questions, which require consideration of ultimate causes (Gould 1997). As tempting as this solution may be, it is based on a presupposition not shared by most people who are concerned about the issue, and is furthermore undermined by anthropology’s own conceptions of the roles that institutions such as science or religion play in people’s lives.

Though there are certainly people who identify as Christian and accept evolutionary origins of life (e.g. Miller 1999), others maintain claims that do, in fact, overlap these “magisteria.” Evolutionary theories have endeavored to answer a range of “why” questions, including many that are relevant to religious claims. For example, why are humans born dependent on adults? Why are humans predisposed to reciprocate or to help others recognized as kin? More generally, why are we (humans) here on earth? If humans evolved from ancestors shared with other primates, this fact has implications for why we look the way we do, why we perceive the world the way we do, and possibly even what we consider to be morally good and bad.

Likewise, an interpretive tradition has emerged within Christianity that regards the question of *how* humans originated as being of central importance. This contingent of evangelicals in the U.S. has tied the credibility of the Bible and even their very identity to the answer for that question. Indeed, according to many Christian thinkers in this tradition, the core theology of the faith depends on it. To wit, these Christians claim that all humans live in a “fallen” world and are in need of “salvation” specifically because historical persons named Adam and Eve, the literal ancestors of all humans, made a decision to disobey God and eat the fruit of a particular tree, as described in chapters 2 and 3 in the book of *Genesis*, the first book in the Bible. If Adam and Eve were not created in the way described in *Genesis* 2, according to such claims, then the entire Bible loses all credibility as a source of Truth, and the basis on which Christ’s sacrifice on the cross disintegrates. Thus while the “magisteria” of religion and science may not overlap for some people, for others they have been tied together into what amounts to a Gordian knot.

The research described in this dissertation questions whether evolution truly ought to be presented “in the same manner as other well-supported scientific theories...,” as is prescribed by the AAA. The issue is not whether in fact evolution is well-supported science. I speak with no authority on this fact, but I accept it nonetheless as true based on my understanding of arguments for it, my personal experience with the evidence, and—most importantly of all—my trust in the competence of scientists who find it to be among the best scientific theories in existence (NAS and IOM 2008). Rather, the issue is that the implications of the theory and the deeply felt reactions to it from many members of the public lead to two critical questions. First, is it possible that evolution actually should be taught in a manner that is *different* from other well-supported scientific theories? Second, why do we feel so strongly that it ought to be universally taught in the first place?

Introduction to the Field

As I drive along Interstate 40 to my field site in eastern Tennessee, a small town in the foothills of the Appalachian Mountains, I survey the available radio stations. There are the ever-present conservative talk radio programs: the voices of Rush Limbaugh, Mike Savage and Sean Hannity being the most frequently heard. They sound unmistakably Northern, with East Coast

dialects that contrast sharply with the Appalachian dialect heard in the towns and off-roads throughout this region. And yet they are not exactly foreign. Eastern Tennessee has long been a popular destination for migrants from the cities of the Northeast. Known to people at my field site as “half-backers,” these Yankee migrants often begin their journey by moving south to Florida. Then, discovering the same high taxes and liberal politics in that state as in their home state, they head back north and stop in Appalachia, where they find the natural beauty and conservative values they were seeking. Such transplants have played an important role in the area. Today they are a boost to the economy through tourism, but nearly a century ago they came seeking to build industry by exploiting the cheaper, anti-union workforce and natural resources. Indeed, the notorious Scopes “Monkey” Trial, which will be discussed in chapter 2, was largely staged by Northern transplants in Dayton, Tennessee, seeking publicity for their small town (Larson 1997).

As I roll through the dial, music stations are primarily Country, though I am getting one Oldies Rock station out of Knoxville. There are several Christian stations, which tend to include a mix of old timey gospels, contemporary Christian rock, sermons, and call-in programs. I stop on one such station when I hear the word “adaptation.” Tuning in, I note that it came from the mouth of a guest expert on a Christian talk program. As I listen, the host feeds him questions in what might appear to be an impromptu conversation, though the arc of the discourse is well-known to me at this point: evolution is a dangerous doctrine that poisons people’s minds against the Word. It is taught in schools despite the fact that it has no real evidence in support of it. It is based on a set of assumptions, based in a naturalistic (read atheistic) worldview. Evolutionists misinterpret and imagine evidence for it in order to justify their rejection of God and the Bible. In fact, the guest expert tells listeners, there is more evidence for special creation and the historical accounts of the Bible than there is for an ancient earth and evolved life. The expert goes on to recount the many examples of complexity in nature that require an explanation from design. From the human immune system, to the bombardier beetle and the flagellum of certain protozoa, “the world cries out for Creation.”

To the ears of someone with a secular education, familiar and comfortable with modern scientific knowledge, the account presented by the so-called expert is ridiculous. It would seem that the man is a charlatan, ignorant of the science for which he presumes to speak. If he is not ignorant, he is a liar, using his scientific credentials to mislead the uneducated and gullible. Before I came to this project, I would have found myself arguing, even shouting at the man on the radio. Eventually I would have forced myself to turn it off out of anger and frustration. Now, instead, I listen attentively, noting his choice of words and how he frames each topic. I am interested to hear with whom he is affiliated (he never says) and whether he uses some new argument or claim with which I am unfamiliar (he does not).

Through an anthropological lens, it is not possible to simply discount the expert, his host and their many credulous listeners as simply “wrong.” In his classic exposition of witchcraft beliefs among the Azande, Evans-Pritchard hardly even considers the question of whether witches and their powers are real¹. He saw his responsibility not in debunking the claims of his Azande informants, but rather in understanding how people came to believe them and how those beliefs shaped their behavior and relations with one another (Evans-Pritchard 1976). In the end,

¹ Granted, Evans-Pritchard insinuated in various places throughout the text that he regarded them false, even while admitting occasionally to thinking about them as though real. Though his position on their ontological status was ambiguous, his sociological analysis proceeded from the recognition that the Azande in general regarded them as real.

he concluded that Azande thought regarding witchcraft beliefs was rational, empirically-based, and useful for making sense of the world. In short, it was in many ways similar to scientific thought, a bold claim that continued to be debated decades later (e.g. Douglas 1967; Horton 1967). And Evans-Pritchard is not unique in his approach among anthropologists. It would be odd to read an ethnography in which the author spends any time at all considering that the ideas and explanatory models she reports from her informants are simply mistaken and ought to be disregarded as superstitious, ignorant or irrational².

Across Tennessee (and beyond) I encountered a set of ideas and assertions known generally as “creationism.” “Creation” or “creationism” refers to an account of origin based on a reading of the first two chapters of *Genesis* according to an interpretive tradition (Malley 2004) referred to as “literalism.” According to this literal reading, God created the universe, along with earth and all life, in six days. So-called “old-earth creationists” interpret *Genesis* 1 in a way that allows for the inclusion of millions or even billions of years between the creation of the universe and that of humans, permitting an overall creation account that is far more consistent with modern scientific estimates. There are two strategies for such a reading: the day-age theory and the gap theory. Whereas the former claims that these six “days” could refer to very long, unspecified periods of time, the latter claims that a gap of time exists in the account between the first and second verse, allowing for the possibility that other “worlds” existed before the one for which humans were created. By contrast, “young-earth creationists” reject these kinds of readings, assenting to the estimates of Bishop James Ussher that the world was created on October 23, 4004 B.C.³ Several Baptist pastors insisted to me that the Hebrew term translated as “day” could only mean a 24-hour period of time, especially since the text refers explicitly to the evening and morning of each day of creation. According to them, any other reading is a “slippery slope” toward compromising scripture to suit our modern expectations, which opens the way for more theologically (and politically) liberal understandings of the Bible.

As I met with, discussed, listened and debated self-proclaimed “creationists” at my field site in eastern Tennessee, and as I tried as much as possible to understand them, I grew to appreciate that they live in a social world that is very different from my own, despite geographical overlap. The people with whom they interact on a daily basis, the “truths” they read and hear in the media, and the ways they interact cognitively with their environment all serve to reinforce their claims about creation. Their social world has no less respect for rationality, evidence and science than the one I normally inhabit. It would, in fact, be difficult to imagine “creation science” gaining any traction among these Christians were this not the case (Toumey 1994). In their world, the radio guest really is a scientific expert, presenting scientific facts. That these facts support the history given in the Bible is not only true, according to them, but could not be otherwise given that the Bible is God’s Word, infallible Truth. From their vantage point, the scientific facts support their view of creation to such an obvious extent that the only way evolutionists could deny them is due to stubbornness, blindness, or a will to deceive. The fact, it should be noted, that those who accept evolutionary accounts assert the very same thing about creationists⁴ suggests an underlying parallel that begs for exploration.

² One exception may, ironically, be Evans-Pritchard’s efforts to infiltrate the world of witchdoctors. However, he never actually debunks the notion of witchdoctors, reporting the claims of some that there are true witchdoctors though most are fakes.

³ The Irish bishop calculated the age of the earth in the 17th Century based on genealogies presented in the Old Testament.

⁴ <http://www.philvaz.com/apologetics/p88.htm>

Introduction to the Project

The doctoral project outlined in this dissertation arose out of a study organized by the Center for the Study of Religion and Culture at Vanderbilt University. During the summer of 2008, I was sent to live in the same Appalachian town in eastern Tennessee, in order to conduct ethnographic fieldwork on “politics and religion.” I spent 10 weeks in the town, attending public meetings and religious gatherings, interviewing pastors, politicians and administrators, and talking with people in parks, pews, bars, cafes and anywhere else I could find them. Though I had been living in Nashville, the state capital of Tennessee for half of a decade at that point, this was my first sustained experience outside the Metropole, in the hinterlands of the state. Prior to that research, I was aware that a large percentage of the US nation, particularly in rural areas, was politically, socially and religiously “conservative.” However, my understanding of these perspectives was little more than vague and caricatured. Furthermore, while I grew up in a somewhat rural area of south-central Missouri, where conservative politics and evangelical Christianity seemed to dominate, I had no awareness of their distinct character in the context of the US South⁵. My initial shock was replaced by fascination as my research in eastern Tennessee continued.

The most striking aspect of my experience in Appalachia was the ubiquitous hostility I heard expressed regarding the topic of evolution. It came up in sermons, on the local radio, and even in casual conversation. Early in the fieldwork⁶, a thirty-something year old blonde woman noticed me sitting on a park bench, writing in my notebook, and began a conversation. When I identified myself with Vanderbilt University, she asked what I studied there. I answered, “Anthropology,” and her demeanor shifted from friendly to wary before she asked with a tone of incredulity, “You don’t believe we came from monkeys, do you?” I told her that, technically, evolutionary biologists would say that humans and monkeys share a common ancestor. Undaunted, she asked whether I believed that idea. I replied that I accepted evolution based on the overwhelming scientific evidence. My response seemed to confirm her suspicions about me, as she immediately frowned and then began to witness⁷ to me, explaining the fate of my soul and my need for salvation through Jesus Christ.

The experience, which was followed by a host of similar experiences with others I met, revealed several underlying assumptions in play regarding attitudes toward evolution in the region. First, the discipline of anthropology was immediately associated with evolution. Hostility toward evolution thus has implications for anthropologists as a whole, which could be manifested in how undergraduates approach an anthropology course or in whether politicians support anthropology departments in public universities or public funding for anthropological research. Second, the woman felt sufficiently confident in her rejection of evolution that, after only recently meeting me, she was comfortable informing me that the only socially acceptable position was to reject evolution (literally, “You don’t believe in evolution...”), and then inviting me to take said position (“...do you?”).

⁵ The US South or “The South” is understood in the United States context to refer to the region of the country comprising those states that seceded from the Union just before the American Civil War (1861-1865). Linguistic, cultural, economic and political differences between the North and the South preceded the Civil War and continue to the present day.

⁶ June 28, 2008.

⁷ Witnessing is a behavior wherein a Christian “believer” tells a non-believer about the believer’s personal experience coming to have a relationship with Jesus, for the purpose of enticing the non-believer to convert or “give your life to Jesus.” This and other practices will be examined in Chapter 3.

Third, my belief in evolution identified me as a “non-believer” in the Bible and Jesus Christ, based on the presumption that an evolutionary account of human origins contradicts the Word of the Bible. Since I was an evolutionist, according to this logic, I was a lost soul, desperately searching for meaning denied through a naturalistic worldview. My naiveté regarding the offensive nature of evolution suggested that I was a victim, a casualty of the forces of materialism, deserving pity and needing salvation. The woman, as a self-identified evangelical and “born-again Christian,” was therefore obligated to help me to “accept Jesus as my Lord and savior.” Simultaneously, however, the evolution I accepted and espoused was recognized as a tool in undoing the faith of others, especially children. By maintaining my belief in evolution in spite of the problems associated with it, I represented a moral danger. In short, evolution is both cause and symptom of unbelief. Furthermore, I, and anyone else who might advocate evolutionary views, was both an agent and victim of the evil it represents⁸.

While the logical interconnections of the afore-mentioned assumptions escaped me during my initial encounter, these were clarified through sermons and conversations with conservative pastors. I came to understand that evolution is an idea that is thought to lie at the root of an entire complex of evils that concern conservative Christians in this country—including abortion, drug addiction, communism, pornography and secular humanism (see for example LaHaye 1980). Given these associations, one who accepts evolution, is not merely identified as a non-Christian, and thus as a potential convert, but as morally suspicious and even threatening. In fact, I once experienced a violent response to my presumed acceptance of evolution while hanging out in a bar in this town.⁹ I wore a t-shirt that features a modified version of the ape to man diagram where each of the figures is bowling. A regular at the bar, and Iraq War veteran, saw my shirt and walked up to me. With his finger on my chest, he said that evolution was a bunch of atheistic nonsense and that he didn’t come from a monkey. Terrified, I emphasized that the shirt was merely a nod to the film “The Big Lebowski.”

Given the deep-seated animosity toward evolution in eastern Tennessee, I began to wonder how it was that teachers were able to cover the topic in their classrooms. According to the logic laid out above, any teacher who promoted evolution would be open to severe criticism from members of their communities, likely including their own students. Do these teachers have a strategy for avoiding the negative repercussions? Even more, as an anthropologist, with a disciplinary predilection for the plight of the marginalized, I wondered how people in the area perceive and respond to the imposition of evolutionary ideas on their communities through public schools. These are not idle questions, but instead concern the nature of state power in relation to the establishment of true knowledge vis-à-vis a duel between conflicting visions of society played out in an arena where the minds of the next generation are developing.

As I began this research, it happened that Tennessee’s Board of Education had recently approved new science standards as part of a general education standards overhaul from the Governor’s office (Mielczarek 2008). These new standards expanded content related to evolutionary theory from Biology I, a high school course, to earlier grades in the form of Standard 5: Biodiversity and Change over Time. Concepts relevant to understanding evolution, such as population genetics, adaptations and natural selection, were introduced in elementary school grades. The standards for Eighth grade science in particular was changed from basically no mention of evolutionary theory in the former standards to include all basic evolutionary

⁸ These themes will be explored in much more depth in chapter 2.

⁹ July 25, 2008.

concepts (from natural selection as mechanism to fossils as evidence of change) comprising nearly one-third of the science content for that grade level in the new standards.

I recognized in the adoption of the new science framework an opportunity to elucidate the relationship between contemporary evolution education in Tennessee and ongoing and pervasive antievolution sentiment. This central research question can be broken down into several related questions. First, why would the Tennessee Department of Education have decided to expand evolution coverage, given the widespread opposition to evolution? Second, how do teachers navigate in their classroom practices between the evolution content in state education standards and the concerns of their communities? Third, how do students, parents and other community members respond to the content as presented?

With funding from the National Science Foundation, I delved into these questions through a two-year, multi-site, mixed methods project that ranged from the bureaucracies of the Tennessee Department of Education to classrooms in three different school districts. My work upsets the prevailing assumption in popular discourse and science education scholarship that the controversy surrounding evolution education stems from clashes over deeply held internal beliefs and ideas. Instead, I will demonstrate how the expression of various ideas and beliefs are actually symptoms of social conflict situated in a particular history.

Today evolution is considered by a large minority of the population of the United States to be offensive to Christian faith, owing to a set of assertions about the nature of scripture and a particular interpretive tradition employed in reading it. It is important to note that this interpretive tradition is not the only one possible. Many have noted that an evolutionary account does not actually deny God's existence, but simply proposes a way that humans would have emerged without God's direct involvement. Some have noted furthermore that an evolutionary account does not necessarily render God non-essential, as He may still be called upon to explain how life first began or even how the universe came to exist at all. Many of these people believe that it is possible and reasonable to be a Christian while accepting an evolutionary account of origins (e.g. Miller 1999; Polkinghorne 1998). However convincing these alternative views may be, many conservative Christians assert with conviction that evolution and creation are nevertheless diametrically opposed. For their own part, there are plenty of agnostics and atheists who have also asserted incompatibility between creation and evolution (Dawkins 2008; Stenger 2007). Rather than treat such assertions as inevitable, this dissertation will ultimately explore how they were made, and the reasons they are maintained to this day.

Anthropological Significance

The issues surrounding teaching evolution concern themes that have seen increasing salience within anthropology in the last three decades—questions of power and authority, secularism and the State. In this section, I will discuss each of these themes in order to make clear how the work presented in this dissertation is relevant to anthropology as a whole.

First, the struggle over teaching evolution is explicitly about contestations over the power and authority to construct and pronounce what counts as “knowledge” of what is known, accepted or believed about human nature and identity. State science standards are conceived by policy-makers and many education scholars as efforts to replace “backwards” thinking, i.e. non-majority cultural models like creationism, with majority cultural models of scientific authority, of human origins, and of human nature. In parts of rural Tennessee, people claim to be living under siege by a majority culture that invalidates and demeans them. In order to avoid the

cultural imposition by this wider culture, these people go to great lengths to isolate themselves and especially their children from its reach (see Peshkin 1988 for an example).

The situation experienced by conservative evangelicals has some parallels with the experiences of minority and indigenous groups in Western schooling. Anthropologists have criticized indigenous education in the United States, Mexico and elsewhere for functioning to force acculturation to majority cultures (Apple 1982; Bowles and Gintis 1976; Carnoy 1974; Levinson, Foley and Holland 1996; Luykx 1999; Nasaw 1981; Rockwell 1996). Educational anthropologists in the U.S. have documented the ways in which science education does symbolic violence to the cultures and ways of thinking of such groups by privileging majority culture epistemologies over indigenous ways-of-knowing (see Castagno and Brayboy 2008; Levinson, Foley and Holland 1996 for examples of similar perspectives with indigenous groups). Within the indigenous science education literature, these charges have prompted calls for “culturally-sensitive” science education, which typically explicitly recognizes alternative ways of knowing as a means of mitigating the potential for symbolic violence (El-Hani and Mortimer 2007). It is important to recognize the substantial historical differences between white Christian evangelicals and the various minority and indigenous groups that are typically included in discussions of cultural hegemony in schooling. The former group has enjoyed cultural and political dominance in the United States throughout much of its history, and only began to see that dominance eroded in the last century. Nevertheless, if the experiences of the respective students are ultimately similar, and if symbolic violence is recognized as an undesirable outcome regardless of the targeted group, then the parallels deserve further exploration.

Second, the public confrontation over teaching evolution and its “alternatives” in public schools fits within a larger conversation over the role and place of organized religion in modern states. In the United States, this is a legal question of church-state separation, encoded in the United States Constitution under the dual guarantees of the Non-establishment Clause, which prevents a government from establishing or endorsing a particular religion, and the Free-exercise Clause, which ensures that individuals can believe and practice the tenets of their chosen religion without interference from their government. Legislation intended to limit the teaching of evolution meets its firmest opposition from charges that it violates church-state separation because it is motivated by religious concerns or because it attempts to inject views particular to one or a few faith traditions into public school curriculum in the form of creationism, creation science or Intelligent Design Theory. More generally, these ideas reflect a commitment to secularism. Sociologist Christian Smith has examined the historical rise of secularism in the U.S., presenting it as a bloodless revolution whereby educated and scientifically-minded authorities replaced traditional religious authorities, even on moral matters (Smith 2003). However, the ongoing conflicts surrounding the teaching of evolution suggest that this so-called secular revolution is ongoing, with the outcomes still uncertain in many parts of the country.

The site of this contestation is a sacred space referred to as “the science classroom,” a space privileged by two factors. First, public schools are part of the public square. Implicitly, that which occurs in schools is condoned by the entire community; the members of which support it through taxes and allow it to dictate their children’s schedules for 13 years of their lives. Second, inside of these schools, science classrooms are spaces marked off for the discussion of Science, an epistemological powerhouse in the modern world. In science classrooms, students learn the laws, mechanisms and principles that govern the physical world, upon which technology is based. For most people, calling something “scientific” is equivalent to calling it “real” or “true.” Because the science classroom is sacred space, that which is taught within it acquires a cultural

importance far beyond that allotted to other school subjects (Binder 2002). For many critics of evolution, teaching evolutionary ideas in the science classroom is equivalent to compelling children to accept it as true. For advocates of evolution, allowing “alternative” accounts of origin, such as creationism, into the science classroom pollutes that sacred space with “superstition,” and is as morally offensive as would be urine in holy water.

The third major theme, which is closely related to the first two, relates to notions of the State as it is manifest in the daily experiences of citizens. In the case of evolution education in Tennessee, we have governmental entities that establish controls over curricula in local classrooms via the state education standards. Examining how these standards were produced and enacted, offers a window into the nature of the State and its agency. Philip Abrams argued that “the State is a unified symbol of an actual disunity. This is not just a disunity between the political and the economic but equally a profound disunity within the political.” Summarizing the critique, he notes that political institutions:

...conspicuously fail to display a unity of practice...manifestly they are divided against one another, volatile and confused. What is constituted out of their collective practice is a series of ephemerally unified postures in relation to transient issues with no sustained consistency of purpose. (Abrams 1988)

Abrams warns against labeling even this collective practice as “the State,” because the very purpose of the “state-idea” is to create an illusion of unity. The State is, in other words, “the mask which prevents our seeing political practice as it is” (Abrams 1988).

Indeed, as the fieldwork progressed, it became obvious that the state was neither monolithic nor particularly cognizant, but was instead elusive. Instead of “the State,” I encountered individuals who had either been employed or were currently employed by the State of Tennessee to accomplish some set of tasks. Many times these individuals were aware of things that were not officially documented and thereby “known” to the State. As far as I could tell, the State only existed as a thing to be referenced. Its primary form was documental: laws, statutes, policies. Power is distributed and negotiated among actors in the system in accordance with reference to those documents. This being the case, it became impossible to sustain a top-down account of a monolithic state, in which mandates are forced on its citizens, who then pursue strategies of resistance to thwart that imposition. While various actors do engage in practices that could be called “resistance”—teachers find ways to cast doubt on evolution while teaching it, students shut-out lessons on evolution or simply learn what they need for the test—I ultimately found it more helpful to not to separate these behaviors from the enactment of state policy.

Finally, and in addition to the aforementioned themes, this research speaks to topics that have only recently begun to get traction in the discipline, particularly in the fields of educational anthropology and the anthropology of Christianity. In educational anthropology, topics related to science education have mostly been ignored in favor of topics in language and history, with their more obvious relevance to culture. As anthropologists have adopted frameworks from Science and Technology Studies and the Sociology of Scientific Knowledge, they have increasingly recognized the ways discourses of science function in modern societies. Cultural studies of science education seem to follow from such insights by examining the ways such discourses are inculcated in school settings. In the anthropology of Christianity, increasing attention is afforded Christianized peoples around the world, particularly the ways such people confront what it means to be modern, and the relationships among diverse Christian beliefs, practices and identities (Keane 2007; Robbins 2001).

The Idealist Frame and its Problems

As an anthropologist trained in cognitive approaches, I began this project with special attention to ideas, beliefs, understandings, and other mental phenomena relevant to teaching evolution. As detailed in the next chapter, the research project was designed around the notion that particular ideas or beliefs about evolution were transmitted from the offices of state-level actors, through institutions of education and to students in classrooms across Tennessee, based on Sperber's epidemiological approach to culture (Sperber 1996). In this hyper-focus on beliefs, I was following a cultural script wherein the ongoing public debate over teaching evolution in schools results from the collision of mutually incompatible beliefs or claims about reality—Bible-based creationism vs. naturalistic science. The assumption of this script is that the conflict is about *beliefs* or *ideas*.

The most obvious example of this script comes through public polling, wherein participants are presented with two or three propositions, with which they must either “agree” or “disagree.” Results from these polls are presented almost as scorecards, displaying what percentage of the public sides with one or the other. For example, the results of a Gallup Poll from 2014 are summarized in the title of a Gallup Report as, “In U.S., 42% Believe Creationist View of Human Origins.”¹⁰ Many recent polls, including Pew and Gallup have reported a third position as well—that humans evolved, but that God was involved in the process. Regardless of the specific wording of the various positions, the implication is that some people believe one thing, other people believe something else, and these beliefs are important.

Most scholarly literature on issues related to teaching evolution follows this script as well. It goes without saying that philosophical and theological scholarship on evolution is explicitly focused on this aspect, taking up the question of whether beliefs about evolution and creation can be reconciled, or about whether one view or the other is most consistent with scientific observations and/or theological truth claims. Virtually all literature in the science education field is also focused on ideas, including not only understanding concepts related to evolutionary theory, but also understandings of science itself and how these understandings relate to ideas about the implications of evolution for the believer. This focus on ideas is not surprising when one remembers that formal schooling is explicitly about communicating ideas to students, with the hope that these ideas will be “learned” or adopted.

There is plenty of reason to pay attention to these ideas, not least due to the fact that the relevant actors talk about them so frequently. Any conversation over how evolution is taught will prominently feature arguments for one position or another. The issues surrounding evolution in schools are often referred to as a “debate,” indexing the fact that interested parties disagree over certain propositions and truth claims, and those parties wish to assert that their respective positions are rationally and empirically valid (at least more so than the alternative). It would be ridiculous to describe the contours of evolution education without reference to these various ideas, and I am not suggesting such an extreme stance. Nevertheless, there are reasons to look beyond this script in order to better understand the nature of conflicts over evolution in schools.

One problem with the script is that it sequesters the issues within an ideational realm that is disembodied from the social reality in which biology education occurs. By concentrating on the positions themselves, as well as the arguments for and against them, it is easy to forget about the human beings who are arguing about them. After all, there are infinite possibilities for humans to disagree over propositions of truth; so why do people invest this particular point of

¹⁰ <http://www.gallup.com/poll/170822/believe-creationist-view-human-origins.aspx>

disagreement with such importance? Furthermore, given that people identifying as Christian encounter evolutionary accounts of human origins all across the planet, why has conflict over teaching evolution been largely limited to the U.S.? These answers cannot be found in the ideas themselves. They come from a history of interaction that has had, and continues to have, repercussions for politics and society.

The focus of the script on beliefs, specifically, poses a further set of problems. Most immediately, the ontology of “belief” as a phenomenon is unclear. Beliefs are typically understood to be propositions or claims regarded as true, though some definitions contrast beliefs with knowledge with the insinuation that “believed in” propositions are in fact false. Furthermore, we tend to talk about beliefs as though they are stable mental objects, which simply wait around in the mind until called upon, but it may be more useful to think about “believing” as a cognitive act directed toward some proposition. These kinds of questions may seem recondite, but they are prerequisite to an account of colliding beliefs, how beliefs change, and how beliefs affect students as they learn about evolution.

Related to these issues, anthropologists who study religion have attacked the concept of belief as an object of study for several decades (Bell 2009; Carlisle and Simon 2012; Engelke 2002; Kirsch 2004; Needham 1972; Rappaport 1999; Ruel 2008). The criticisms boil down to two basic “problems of belief.” These issues will be discussed further in Chapter 3, but are relevant to review at this point as a way of introducing the central thesis of the dissertation.

The first problem of belief is the likelihood that “belief” is a concept highly specific to modern, Western, Protestant societies, owing to a particular history (Ruel 2008). The meaning of the term has shifted over time, meaning something different for the Hebrew and Greek authors of the Bible than it means for people today (Ruel 2008), and efforts to translate it into other languages are fraught with difficulties (Needham 1972). Scholars who talk about beliefs, therefore, ought to recognize the cultural specificity of the concept and take care not to project it onto non-Western societies. It might be assumed then, that this “problem” can be ignored with regard to the particular topic of this dissertation, being as it is contained in a clearly modern, Western, Protestant context. However, even anthropologists studying self-identified “Bible-believing” evangelical Christians in the U.S., have begun to reconsider the centrality of beliefs in these communities. For example, Elisha has suggested that beliefs ought to be contrasted with faith, with the latter having more importance in motivating political action (Elisha 2008). Likewise, Howell argues that Christians pay more attention to “commitment” than to dogmatic belief (Howell 2007). And Luhrmann claims that, for the Christians she studies, doubt can be an even more important than belief in motivating people to pray and engage in other faith-building exercises (Luhrmann 2012a; Luhrmann 2012b).

The second problem is the existence of a gulf between an anthropologist’s beliefs and the beliefs of her informants. The inability of an ethnographer to share beliefs with subjects draws a distinction between the kinds of ideas that the anthropologist is willing to entertain and those of the cultural other. As Engelke observed, ethnographers are eager to avoid the “embarrassing possibility” that the people they are studying could have anything to say about the ethnographer’s reality.¹¹ The ethnographer always remains, necessarily, outside of subjects’ heads, able to imagine but never experience their world. This gulf is a problem not only for

¹¹ More cynically, Sperber has pointed out that what ethnographers are really after, what counts as “cultural” or “religious” is precisely the sort of thing that they perceive as false. The ethnographer doesn’t pick up his pen until he sees something that defies his own rationality Sperber, Dan. 1975. *Rethinking symbolism*. New York: Cambridge University Press..

ethnography but for any effort to study beliefs. As mental phenomena, they are inaccessible to social researchers (Rappaport 1999). At best we can say what someone claims to believe, but not whether they actually believe it nor what such a belief precisely entails.

The solution to these issues taken by several anthropologists is to focus on religious practices rather than beliefs (Bell 2009). For example, Rappaport noted that “belief” is unavailable for study, but that “acceptance” is a socially observable phenomenon (1999). Rappaport used as his example a public ritual, in which both performers and the audience signal, through their participation, acceptance of the system on which the ritual is based and the obligations to others that the system entails. Translating these insights into the current study, I conceived claims made by my informants about beliefs, not as privileged gazes into the recesses of their private minds, but as socially contextualized pronouncements used by the participants to communicate allegiance to a particular identity.

Following Rappaport’s distinction is useful, not merely for side-stepping the problem of belief, but also in recognizing the power relations involved. The act of “acceptance” presupposes being on the receiving end of a transaction, be it economic or social, with corresponding relations of power. When students or teachers “accept” evolution, they publicly affirm a particular order of things assumed by modern science. Ironically, the power dimensions of “acceptance” can be illustrated through a particular discursive strategy adopted by the evolution education community.

Among scholars and advocates, I often encountered a rhetorical distinction being drawn between the use of the terms “belief” and “acceptance” with regard to evolution. Many teachers and advocates of evolution education told me that it was important to say that one “accepts” evolution rather than “believes in” evolution. The argument for the distinction was that believing implies faith in something without evidence. Because there is abundant scientific evidence for biological evolution, a scientifically minded person can only accept that evidence or deny it. The implication is, of course, that evolution is true whether you believe in it or not. The agency of an individual extends only as far as deciding whether to assent to the “truth” that is pronounced from without. The rhetorical value of this distinction is made clear by the fact that many Christians emphasize that an individual may only choose to “accept” Jesus as one’s personal savior or to “deny” Him. Again, the presence and relevance of Jesus in our lives is presupposed by authorities beyond the individual.

Overview of Dissertation

Ultimately the central thesis of the dissertation is that individuals participating in evolution education (bureaucrats, teachers and students) are acting and thinking within a social realm without which the enterprise and controversy make little sense. These actors have more interest in communicating their commitments to various positions in the “debate” than being strictly concerned with the compatibility of beliefs in some ideational realm. Owing to the importance the issue of evolution and creation has attained in identity politics, it is now the case that by publicly stating, “I believe in evolution,” an individual commits herself to that position. It becomes a part of her identity, and she is obligated to take the position seriously. When it is assaulted, as through a creationist argument, she is obligated to defend it. Depending on her office or position, she is obligated to take actions that demonstrate that position. The same, of course, is true for the individual who tells others that she believes in creation. I support this thesis in the following 8 chapters.

The first chapter provides an overview of the project and situates it within the existing scholarship on this and related topics. The work sits at the crossroads of multiple disciplines. While no other project has previously explored evolution education at this scale, it builds upon research from science education, political science, sociology of social movements, and anthropological studies of Christianity and science. The project involved long-term ethnographic fieldwork in Nashville and a site in East Tennessee, unstructured interviews with pastors, parents, policy-makers and school administrators, and structured interviews with teachers and their students in three different school districts in the state. Inspired by an epidemiological approach to public schooling, it traces ideas about teaching evolution from education policy makers to classrooms. By summarizing the overall project, this chapter provides the reader with an appreciation of how evidence provided in later chapters was produced.

The second chapter historicizes the conflict between evolution and creation in order to show the constructed nature of the debate. Drawing on scholarly historical work, it argues that the histories of the antievolution movement and the expansion of state-controlled public science education are closely intertwined. The historical review begins before the famous Scopes “Monkey” Trial of 1925, when public schooling was being expanded throughout the state. Tolerance of this expansion was dependent on a “home rule” arrangement between the state and local districts along with passage of the antievolution Butler Act that led to the Scopes Trial. The historical background continues through a parade of anti-evolution legislation that reaches into the 21st Century, alongside growing efforts from educators and education policy-makers to expand the coverage of evolution.

Chapter 3 examines the role of belief in issues over evolution and creationism, and argues ultimately that believing ought to be understood as an activity, whether it be cognitive or social. The chapter begins with a review of anthropological approaches to belief throughout the 20th Century and continues with a discussion of contemporary scholarship in the anthropology of Christianity. Then, based largely on ethnographic research in these locales, the chapter will demonstrate how beliefs are publicly performed in a small town in Eastern Tennessee. I conclude the chapter by describing and analyzing my own interactions with self-identified creationists, which serve as further examples of how identity is asserted through “debating” and how commitment to a position obligates us to act in particular ways.

The fourth chapter provides an account of the process by which the 2009 Tennessee Science Framework was developed, based on interviews with various participants in that process. While new, more rigorous science standards were developed at the behest of the governor, in an attempt to make Tennessee more appealing to tech companies, the decision to strengthen evolution within those standards was made in the context of a national discourse of “scientific literacy.” In both cases, decisions were made based on professional and political commitments, with special attention to what these decisions signaled to others. The key emblem of scientific literacy, which is deemed essential to having an informed population capable of responsibly participating in a modern democracy, is evolution—understanding it, accepting the evidence for it, and advocating for it being taught. The authors of the science standards drew explicitly from this discourse when they wrote a draft that featured evolution prominently in 8th grade science.

The fifth chapter is the sequel to the fourth, detailing the edits that occurred to the standards following a period of public review. Public criticism, drawing on another discourse that sees evolution as anathema to Christianity, put pressure on the authors of the standards to replace the word “evolution” with the phrase “change over time,” and to eliminate references to common ancestry. The individuals involved in forcing the edits reveal the ways that personal

commitments motivated them to take action. The authors, working in the confines of a political environment, capitulated to the edits, while maintaining that the meaning behind the standard on “biodiversity and change” remained unchanged.

Chapter 6 examines how the new standards were implemented in local contexts by educators. The Tennessee Department of Education organized standards-training workshops throughout the state in order to facilitate the transition to the new standards by teachers. I attended several of these workshops in order to document the state’s efforts to implement the standards and the responses of teachers to them. Teachers, of course, are crucial to implementation, as they make decisions in the classrooms that ultimately determine whether and how materials in the standards are in fact covered. However teachers are simultaneously state actors and community members—living and working in a local context and making decisions that are sensitive to local concerns. Structured interviews with middle and high school science teachers reveal how they interpret standards and negotiate them based on their own education and religious background and motivation to signal their personal and professional commitments. The result is that many teachers, in areas where evolution is taboo, find ways of subverting the curriculum.

Chapter 7 reports findings from analyses on how middle and high school students in the participating districts understand evolutionary theory, and how this understanding relates to their religious commitments. The chapter addresses an ongoing debate in the evolution education literature on whether understanding evolution yields belief in/acceptance of evolution. While my results show a positive correlation between understanding and acceptance, this relationship is complicated by two facts. First, there is no evidence that students’ beliefs about origins change following instruction. Second, students identifying as young-earth creationists, whose position includes a rejection of most of modern science, understand evolutionary theory at a level equal to students identifying with naturalistic evolution, even as old-earth creationist students, whose position is more consistent with scientific estimates for the age of the earth, have among the worst understandings. I argue ultimately that these results are best understood when beliefs are recognized as statements of social commitment that motivate certain reactions to the evolution curriculum rather than internal mental objects acting like stumbling blocks for understanding.

Then, the eighth and final chapter considers theoretical lessons of the fieldwork. The chapter begins with an analogy of an actual public debate carried out in 2013 to illustrate the thesis of this dissertation. The chapter then provides an epidemiological account of evolution education in Tennessee, based on the previous chapters, and highlights several issues with the approach. I then synthesize findings from earlier chapters to suggest a new perspective in thinking about the debate between evolution and creation, which takes seriously the identity claims implied by the major actors. The conclusion then applies this perspective to discuss the so-called Academic Freedom law, which protects teachers who teach the “weakness” of evolutionary theory. Finally, new directions for research will be explored.

A note on the ethnographer and his fieldwork

The ethnographic work that forms the base of this research project has posed a variety of challenges, and it is appropriate to lay them out at the beginning. No anthropologist since the 1990s would presume to present his or her work as objective, as though the observer can exist apart from the observed. The ethnographer brings his own opinions and allegiances, along with the theoretical baggage of the field at large. All of these color observations. It is relevant to note that I am an atheist, and that I generally accept the scientific consensus on the reality of evolution

as a true account of natural history. That said, I did not approach this topic with “an axe to grind.” My intent has never been to “expose” creationists in our public education system or to ridicule those who refuse to accept evolution as fact. On the contrary, I began this project with the aim of helping to give voice to the concerns of evangelicals who see evolution education as threatening their faith and communities. And though I personally believe that creation accounts of origins are incorrect, I also recognize that excluding them from public school delegitimizes and implicitly devalues such accounts, in much the same way that excluding indigenous knowledge from curricula aimed at indigenous students implicitly devalues that knowledge in favor of Western Scientific Knowledge (cf. Cobern and Loving 2001).

Second, just as I would not presume to say that the characterizations I give are free from bias, I feel obliged to note that I have not always been able to maintain disinterest in the work. Doing so has been especially challenging for me, given the proximity of the subject matter to my own social position. When an anthropologist in Chiapas learns that many people report to believe that invisible spirits own and live within certain caves, and that these spirits demand gifts in the form of distilled grain alcohol, that anthropologist can respond with pure anthropological interest. Possibly, he or she will think (though never admit to thinking), “how quaint!” This kind of reaction is fairly easy with people in a place half a world away whose religious ideas have very little bearing on day-to-day life back at home. The possibility disappears when the people are fellow citizens in a representative democracy, whose ideas help to determine outcomes of local, state and federal elections, or whose activities have a direct bearing on the curricula (official and unofficial) of the very schools where the anthropologist’s own children may someday attend. In such a situation, it is not really possible to be disinterested.

However, this personal investment in findings is perhaps not a bad thing. My limited ability to merely smile politely and nod in response to every comment from my interlocutors has had at least one quite positive outcome: I have been able to note and reflect upon how my own beliefs determine my reactions to such comments. This is, I should add, a twist on arguments from some Christian anthropologists who have claimed that sharing beliefs with interlocutors gives them a privileged perspective into the inner thoughts of the Christians they study (Howell 2007). In my case, I cannot pretend to share the beliefs of evangelicals and creationists, but I can appreciate why the outcome feels so important. I cannot pretend to respond to creationist arguments as they do, but I can note the similarities in how each of us responds to the arguments of the other. As noted earlier, at least one critical insight has resulted: neither I nor any of my creationist interlocutors has a purely empirical epistemology, despite what we believe or pretend. We are both beholden to the claims of trusted authorities.

In the end, I have resolved to be aware of my biases from the beginning, and to exploit them for insight where I can. The reader is advised to do the same.

Chapter 1: Overview

This chapter will provide an overview of the research project on which this dissertation is based. The project was designed to answer this central research question: what is the relationship between antievolutionism and evolution education in Tennessee? This question can be broken into three arenas: 1) the development of science standards that sought to expand evolution coverage, 2) the everyday negotiations of teachers between calls to teach evolution and community concerns about evolution as a dangerous idea, 3) the response of students to the evolution instruction they receive. In the following sections, an argument will be made that this question was worth asking and that this project can help answer it.

In the first section, I will situate the project within the extant research literature on teaching evolution and associated issues. This literature review will be bifurcated in accordance with disciplinary divisions, which have so far restricted the ability of either body of research to speak to the other. The first part of the literature review will deal with the mostly quantitative research taking place in the context of science education, and the second part deals with qualitative research conducted by anthropologists and sociologists. Bringing these literatures together reveals conspicuous deficiencies in our understanding, which this project aims to address.

The second section will explain how the research design of the project was conceived to address the research question. It is worth recognizing at this point a tension between the theoretical framework that served as the basis for research design and the ultimate argument of the dissertation. At the beginning of the project, I used a model of cultural transmission from Dan Sperber. Known as cultural epidemiology, Sperber's framework is focused primarily on ideas and how they are transformed during transmission across individuals. It was apparent already from the beginning that this particular framework would require modification in order to incorporate aspects of social context and power dynamics that were apparent in school and political settings but absent from Sperber's original formulation. As noted in the previous chapter, this dissertation ultimately argues that ideas are only secondary to social contexts and practices regarding the state of evolution education in Tennessee. I will attempt to reconcile this tension by revising Sperber's framework in light of findings. Finally, I will discuss my principle methodology—a mixed methods approach incorporating multi-sited ethnography, structured interviews and textual analyses.

The third section provides an overview of the setting for the research, describing the state of Tennessee in terms of its constituents and the sites for the formulation and implementation of education policy. This section will also describe the four school districts studied in the course of this project. Three of these districts consented to participate fully, facilitating interviews with students and their teachers on school grounds. The fourth district did not participate, though interviews with students and some teachers outside of school reveal the ways that evolution was being covered.

The final section of the chapter will provide a timeline of my activities throughout the project, explaining how data were collected through ethnographic field notes and interviews with various actors in the system. While this account is not essential to my overall thesis, it serves as a reference for discussions in later chapters, and provides an overall orientation with regard to my experiences in the field and the range of data I was able to collect. Readers interested in the nuts and bolts of the actual research project should find it to be most interesting.

Literature Review

Quantitative/Education Research

Scholars from a variety of fields have sought to elucidate the many controversies that come with teaching evolution. The earliest academic study appeared in 1976, with a public opinion poll that compared attitudes among the public in Tennessee with educators (Fletcher 1976). However, the topic remained severely understudied until the mid-1990s when Douglas Zook called on science education scholars to correct this lacuna (Zook 1995). When the field of evolution education emerged in the last two decades, it was initially dominated by biology professors who either used their own undergraduate students as the study population, or teamed up with high school biology teachers and studied high school students. These studies were published mainly in science education journals such as *The American Biology Teacher*, with its eponymous audience.

This body of literature is substantial, but it can be broken down into three types of studies, distinguished somewhat by methods but mostly by guiding questions. The first type of study, which is dominated by cognitive and educational psychology, looks at misconceptions that people have about how evolution works even after learning about it. The next type is concerned with creationism as a barrier to accepting or understanding evolution. These studies assess student beliefs and understanding and compare them, hoping to find relationships. While most of this work is conducted with high school or undergraduate students in introductory-level biology courses, preservice science teachers, completing coursework for teaching licensure are also examined. A third type of study involves mailed surveys to active science teachers. They attempt to identify heterodox practices with regard to evolution, such as creationist criticisms, and to determine teachers' motivations for their teaching choices. In virtually all science education research that considers creationism, it is conceived as a pathology in need of an explanation or a problem that needs to be overcome.

The first type of study is mostly conducted by cognitive psychologists, who have maintained attention on ideas, beliefs and understandings of students and teachers. This research reliably finds that students from high school through graduate school tend to have substantial misconceptions about evolution following instruction (Greene 1990; Jensen and Finley 1996; Jiménez-Aleixandre 1996; Moore et al. 2002; Shtulman and Calabi 2012). Students' understandings tend to be *Lamarckian*, wherein heritable changes are produced by the needs or desires of the organism (Jiménez-Aleixandre 1994; Paz, Martinez et al. 2001; Moore, Mitchell et al. 2002), *teleological*, wherein the overall process is assumed to have an ultimate purpose or goal (Bizzo 1994; Paz, Martinez et al. 2001; Moore, Mitchell et al. 2002; Poling and Evans 2002) and *essentialist*, wherein species may change characteristics but never become a different species (Samarapungavan and Wiers 1997; Evans 2000; Numbers and Stenhouse 2000). These well-documented misconceptions persist after evolution instruction, suggesting that teachers must make strong efforts to correct them in students. The abundance of misconceptions noted is consistent with claims that evolutionary theory is inherently difficult to understand (Atran 1990; Mayr 1982), prompting calls to teach related concepts earlier (Catley, Lehrer and Reiser 2005). At the same time, however, similar misconceptions are also found in teachers (Jiménez-Aleixandre 1994; Nadelson 2009; Rice and Kaya 2010), suggesting that more efforts are necessary to ensure that students are actually being taught accurate ideas. Notably, science teaching methods courses do not typically cover strategies to teach evolution explicitly.

The second body of research has examined the relationship between beliefs and understanding among students. The bulk of this research has failed to demonstrate a relationship between accurate understanding and acceptance of evolution (Bishop and Anderson 1990, Lord & Marino 1993, Anderson 1994, Demastes, Good and Peebles 1995, Sinatra et al 2003, Brem et al 2003, Ingram and Nelson 2006). Those studies that claim a relationship, specifically that creationist students have poorer understandings than evolutionist students, suffer from serious methodological flaws. These problems will be examined more closely in chapter 7. At this point, it is most relevant to note that improving student understandings of evolution do not make students more likely to accept evolutionary accounts as true. The only exception to this claim is found among upper-level biology majors. Southerland and Sinatra (2005), who had reported in an earlier study no relationship between understanding evolution and accepting it (Sinatra et al 2003), did a follow-up study with upper-level biology majors. In this case, they found that there was an effect of understanding on acceptance among biology majors, presumably because their knowledge was so much more robust due to additional coursework. Moore et al (2011) found a similar pattern among biology majors on their Midwest campus.

More recently attention has turned to understandings of the nature of science (NOS) rather than understandings of evolution itself as the relevant bridge to acceptance of evolution. Lombrozo and her colleagues found a correlation between measures of acceptance of evolution in their undergraduate participants and their understanding of certain key aspects of the nature of science (Lombrozo, Thanukos and Weisberg 2008). In particular, the researchers found greater acceptance of evolution among students who understood that a scientific theory is not merely a guess, that interpretation and inference are intrinsic to all scientific work, that scientific testing is not necessarily experimental, and that science is tentative or subject to change with new evidence. The researchers recognize that the connection between understanding NOS and accepting evolution is complicated. Better understanding is not predicted to convince creationist students to accept evolution, but is rather expected to provide students open to evolution with conceptual tools to deflect creationist criticisms of evolutionary science (Lombrozo, Thanukos and Weisberg 2008).

A third body of research considers factors that convince high school science teachers to teach evolution or creationism in classrooms. This research has been restricted mainly to mailed surveys, which provide broad but limited data. Researchers relied on the time and importance teachers *reported* giving to evolution (Ellis 1983; Aguillard 1999; Rutledge and Mitchell 2002; Trani 2004) and can thus only speculate about how the topics were actually treated in the classroom. Additionally, few of the studies reported a response rate over 50% from the surveys, making a sampling bias likely. The most recent Tennessee study (Ellis 1983) found that 30% of high school biology teachers did not feel comfortable teaching evolution in their classrooms. The survey was conducted prior to *Edwards v. Aguillard* (1987), which declared teaching creationism and creation science in public schools to be unconstitutional, and yet 60% of the teachers surveyed reportedly believed that evolution should be taught more than creationism. However, 80% of Tennessee teachers also reported occasionally or often inviting students to question the theory of evolution. More recent studies in Oregon (Trani 2004), Indiana (Rutledge and Mitchell 2002), Louisiana (Aguillard 1999), Pennsylvania (Osif 1997), South Dakota (Tatina 1989), and Ohio (Zimmerman 1987) all find that a lingering minority of science teachers report giving as much attention to creationism in their classes as they give to evolution.

There is unfortunately no research that documents by classroom observations how creationist teachers actually treat evolution. There is likely a confluence of factors for this

absence. First, education researchers are more concerned with how to teach a topic well than documenting how teachers do the opposite. But second, and just as importantly, it is very difficult for a researcher to get access to a public school classroom where creationism is being openly taught, owing to the legal problems raised by a teacher who covers creationism in the first place. Covering creationism, creation science and Intelligent Design Theory, have all been ruled in federal courts to violate the constitutionally established separation of church and state. Third, research on specific bodies of students is always conducted in concert with an insider science teacher, who is obviously supportive of the researcher's efforts to better educate students about evolution.

These three bodies of literature coming out of the science education research community are extensive, and much of the work is valuable. However, a few limitations can be noted. First, these three kinds of studies are almost never connected to one another in a way that might reveal a larger picture of evolution education. For example, if students are prone to misconceptions about evolution, and student-teachers share those misconceptions, then is it not reasonable to infer that most science teachers also have misconceptions? And if so, then would it not be possible that these teachers would actually reinforce students' misconceptions in the classroom, thereby making calls to teach evolution actually counter-productive unless first preceded by substantial changes to how science educators are trained? Second, this research is primarily interested in teaching evolution, such that antievolutionist sentiments and creationist beliefs are framed as problems to be overcome, with little no interest in uncovering how or why they persist (see for example Cavallo and McCall 2008; Moore and Kraemer 2005). Third, in virtually all cases, these researchers locate issues with teaching evolution squarely in the realm of ideas and how they clash. Religious beliefs are portrayed as stumbling blocks to better understanding and acceptance. Researchers often attempt to identify the presence of these beliefs based on the religiosity of students and teachers, usually indexed through church membership or attendance. Finally, because the researchers tend to locate the relevant conflict in an ideational realm, the results are not contextualized within the larger social and cultural environment in which students and teachers are situated.

Qualitative/Ethnographic Research

It is not a little ironic that the marginalized position of conservative evangelicals in the United States, who have spent nearly a century resisting a materialistic worldview that they find alien, has been mostly ignored by anthropologists. Though approaches coming out of educational anthropology would be useful to understanding the complex situation of contemporary evolution education and community objections to it, the anthropological subfield has rarely seen research on it. With the exception of a few essays by biological anthropology professors writing about their personal experience teaching evolution at the college level, the principle journal of the subdiscipline—*Anthropology of Education Quarterly*—has not published any research articles on teaching evolution in schools. This lacuna may result from certain sub-disciplinary theoretical foci, including an emphasis on minorities and indigenous students, and on the "hidden curriculum" over the manifest curriculum in classrooms (Apple 1980; Snyder 1973).

Many educational anthropologists also may have assumed that science education has little to do with culture, except when students of certain ethnic groups do better or worse in science classrooms, a situation that is blamed on cultural differences between instructors and students (Bucholtz et al. 2012; Bucholtz et al. 2011; Haig-Brown 1995; Hogan and Corey 2001). Too often it is assumed that cultural differences only fall along racial or ethnic lines, despite the observable differences that exist across geographic regions, class lines, and proximity to cities.

The lack of attention from anthropologists is especially unfortunate when it is noted that the purpose of science education is to change how students think about the world (Carey 2000; Jegede 1997). In other words, to the extent that culture comprises attitudes and models for thinking about the world (Geertz 1973a), successful science education changes culture.

Anthropologists ought to be sympathetic to the perspective of people who witness a daily assault on core aspects of identity. When evolutionary accounts are presented as scientifically credible in contrast to the Creation account presented in the book of Genesis, they usurp the legitimacy of traditional authorities such as parents, pastors and their readings of scripture. Conservative evangelicals in this interpretive tradition are seeking to maintain the credibility of that scripture by having it included in the science classroom, itself a crucible of scientific knowledge.

The vast majority of the studies in the previous sub-section were conducted using surveys and questionnaires, by researchers in the fields of education, psychology and political science. The focus of these studies was answering general questions about what “students” or “teachers” believe and/or understand regarding evolution. Anthropologists and sociologists, by contrast, tend to examine the specificities of local contexts, using methods that stress deep, reflective analysis over longer periods of time. Additionally, in sharp contrast to the education research noted above, ethnographic studies of creationists strive to empathize with them, and make sense of their actions and concerns. In this vein, several examples exist in which the researcher presents the perspective of creationists faced with evolution in schools (Binder 2002; Long 2011; Nelkin 1984; Peshkin 1988; Toumey 1994).

Sociologists and anthropologists got interested in conservative Christians following their appearance on the national stage in the 1980s, with the rise of fundamentalism in US politics. The best example is Harding’s work with Christian fundamentalists, which brought an anthropological analysis to bear on the practice of witnessing—an oratory performance aimed at converting the listener (Harding 1987). Though Harding noted that her interlocutors rejected evolution, as one of a list of societal evils, such as secularism, materialism, and humanism, she did not focus her analytical talents on their discourses on evolution (Harding 2000). Indeed, very few anthropologists have examined creationism and evolution education directly, though there is burgeoning growth in research on American evangelicalism, among groups for whom Biblical literalism is a point of identity (Bielo 2008; Elisha 2008; Malley 2004). The greatest accomplishment of this body of research is the de-emphasis on doctrines and beliefs, in favor of their language (Harding 1987), religious practices (Elisha 2008; Luhrmann 2012b; Malley 2004), identities (Bielo 2008; Keane 2007; Robbins 1998) and calls to action (Elisha 2008; Harding 2000). This literature will be discussed further in Chapter 3.

In the end, only two anthropologists have published ethnographic fieldwork with creationists. Christopher Toumey’s ethnography of a creation-science study group, *God’s Own Scientists*, examines how the men actively work to maintain their strict literalist interpretation of scripture in the face of the scientific evidence that contradicts it. Toumey’s work usefully subverts the popular narrative in which creationists are portrayed as corrupting science and science classrooms. He points out that creationists are not against science at all. In fact, they place so much stock in science that it colonizes their religious beliefs and practices, particularly how they read the Bible. For example, rather than read the story of Noah for its moral instruction (e.g. *Do what God asks of you*), they read it for clues about flood hydraulics and the architectural stability of the ark (Toumey 1994). Despite these insights, however, Toumey’s account continues the tradition of evolution education research noted above by relegating his creationists to a world of ideas.

Much more recently, David E. Long published *Evolution and Religion in American Education: An Ethnography* (2011), along with a series of articles (Long 2010a; Long 2010b) detailing aspects of his project. Long's research represents the first attempt by an anthropologist to understand evolution education from a student's point of view, though it has been anticipated by a number of more qualitatively-oriented education researchers (Brem, Ranney and Schindel 2003; Dagher and Boujaoude 1997; Demastes, Good and Peebles 1996; Ladine 2009) who, like Long, interviewed college students on multiple occasions throughout a course covering evolution in order to document how students' ideas and beliefs change over time. The major difference between Long's and earlier researchers' projects is the length of study, which continued beyond a single course. Long's work was conducted with self-identified creationist undergraduates in Kentucky and focuses particularly on their religious commitments, and how those commitments inform their experience of evolutionary course content. He reports that the students experience evolution as a threat to their worldview and even associate it with mortality. When they encounter it, they find ways of mastering the material enough to know the right answers on a test, but they do not accept it (2011). While Long's work has similarities with the work described in this dissertation, it has important differences. First, Long worked with college-age students, whereas this research was conducted with middle and high school students. Second, Long's methodology was based on unstructured interviews, whereas the research described herein comprised both ethnographic work as well as structured interviews.

A few sociologists have studied the topic as well. Dorothy Nelkin's *The Creationist Controversy* attempts to shed the light of social theory on political battles between advocates for and against evolution education. Nelkin, a sociologist of science, looks at the strategies and motivations of creationists during the 1970s and 80s in the United States, using a mostly historical approach. Her book focuses on major controversies like disputes over the California Science Framework and disputes in Arkansas over the equal-time legislation. Like Toumey, Nelkin points out that, because science holds legitimizing power in the modern world, modern creationists attempt to present their position as scientifically sound (Nelkin 1984). While she does not cite James Scott nor invoke the theoretical concept of "resistance" explicitly, Nelkin's account fits the frame well. She concludes from her work that the anti-evolution movement has been long-lived and successful because creationists "have been able to frame their opposition to the teaching of evolution in ways that resonate with persistent public concerns" (Nelkin 1984). In particular, Nelkin lists three political and social tensions that underlie disputes like the creation-evolution controversy: 1) disillusionment with science and technology as threats to traditional values; 2) resentment of authority represented by scientific expertise as it is reflected in public-school curriculum decisions; and 3) defense of the pluralist and egalitarian values that appear threatened by modern science. Notably, these same issues are identified by Lienesch, a political scientist, as major themes he identifies in his historical analysis of antievolutionism at its inception (Lienesch 2007). Nelkin recommends that the response of scientists and advocates for evolution education be aware of these tensions when devising strategies for fighting creationist challenges. She warns against the tendency to explain to people that evolution has the backing of scientific experts and that those who challenge them are imposters, suggesting that such strategies are likely to be counter-productive.

In *Contentious Curricula* (2002), sociologist Amy Binder examines several case studies in which members of the public have attempted to change curricula in their public schools. The work problematizes the dichotomy in social movements research that pits "outsiders," who seek to change an institution, against "insiders," who seek to maintain it. Instead, Binder emphasizes

that a school district may comprise insiders to align with outsiders and vice versa. As a central analytical contrast, Binder compares attempts to introduce creationism into science classrooms with attempts to introduce Afrocentrism into history classrooms. In all cases, the groups seeking change appealed to educators and the larger public based on claims of injustice toward certain students in public schools. Afrocentrists claimed that traditionally Eurocentric histories contribute to the achievement gap between white and black students by devaluing the ancestors of the latter group. Creationists claimed that biological evolution undermines Biblical teachings about creation and thereby does harm to Christian students (Binder 2002).

While all groups ultimately failed in their efforts to change respective curricula, Binder observes that Afrocentrists had more success, at least initially, in getting educators to recognize their concerns. Binder cites four reasons for the discrepancy, including a failure of creationists to frame their demands in a way that resonated with school insiders such as principals, curriculum coordinators and teachers. She contrasts the *political* power many of these groups manage to acquire through being elected to public office with the *institutional* power that is ultimately crucial for effecting real change. It could be added, though Binder strangely does not do so, that creationists faced additional organized opposition from groups outside of schools such as the National Center for Science Education, which serves as both watchdog and resource for educators and others to fight creationist efforts specifically.

Most intriguingly, Binder argues that history curricula are simply seen as more *negotiable* than science. Citing polling statistics, she claims that Americans “are generally impressed with the integrity of the scientific endeavor” (Binder 2002). Opponents to creationism were able to draw on this perceived integrity when appealing to educators and the public. Though creationists frequently attempted to cast themselves as scientific, their opponents have so far been effective in “boundary-building” or establishing clearly what kinds of epistemological claims count as science and which do not. This particular argument becomes relevant in later chapters that deal with pro-evolution teaching discourses, which talk about the science classroom as a kind of sacred space that is polluted by creationist “pseudoscience.”

The present study is informed by this earlier work, but is able to move beyond it through the simple virtue of being set within a situation that has never before been examined. Whereas Toumey’s ethnography of creationists was concerned with how particular men don the cloak of science to reconcile their Biblical views with evidence and scientific models, my dissertation is more concerned with how the arguments and materials produced by similar groups are understood and translated by teachers and students into responses to evolution. Whereas Long explored the ways that creationist students navigate the difficult currents of college biology, this dissertation considers how creationist identities were formed in middle and high school, in response to the threat of evolution instruction. Whereas Binder’s comparative study questioned the insider/outsider distinction in institutions undergoing challenges and established the importance of the institutional power of educators in resisting and transforming attempts to alter curricula, this dissertation threatens to erase the distinction altogether by examining contexts in which educators themselves are interested in instituting creationist curricula and state-level bureaucrats are distant and blind to the challenge.

In contrast to most of the science education research, these qualitative studies are interested in creationism and its reasons for rejecting evolution, with little or no attention to evolution itself, neither how it is taught nor how it is understood. For reasons already mentioned above, none of this research on creationism takes place inside public secondary schools. Long comes the closest, by interviewing college students in campus settings, both on their experiences

of learning evolution in college classrooms and their memories of learning it in high school. Binder examines specific school districts struggling with efforts to include creation science in the curriculum, but her analysis is focused on the board members and administrators who are involved directly in policy contestations and who also operate outside of schools themselves.

[I need one more paragraph that discusses the advantages/usefulness of combining these two approaches!] This research project seeks to combine insights from both of these bodies of research in order to create a more complete image of evolution education in Tennessee. I employed various research methodologies from cognitive psychology and science education research in order to compare the populations with which I worked to those in other studies. Using these approaches brought to the fore particular questions about beliefs and understandings, which are typically ignored in more anthropological studies. I employed anthropological field methods such as participant-observation, unstructured interviews and a methodological commitment to cultural relativism in order to gain a better intuitive understanding of the contexts in which students, teachers and policy makers work, and to better appreciate the reasons that some of them are opposed to evolution. The resulting project provides new ways of thinking about these issues, which will be discussed in later chapters.

Research Design

Cultural Epidemiology

The preceding section noted that most studies of evolution education are either based on polling data, or focused on students in a single class. My research pulls together these disparate literatures, employing a mixed methods approach to look at evolution education in a single state—Tennessee—alongside the creationist sentiments that hang perpetually over efforts to “teach evolution.” There are many challenges to a project of this scale, which attempts to account for both the formation and implementation of a portion of the Tennessee Science Framework, a policy document that sets science education standards for grades kindergarten to 12th in Tennessee schools.

By working both inside and outside of schools, with teachers, parents, students, pastors and state actors, and by shifting perspectives from one actor to another, my ethnography is both locally situated and a more-or-less comprehensive view of a sprawling institution that is the state system of education. The guiding research question was originally how antievolutionism affects evolution education in Tennessee. However, it grew to encapsulate also the ways in which evolution education affects antievolutionism once it became clear that the two were symbiotically linked.

In order to attempt to answer such a large question, I needed an approach that matched it in scale. Since I was studying a system of education, with a charter to transmit ideas, I used Sperber's epidemiological approach because it is centrally concerned with transfer of ideas through a population. In addition to examining the social and cognitive factors involved in learning about evolution at specific sites, an epidemiological approach encourages the researcher to trace the transmission of representations through a network or system of educators and students, as well as administrators and policy-brokers.

The epidemiological approach to representations is based on an analogy with epidemiological studies of disease. Like the latter, it focuses on distribution and transmission of some phenomena, which in this case are ideas or beliefs (Sperber 1985). Epidemiological models of disease conceive bodies as vectors, where transmission is dependent on the host's biology. A cultural epidemiology looks at individual minds as the relevant vectors, where psychology is

necessary to understand how the ideas are transmitted and why some ideas are easier to transmit and more likely to spread than others.

Education psychologists for half a century have understood that learning involves more than putting information into the minds of students. In particular, child psychologist Jean Piaget theorized that learning occurs through doing things and interacting with the world. It is a process involving assimilation of new information into existing cognitive structures and transforming existing structures to accommodate information that cannot be assimilated. In other words, an individual perceives the world by organizing it into existing cognitive structures, but these structures themselves are also changed by the incoming information (Piaget 1972).

Like Piaget, Sperber recognized the transformative nature at the heart of learning (1985; 1996). Unlike diseases communicated via relatively stable pathogens, representations are constantly changing, both within individual minds and during transmission from one mind to another. He reasoned that concepts cannot be simply transferred wholesale from one mind to another. An epidemiology of representations “is first and foremost a study of their transformation” (Sperber 1996: 58). Before an idea, which he called a mental representation, can go from one mind to another, Sperber noted that it has to be transformed into a public representation, such as words or illustrations or anything else that conveys the idea. Then, the receiver of the idea must interpret the public representation as an attempt to reconstruct the mental representation, based on other ideas. At every step along the way, there is the potential for mistranslation. Those ideas that correspond well with intuitions and concepts the learner already has should be easily and reliably learned, whereas ideas that contradict previous knowledge will be forgotten or misunderstood (Sperber 1996).

Modifying the Framework

An epidemiological approach focuses the researcher’s attention on these various sites of transformation, from public to mental and vice versa. The approach nevertheless suffered certain limitations. Despite its recognition that intended meaning must be reconstructed, with potential for transmission errors, Sperber’s model is only skeletal with regard to how people actually translate between public and mental presentations. Why does a person choose to draw a picture instead of telling a story, for instance? How are public representations identified as such? Whether something is interpreted as a public representation depends on what Keane calls semiotic ideology—which denotes what kinds of things can be messengers and what messages may look like (Keane 2003).¹² There are also many externalities to the model. If a student is stressed by an unhealthy home or schooling environment, then that student is less capable of giving attention to learning content. Likewise, a student may disregard the public representations, believing them to be irrelevant or the teacher to be confused.

Using Sperber’s framework as a basis for the research design of this project focused my attention on identifying specific vectors of transmission. I knew that I would need to interview students, teachers and biology instructors that serve teacher education programs in order to trace concepts about evolutionary science from biological experts to students themselves. At the same time, I realized that Sperber’s original conception is fairly lopsided in its attention to minds and the mental representations that reside inside of them. What he seems to ignore are the public

¹² Some examples would include: natural events interpreted as signs either that originated through supernatural (divination) or natural means (as may be done by a mechanic, doctor, scientist, investigator, tracker or researcher attempting to infer the truth of a matter); and unintended communication, as in a “tell” in poker, or the “hidden curriculum.”

representations in the world around us. These public representations are also clearly vectors to convey these representations. In addition to teachers and other such actors, then, I looked to particular means of conveying ideas about evolution, including especially textbooks and the Tennessee Science Framework itself.

Other issues with applying the epidemiological approach to the issue of evolution education became apparent immediately when I began to design this project. The approach calls for locating a specific mental representation at the beginning of a chain of transmission and then tracing its transmission to the end. It goes without saying that identifying a “beginning” and “end” to a chain of transmission is ultimately an arbitrary exercise, a point made by Sperber himself (Sperber 1996). My project is restricted to links of the chain located in the state of Tennessee and confined to a relatively short time period.

However, a more serious issue appears when considering which particular representation or idea we are tracing. If it were the evolution content itself, then there was very little contained in the Tennessee Science Framework. The evolution standard is not a public representation of the idea of evolution, but rather the idea that “evolution” should be taught. It is difficult to pinpoint the ultimate source of this idea, but the proximate beginning is a set of documents (public representations) known as the *National Science Education Standards* and the *Benchmarks for Scientific Literacy*. They are guidelines for state education standards, recommended by professional organizations of scientists (NAS and AAAS). As detailed in Chapter 4, the evolution content from these documents was interpreted by the authors and then reconstructed as drafts of the Tennessee Science Framework, another public representation. Next teachers interpreted the Framework, using their understanding of it, based on information they have, on their familiarity with past standards, and on their comprehension of the content to which the standards refer. If the effort at transmission is successful, then students ought to have access to public representations, produced by the teacher or in the form of a textbook, that refer back to the evolution content intended by the authors of the Framework.

Comprehension of evolution content itself, it should be noted, would be transmitted along a separate pathway, more than likely from biology professors to preservice teachers and textbooks and then on to students¹³. Again, each step along this pathway requires transformation. If the literature on undergraduate understandings of evolutionary theory is correct, then we can say that the content is transformed *substantially* from professor to teacher and again from teacher to student. The textbook is a negotiated public representation produced by a host of editors and experts. Textbook publishers tailor textbooks to different states, based on a state’s standards, so editors interpret the content of those standards carefully. While the resulting textbook is likely to present fewer misconceptions than most teachers, it is still prone to misinterpretation by students and teachers.

While Sperber’s epidemiology of beliefs approach provides one framework for the research, I drew from other theoretical approaches to consider the role of beliefs, motivations and contextual factors, from employment considerations to social pressure, in determining which representations are transferred, how they are encoded, and how they are interpreted. I drew particularly on theories of belief emerging from the anthropology of religion. Since they were less relevant to the overall design of the project, these ideas will be discussed in Chapter 3.

¹³ This account is greatly simplified, as teachers (pre- and in-service) may have learned about evolution from a variety of sources, including not only college courses but also books, television programs and the internet. The same is also true for middle and high school students.

Multi-Sited Ethnography

While the epidemiological approach helped me to identify where the action is, it was less helpful in providing solutions to the logistical challenges of observing all that action, which insinuates a project on the scale of a state educational system. In order to trace the transmission of ideas about evolution through the formal education system in Tennessee, I needed to incorporate these several sites of transformation. As an anthropologist, I was committed to locally situated accounts, but a traditionally conceptualized field site would not encapsulate the scale of the question.

Fortunately, there is precedent for a mode of research that “moves out from the single sites and local situations of conventional ethnographic research designs to examine the circulation of cultural meanings, objects, and identities in diffuse time-space” (Marcus 1995). Multi-sited ethnographies developed in response to the growing realization that the traditional ethnographic focus on a single community is unrealistic in a world where connections abound and borders are porous (Falzon 2012; Marcus 1995). Multi-sited ethnographies are divested of the coherence afforded by the (imagined) boundedness of a single community. Instead, coherence is organized “around chains, paths, threads, conjunctions, or juxtapositions of locations...” (Marcus 1995). In his seminal review article on the subject, Marcus discusses a variety of possible threads that multi-sited ethnographies may follow: people, things, metaphors, stories, biographies and conflicts (1995).

Marcus situates multi-sited ethnography in studies on world systems (1995), and much of the work has taken this perspective. For example, Fisher and Benson (2006) traced broccoli from the Mayan growers in Guatemala to the affluent shoppers in the U.S. who purchase it in their supermarket. However, there is no reason the mode of research could not be employed on a smaller scale, such as national or provincial systems, recognizing that some chains could nevertheless be traced beyond them. In fact, many of the criticisms of multi-sited ethnography target the presumption that something as holistic as a world system could be given account by stitching together a few additional sites of observation (Candea 2007; Falzon 2012; Hage 2005). Multi-sited ethnography is defined not by an international scale, but rather of the inclusion of sites that are both separated in space and culturally different enough to offer different perspectives (Falzon 2012).

Multi-sited ethnography has faced another criticism: by including multiple field sites, ethnography has the potential to become shallow, as a practical consequence of the fact that the ethnographer’s time is divided across space (Falzon 2012). One way of answering this challenge is to question why the depth afforded by traditional ethnographic fieldwork ought to be expected to derive from a specific *place* at all. The expectation makes sense when we want to understand quotidian life in a relatively isolated village, but not for understanding lives in a modern, globally connected, world. Something that unifies multi-sited projects is that they formulate a research topic that is what Hannerz calls “translocal,” meaning that the formulation is:

...not to be confined within some single place. The sites are connected with one another in such ways that the relationships between them are as important for this formulation as the relationships within them; the fields are not some mere collection of local units.
(2003: 206)

Falzon remarks that if he wants to understand the restricted nature of social relations experienced by the globe-trotting Indian business people he studies, then he might need to experience “a broader, but possible ‘shallower’ world, as they did” (2012: 9). The ethnographer still spends prolonged time in “the field,” immersed in the topic, he just moves around a lot more.

My topic, centrally concerned with relations between state standards, teachers and communities, is similarly translocal, making multi-sited ethnography an appropriate approach. Even so, the ethnographic component of this approach requires further explanation, given that there are no set standards for what ethnography must comprise. Following Ortner, I use the term ethnography more to index an attitude toward research than any particular set of practices (Ortner 1995). An ethnographic approach comprises three attitudes in particular. The first, cultural relativism, entails a conscious effort to put aside one's own cultural biases and understand the beliefs and actions of others in their own terms. This can be especially difficult when working with creationists in one's own country. Success in attempts at cultural relativism are typically de-centering, in that the anchors long-used by the researcher are weighed and it becomes possible to lose sight of land. The second attitude is reflexivity. During ethnography, a researcher is constantly questioning his assumptions and interpretations. New experiences force him to revise earlier notions and sometimes start over. I took a similar approach to the research project, as is evidenced by the contrast between my initial research framework and my final conclusion. The third attitude to cultivate is holism, by which I mean allowing that seemingly unrelated things can in fact be connected, and looking beyond conventional categories and boundaries to trace where certain activities go after they disappear around a conceptual corner. One example of this attitude is manifested in my realization while conversing with self-identified creationists that we were each reacting to one another's arguments and evidence in the same way. This insight allowed me to rethink epistemology and belief in productive ways.

In this case, I employed a variety of methods ethnographically, including observation and limited participation with note-taking, as well as interviews ranging from conversational to semi-structured. Based on my graduate training and experience in experimental cognitive methods, I also included several such methods in the research, particularly in formal, structured interviews with students and their teachers. Though this class of methods is typically contrasted with ethnography, I reject this dichotomy in my own work. I brought the same ethnographic attitudes to bear in crafting, employing and interpreting these instruments as I brought to more traditionally conceived "ethnographic" activities such as observation and informal interviews. All such situations are somewhat unnatural, in that they inject an outside researcher into the everyday lives of subjects. All feature a relationship between researcher and subject, which gives the interaction a social context, with its attenuating expectations and assumptions.

In order to examine the multiple pathways for transmission of ideas about evolution, the project required investigation at several different locations in the greater education system. At the state policy level, I interviewed individuals involved in developing the Tennessee Science Framework, including the state science coordinator. I also tracked down and analyzed three drafts of Standard 5: Biodiversity and Change over Time in eighth grade science, in order to describe the substantial changes to wording and content as a result of various factors. I attended Standards Training Workshops to document how the authors intended the standards to be read, alongside how teachers intended to read the standards. At the district level, I interviewed teachers formally and informally, in order to establish how they translate Standard 5 into classroom instruction. Along with research assistants, I interviewed students and their science teachers in three different districts, in order to understand their experiences of evolution instruction. Altogether, we interviewed around 300 students in 8th grade and high school Biology I. I conducted 9-months of ethnographic fieldwork in a community in eastern Tennessee. During that time I attended a wide variety of churches, and had long conversations with attendees as well as pastors. I met with several science teachers, though I was denied official cooperation

from the district. I also interviewed parents and their children in 8th grade or high school. Finally, I carried out more than a year of fieldwork in the vicinity of Nashville, the state capital, where I was primarily living throughout the development of this project itself.

The Setting: the State of Tennessee

Tennessee is located in the southeastern United States and was part of the Confederate Rebellion during the US Civil War, making it part of a region of the US known as “the South.” The state is typically divided into three regions—West, Middle and East—which is represented in the state’s flag by three stars. The western portion of the state is dominated by flood plains and is best suited for agriculture. For this reason, prior to the Civil War, plantations were concentrated here. Accordingly African Americans who had been enslaved prior to the War, settled in the area after their emancipation, in the period of Reconstruction that took place after the Civil War. This region retains the highest concentrations of African Americans in the state. The Middle region of the state is characterized by the Cumberland Plateau, which is less suited to agriculture, but also lacks the mining resources found in the Eastern region. Outside of the Nashville Metro area, levels of poverty and high school dropout rates are higher in Middle Tennessee than other parts of the state. The Eastern region is characterized by the Appalachian Mountains. It is rich in mineral resources like coal, copper, iron, lead, phosphate and zinc, but also natural beauty, which draws tourists and retirees. Because of differences in terrain and resources, these three regions evince cultural and political differences. In particular, the eastern part of the state, which relied very little on slave labor in the Old South, was the center of the abolitionist movement in Tennessee, which gave way to pro-Union sentiments after Tennessee seceded (Sheeler 1944). Because of pro-Unionism in the East of the state, it was from this region that Reconstruction government officials were selected following the Civil War. Accordingly, East Tennessee has voted with the Republican Party for the last 150 years, whereas the rest of the state voted Democrat up until recent elections.

Churches

Like other southern states, church adherence rates in Tennessee are higher than elsewhere in the nation, with 45.2% of the population religiously affiliated. Churches are strikingly common, even in relatively cosmopolitan cities like Nashville. Sociologists typically distinguish broadly between two kinds of Protestantism in the US—mainline and evangelical. Evangelical Protestant denominations, which tend to reject evolution, comprise 64.5% of all congregations in the state.¹⁴ By comparison, only 14.7% of the state’s 10,571 reporting congregations are of mainline Protestant denominations. Mainline churches generally tolerate non-literal interpretations of Genesis and other scripture. Central governing bodies of these denominations have issued statements about the lack of conflict between scientific evolution and core beliefs, though it is important to note that many members and even clergy may nevertheless reject evolution, especially in areas such as the eastern Tennessee town where I conducted fieldwork. It should also be noted that mainline churches are conceived by members and others to be more moderate or liberal in their theology than other churches. While classified by sociologist of

¹⁴ This number should probably be higher, as it does not include “non-denominational” or “non-classified” congregations, which tend to be theologically conservative. If these congregations were included, the proportion of evangelical congregations would be closer to 73%. All of these statistics were found in the 2010 Religion Database from Social Explorer.

religion as “mainline,” United Methodist and Nazarene churches were described to me as more moderate. Nearly two-thirds (61%) of the mainline churches in Tennessee are United Methodist, a “big tent” denomination that permits substantial diversity of thought within congregations. Accordingly, attendance at a United Methodist church is a much less reliable index of a person’s position on evolution than other denominations. The more liberal mainline protestant churches, especially Presbyterian Churches (USA), Disciples of Christ, Lutheran Churches (ELCA), and Episcopal Churches, are found almost exclusively in larger population centers¹⁵. Though Catholic churches are typically assigned to their own category, it is notable that the official Catholic Church position on evolution is most similar to the Mainline group, though positions on other issues, particularly abortion and birth control, are sometimes more conservative than evangelical churches.

Increasingly scholars have recognized a further division, within evangelical Protestantism, based on worship-style and theological commitments, but which also corresponds somewhat to attitudes toward evolution. This division is between “Bible” churches, which trace their roots to the Fundamentalist movement of the early 20th Century, and “Spirit” churches, which trace their roots to any of several waves including the Holiness movement of the beginning of the 20th Century, the Charismatic movement of the mid-20th Century, and the Renewalist movement at the turn of the 21st Century. While this typology is useful for making sense of the diversity within US evangelical Protestantism, it is important to keep in mind its limitations. Bible churches may disagree among themselves over specific points of theology, for example, and some churches seem to blur the line between the two types. Generally, however, relationships between Bible and Spirit churches is adversarial.

Bible churches, or what some of my informants called “Bible-believing churches,” take a firm position of scriptural inerrancy, which includes explicit rejection of evolutionary accounts of origins. Any church where the predominant source of authority comes from the Bible as the Word of God (and thus the primary means of communing with God) would be, according to this typology, a Bible church. Given that most church members believe that authority flows from the Bible, they highly value a preacher with knowledge of the scripture, including ability to interpret from Hebrew and Greek. Accordingly, these preachers tend to be well-educated, often at Southern Baptist Seminaries. Bible churches include those affiliated with the Southern Baptist Convention and Churches of Christ, as well as most independent Baptists, evangelical Presbyterians (PCA and Cumberland) and evangelical Lutherans (Missouri Synod and Wisconsin Synod). Nearly a third of churches in Tennessee are Baptist, mostly of the Southern Baptist Convention.

By contrast, Spirit churches primarily value personal experience of the divine as a source of authority. I adopted the term “spirit church” based on the frequent references to “the Spirit,” during these services. The category includes denominations like Pentecostals and other holiness churches, as well as charismatic variants of other denominations and many “non-denominational” churches. Such churches tend to adopt a worship-style that includes contemporary music, often with live bands and rock-style songs, and informal dress codes. Pastors in these churches tend to be more charismatic and are less likely to be educated. The

¹⁵Half of all Presbyterian Church (USA) congregations reported in the Social Explorer database for 2010 were located in the 8 counties with the highest population density. Half of the Episcopal Church and Evangelical Lutheran Church of America congregations were in the 7 most densely populated counties. Most strikingly, half of all Disciples of Christ congregations were located in the 3 most densely populated counties (which include the three major metropolitan areas: Nashville, Memphis and Knoxville)!

sermons tend to focus on keeping a positive attitude, having faith in God to be there in difficult times, and getting away from negativity (or the devil). These churches usually embrace the expression of spiritual “gifts” such as faith healing and speaking in tongues. While affirming positions of scriptural inerrancy, rejection of evolution is much less explicit. Having personally attended dozens of services at Spirit churches, I never witnessed the topic of evolution being mentioned, in strong contrast to Bible churches wherein sermons commonly make reference to evolution as false doctrine. Because many Spirit churches are unaffiliated with a specific denomination and the majority are small and transient, it is difficult to get reliable statistics on their prevalence. However, in the locations where I worked, Spirit churches outnumbered both mainline churches and non-Baptist Bible churches, but were less numerous than Baptist churches.

Frequently, Bible and Spirit churches seem to be in competition. Bible churches, particularly Baptist, tend to outnumber Spirit churches, but the latter are experiencing growing attendance at a time Bible churches are experiencing decline. One dimension of the antagonism between Spirit and Bible churches is related to social class. The majority of people I met at Pentecostal churches were working class or unemployed, occasionally homeless. As a general rule, the Spirit churches tended to keep their dress code as informal as possible so that people can walk in off of the street. Spirit pastors accused many Bible churches (specifically Baptists) of being elitist and legalistic, and compared them to the Pharisees. One such Spirit pastor, whom I will refer to as Pastor K, told me a story of how a woman with little means brought her son to a Baptist church each Sunday poorly dressed. She was confronted by spokesmen of the church that her dress was disrespectful of the Lord, but that they would buy her son nice clothes if she would pay them back over time. He shook his head as he told me the story, characterizing the behavior of these Baptists as legalistic, which he said was what Jesus was preaching against.

A second dimension of the antagonism is epistemological. Whereas Baptist pastors seemed to draw legitimacy from a formal education, preferring to argue with logic and supposed evidence for the historical accuracy of the Bible, Pentecostal pastors emphasized the primacy of individual experience of the Holy Spirit.¹⁶ Importantly, Bible churches generally hold to a principle called *sola scriptura*, which sees scripture as the only legitimate source of God’s pronouncements on truth. Scripture is “sufficient” as revelation, meaning that additional revelations through the gift of tongues or prophecy are superfluous. For example, the Trustees of the Southwestern Baptist Theological Seminary (affiliated with SBC) released a statement on spiritual gifts which disallowed any faculty to endorse them.¹⁷ For Bible churches, truth can only come from scripture and is spelled out by authorities like pastors, elders and Sunday School teachers. These ideas about authority were reflected in Adult Sunday School classes, which took place immediately before or after church services. Whereas similar classes in Mainline churches tended to emphasize discussion among participants, in Baptist churches these classes followed a

¹⁶ I became good friends with one Pentecostal pastor, who was very supportive of my project. He often indicated a level of resentment against the more powerful Baptist churches in town and the resistance of the school district to the project. He rejected evolution, citing personal communication with God as his evidence. He claimed to have asked God about it, and was left with the impression that evolution was not true. Though he did not rely on formal argumentation to justify his own faith, like creation science tracts, he believed that they may persuade me. He gave me a book by Ravi Zacharias called *The End of Reason*, which included logical arguments for God and against atheism, including a refutation of evolution.

¹⁷ http://www.swbts.edu/swnews/archives/swnwi2007_65_2/news/trustees.cfm

central lesson plan through which a particular message was communicated, and participation was restricted mostly to answering largely rhetorical questions posed by the teacher.

By contrast, Spirit churches predominantly comprised people with low levels of education, and the pastors at such churches were not excepted from this generalization. For Spirit churches, truth comes from direct experience, as when God “speaks” to participants, making formal education, in scriptural hermeneutics for example, less important.¹⁸ During Pentecostal worship, anyone may speak out, presumably moved by the Holy Spirit to do so. With regard to these practices, two roles are recognized. Someone “baptized by the spirit” will “speak in tongues,” an incomprehensible form of speech known academically as glossolalia. Someone else is then called to “translate” what was said “in tongues.” This translator then delivers a message ostensibly from the Spirit to the congregation. Such outbursts, even during a sermon, are not merely tolerated in a Spirit church, but actively encouraged by those present. In my experience the messages mimic Biblical language, modelled on the King James Version, and do not diverge much in terms of form or content from excerpts from the Bible read during a sermon.

Tennessee Education

Alongside the preponderance of churches across Tennessee is a system of public K-12 education embodied in elementary, middle and high schools that dominate both the landscapes and employment sector of many smaller towns. The governing of education in Tennessee reflects a pattern seen throughout the United States, which has historically favored “home rule” on the part of districts. Official State education policy is formed by and through the Tennessee Department of Education, which is the servant of the State Board of Education, under the direction of the State Education Commissioner. Members of the Board, and the Commissioner, are all appointed by the state governor, though Board members have staggered terms of office that outlast individual governors, making them less subject to the political volatility that comes with regime change. Subject to the Board’s approval, bureaucrats at the Department of Education develop standards and educational goals for the State, certify teaching programs, license teachers, and contract with companies for standardized testing. Though the Board sets policy and regulations in schools in the state, the state legislature can also affect education policy through legislation. In my experience, most of this legislation concerns budget matters and policy changes that require additional funding.

Once state standards have been approved, the responsibility to actually implement them falls on Local Education Authorities (LEAs), also known as Districts. School districts are administered by directors appointed by local school boards, by their Assistant Directors and other district-level personnel, and by the principals they hire to administer each of the schools in the district. Directors have the power to hire and fire teachers and may facilitate or discourage various aspects of the curriculum through approval of curriculum maps for the district, which dictate the timeline for covering various topics. Despite this power, many tasks like developing curriculum maps for particular courses fall on the teachers who teach them.

Tennessee is also home to various other organizations that have some influence over official and unofficial education policy in the state. The Tennessee Education Association (TEA) is the main teacher’s union, and has ties to the National Education Association. Like most unions in the South, however, their power is extremely weak. Their main lobbying powers are directed at Democratic state legislators, which have been in a super minority since 2010. Whereas TEA

¹⁸ Tanya Luhrmann’s *When God Talks Back* (2010) explores how people are able to experience God and may even hear Him speaking.

suffers from declining membership rates among teachers, it maintains an active presence in many metropolitan school districts.¹⁹ Two teacher organizations actively focus on professional development of science teachers—The Tennessee Science Teachers Association (TSTA) and the Tennessee Earth Science Teachers (TEST). Both organizations connect science teachers with professional scientists to improve curriculum. TSTA has a conference every year in the Nashville area, which is attended by teachers and even some administrators from nearly every district.

Finally, education policies connected with church-state separation issues, including efforts to undermine evolution in the classroom, receive special attention. When laws are introduced that threaten to violate church and state separation issues, Tennessee’s American Civil Liberties Union (ACLU) and the local chapter of Americans United for Separation of Church and State take notice and attempt to stop it. For example, when House Bill 0368—a bill that would protect teachers who taught “scientific weaknesses” of evolution, branded a “stealth creationism bill” by opponents—was introduced in 2010, Hedy Weinberg of the TN-ACLU spoke against it at the Tennessee Legislature. I was included on electronic correspondence among interested parties from the ACLU, Americans United and the National Center for Science Education, a national watchdog group that monitors attempts to deflect or undermine evolution education within the country. This small group was responsible for reaching out to experts, such as a high school biology teacher and a university professor to speak against the bill and persuade legislators not to support it.

The Fieldwork

As can be seen from the last section, the education system in Tennessee is complex, with a variety of actors and organizations working in tandem with or opposition to one another. In order to make the research feasible, I focused on the conflict over the expansion of evolution coverage in the state science education standards, which pitted a handful of state policy-makers, interested in making Tennessee appear to be pro-science and therefore attractive to industry, against popular notions that teaching evolution threatens the spiritual health of children and families, with voice in the legislature and local communities. While these factions are dispersed throughout Tennessee, they are concentrated in certain areas, where each respective view enjoys dominance in public discourse. My primary ethnographic sites were located in Middle and Eastern Tennessee, including the state capitol of Nashville, where I had my primary residence, and a small town in Appalachia, where I lived for a total of 8 months, including two and a half months working on a previous project. I conceived of these two sites as “poles” in the struggle over evolution education.

The pro-evolution pole was located in Nashville, the capital, where state education policy is formed. All of the public offices concerned with state education are physically located in Nashville, inside buildings that stand within blocks of one another. In general, those who work in each office, live in the Greater Nashville Metropolitan Area. Their children attend schools in Nashville, its suburbs and exurbs. Those who attend church, attend a church in the area. They shop, dine and socialize in the Nashville metropolitan area. Nashville is the second largest city in

¹⁹¹⁹ TEA has officially endorsed a statement that supports teaching evolution in schools. At the time of research, another organization known as Professional Educators of Tennessee (PET) appeared to be the only alternative teacher’s union for teachers who disagreed with such policies. In contrast to TEA, PET made a statement to support teachers for not teaching evolution. However, PET’s membership was negligible, and I found no evidence of recent activity by the group.

Tennessee, and home to a number of universities, including Tennessee State University, Vanderbilt University, Lipscomb University, Belmont University, Fisk University, and Trevecca Nazarene University, in addition to several colleges. Major industries include music, government and healthcare. In addition to the universities and colleges, they attract and employ highly educated people, often from out-of-state. Thus levels of education and income are higher here than in more rural areas. The music industry, and branding as “the music city” furthermore attracts young adults from across the country. The city is also home to immigrants from Latin America, North Africa and South Asia. The resulting mix gives Nashville a much more progressive attitude than the rest of the state. Evolution was rarely considered controversial, and many people with whom I talked were surprised that it was still an issue outside the city.

Metro Nashville Public Schools is a consolidated city/county system divided into twelve clusters, corresponding roughly to broadly defined neighborhoods throughout the county. Each cluster includes a single high school, two to four middle schools, and up to 8 elementary schools. In addition to these core schools, nearly all clusters include several magnet schools, from elementary through high school level. The magnet schools are situated within clusters, but draw students from other clusters as well. Some of these magnet schools are recognized as among the best schools in the state, presenting a sharp contrast with the non-magnet public schools. Middle class, mostly white parents are faced with a difficult decision when deciding where to send their children to school in Nashville. While the magnet schools are top choice, they limit their enrollment and draw preferentially from students in their own clusters. Failing admission to one of these top magnet schools, parents tend to either enroll their children in a private school or relocate to a neighboring county. There are also a number of privately-run, publicly-funded, charter schools scattered throughout the district, which are intended to fill the gap between the high achieving magnets and the failing schools, but none are as coveted by concerned parents as are the magnets and private options.

The population of Nashville, as of the 2010 census was 626,681. Just over 57% of the population is identified as white, non-Hispanic, whereas 28% are black. Race is relevant to the situation of schooling in Nashville. Neighborhoods remain effectively segregated, with blacks concentrated in areas north and east of the downtown area. Whites tend to locate themselves on the periphery of the downtown area or in the suburbs of neighboring counties. This pattern is traced to “white flight” which followed desegregation in most city schools in the South and elsewhere in the country. Its effects are obvious in the demographics of student populations. While whites account for a majority of the population in Nashville, they comprise only 33% of the student population in Metro Nashville Public Schools, whereas blacks account for 46% of the student body. In addition, Hispanic students comprise 17% of the public school student population, and 12.3% are considered English language learners (though ELLs include Egyptians, Kurds and other immigrant populations as well). Several schools in the southern parts of the county have been classified as failing, due to low test scores, and concerns about school quality are heard frequently among middle class whites living in the city.

By contrast, the anti-evolution pole was in Appalachia, in the eastern portion of the state, removed geographically and culturally from middle Tennessee. This region has historically housed the strongest sentiment against evolution. Virtually all anti-evolution legislation has been introduced in the state legislature by representatives from east Tennessee districts. This includes the Butler Act, leading to the Scopes trial, and the most recent “Academic Freedom” bill. Criticized as a “stealth creationism bill” and signed into law in 2012, it was sponsored by east Tennessee representatives and senators. Public representatives of East Tennessee know that their

voters are overwhelmingly Baptist or otherwise evangelical. I became familiar with my eastern Tennessee field site while working on an earlier ethnographic project.

March – July 2009

I began the research at the level of state policy formation, by contacting people in the Tennessee Department of Education who were connected with developing the science standards. During the Spring, I met with Dr. Connie Smith, who was in charge of the development of new standards. She gave me copies of two books—the *National Science Education Standards* and *Benchmarks for Scientific Literacy*, which were used by the science coordinator to write them. She was strongly supportive of the evolution content in Science Framework, which she believed brought the state “kicking and screaming out of the Dark Ages.”

The Department of Education was busy at that time, preparing for implementation of the new standards, in not only science but language arts, math and social studies as well. In an effort to ensure that teachers were prepared for the transition, the Department organized standards awareness workshops at several locations throughout Tennessee. The idea behind these workshops was to train one or a few teachers from each district, who would then return to their respective districts and train his or her fellow teachers. I got permission from the Department to attend three of these workshops—in Nashville, Knoxville and a town in northeastern Tennessee—where I conducted participant-observation alongside teachers. I also introduced myself to workshop coordinators, many of whom were involved in developing the science standards, and eventually interviewed many of them about their roles and perspectives. At the workshop in Nashville, I was first able to meet the lead author and science coordinator for the Tennessee Department of Education, Dr. Linda Jordan. Jordan later met with me for an interview, in which she described the process of developing the standards, as well as her experiences trying to expand the coverage of evolution. She helped me to track down three drafts of the 8th grade standards, which featured the most substantial changes in terms of evolution content.

August – December 2009

I continued my efforts to follow the policy, from its inception in the Department of Education, through these standards awareness workshops, and from there to the teachers who would implement it in their classrooms. In August, I moved to a town in eastern Tennessee, where I had worked previously. In order to protect the privacy of participants, I will not be identifying the town. It was middle-sized, with a population close to 30,000. I got a “welcome packet” from the town’s Chamber of Commerce, which included a list of churches in the town. There were nearly one hundred, four-fifths of which were Baptist. Most of the remaining were either Spirit churches or United Methodist. Only three relatively liberal denominations were represented, each by a single church: Presbyterian (USA), Episcopal, and Lutheran (ELCA), listed in order of decreasing membership. While driving around the town, I saw at least a dozen “storefront” churches that were not on this list, likely because they were recently established, typically in a repurposed building. According to ASARB data from 2010, more than 60% of the population in this town belonged to a church.

My original intention was to secure permission to work within local schools, where I could interview students and teachers about their perspectives on “teaching evolution.” I had already known the director of schools from preliminary research. His admission in an interview that he believed that some of his teachers taught creationism was the reason I had selected this particular site to look at the issue. Unfortunately, after I submitted an application to conduct

research, which noted that the primary topic of research was evolution, his interaction with me was brief and impersonal. Instead I was directed to the assistant director of curriculum for the district. She was a former biology teacher and well-known throughout the town²⁰. She turned down my request and another request by my advisor Norbert Ross. The director allowed me to send an appeal, which she agreed to consider, but I never received a response from her after delivering it.

Due to opposition from central offices, my contact with teachers was limited. While I attempted to appeal the rejection of the project, I began to contact science teachers in the district individually and attempted to meet with them personally, outside of school grounds. I was eventually able to interview two middle school science teachers, one of which I had met earlier at a standards workshop.

During a trip to Nashville, I met with the TEA representative for the district and explained the difficulty of finding teachers to interview. She agreed to ask the other TEA members in the district to participate, but she later requested that we ask the school board. I resisted this plan, having already been told no, but she believed it would force the administration to answer to public pressure. She used the TEA's privilege to put me on the agenda for a public school board meeting. The presentation went wrong, badly. First, the director was hostile to the teacher's union, so I was perceived foremost as colluding with the enemy. Second, the school board was little more than a panorama of figureheads for the director. Multiple contacts informed me that the board meetings are rubber stamp shows and pageantry (which was also my experience). According to a former director, whom I interviewed at the time, the real meeting occurs beforehand, and all members are inclined to agree with anything the director wants to do. Nevertheless, I spoke to the director after the meeting and pointed out that I had never heard back on my application for research after the letter of appeal I had sent to the assistant dean. He asked me to bring a copy of the proposal to his office, which I did the next day along with making an appointment with him the following week. When I arrived for the meeting, I was escorted into an office with the assistant director of curriculum, along with another assistant director, who was mostly irrelevant to the topic. The purpose of the meeting to formally and personally refuse to cooperate in any way with the research. I was not told the reasons for the refusal.

After the incident with the school board, it was impossible to get teachers to participate, speak with me, or even answer my emails. The union representative told me she had been forbidden by the director of schools to interact with me in any way, whereas only one other teacher hinted that the refusal was concern over her job. It occurred to me that the director holds a good deal of power. After all, the school district is the primary employer in the county, and the director has the authority over all hiring and firing. He was a member of the Rotary Club, which hosts a monthly luncheon among the leaders of the town. He was an Adult Sunday School teacher at one of the town's largest Baptist churches. Even more he was associated with the town's second greatest obsession (behind college football): high school football. And his power over the board was virtually assured since board members who challenged him would be painted

²⁰ I later attended a Church of Christ in the town, where I learned that the assistant director of curriculum was active as Sunday School teacher, with a husband who served as an Elder in the Church. I interviewed another Elder, who claimed to know her and her husband very well. He told me that he knew her to be a creationist. It is impossible to say with certainty that the hostility she directed toward the project was related to her position, but it seems likely.

as obstructionist in future elections, making reelection unlikely, as was explained to me by a former superintendent of the same district in a personal interview.

Thus, in the process of finding schools to participate, it became apparent that the very nature of research makes it prohibitively difficult to peer into situations in which state policy was being defied. Obviously, the teachers and administrators, on whose authority research proposals are accepted, are not ignorant of the potential legal problems that could result if unofficial policies on creationism were reported to others. As a result, all studies of evolution education (excepting only anonymous teacher surveys, for which virtually no contextual information is available for teachers' responses) are conducted in an environment in which school administrators are comfortable with evolution being taught. Facing the likelihood that my original plan to interview students and parents through schools was not going to happen, I shifted my strategy for research. I tried to get permission to conduct brief surveys in a city park and a nearby mall, but both efforts failed. More successful were efforts to meet parents of 8th grade and high school students through churches and then interview them and their children in their homes.

My most common activity, aside from sitting in my apartment writing field notes, emailing or searching online for local events, was attending area churches. In a town where a person is more likely to ask "what church do you go to?" before asking "what do you do for a living?" I was able to boast spending more time in church than most pastors. I attended a wide variety of churches, though I targeted especially the larger congregations in the town center, including United Methodist, Southern Baptist and Presbyterian (USA). I tried to balance between visiting as many different churches as possible, and building relationships within a more limited number of congregations that I would visit regularly. My typical schedule included an early morning Sunday service at one church, a late morning service at another, and then a Sunday evening service at yet another. I regularly attended a Tuesday service at a small Pentecostal church, and an evening service or Bible study group on Wednesdays at one of several churches. In order to maximize social interaction and opportunities to meet people, I sought out Adult Sunday School classes and discussion groups where available. Many of the larger churches hosted weekly dinners for congregants, which I attended regularly.²¹ During this period of fieldwork, I attended around half of the Baptist churches in town, some of them regularly. Because there are more Baptist churches per capita in Appalachia than anywhere else in the state, I opted to focus more on Baptist churches than other denominations.

The topic of "evolution" makes regular appearances in Baptist sermons and never in a positive role. The pastors of these churches²² all asserted to me that evolution is not and *could not be* true, based on the fact that it contradicts a literal reading of the creation account in the first chapter of Genesis. Through personal interviews with Baptist pastors, I learned that it was not possible for a True Christian to believe in evolution. Those Christians who do are "back-slidden," a Baptist term that means they have severed their relationship with God and their salvation is in danger. Pastors at Pentecostal and other charismatic churches, which also fall under the "evangelical" label, do not tend to attack evolution from the pew, though they do not seem to accept it either. Among the few mainline churches in town—Presbyterian USA, Episcopalian, and a few United Methodist—ministers told me privately that evolution is

²¹ The dinners were open to the public and were not free, so I did not feel that I was violating any ethical standards in attending them.

²² Southern Baptists comprise the largest and majority of Baptist churches in the area, but there are also Free Will Baptists, Missionary Baptists, Independent Baptists and Primitive Baptists.

compatible with Christianity, but they do not announce this to their congregations—more evidence of the ability of anti-evolution sentiment to dictate local norms.

Whenever asked, I was always upfront about my research project. In fact, I found that mentioning it was a useful way to bring up the topic of evolution to people I met. In addition to talking to people in pews and small group meetings in churches, I introduced myself and the project to the pastors of the various churches I visited. Many of these pastors were happy to talk to me about the issue, and I interviewed a great many in their offices outside of services. I actually became friends with four pastors, with whom I would meet fairly regularly for lunch or coffee. Our conversations provided me opportunities to reflect on the nature of the evolution-creation conflict, based on the roles we would each assume in debates. These reflections will be developed further in chapter 3.

By attending various churches and building relationships throughout the town, I was able to meet and interview parents and their 8th grade and high school children. I interviewed parents and students from several Baptist churches, two holiness churches, two United Methodist churches and the largest Presbyterian Church (USA). I also interviewed a parent and an elder at the Church of Christ, where, I later learned, the school district's assistant director of curriculum attends. In virtually all interviews with students, I was told that science teachers were including some version of creationism alongside evolution coverage. One student claimed that her biology teacher was not teaching creationism, but that he had taught his class about Intelligent Design as a viable alternative theory to evolution. One Baptist pastor's son reported learning about evolution and creation science side-by-side, wherein students were invited to "decide for themselves" about the evidence for each. He thought that more evidence supported creationist accounts. During none of the interviews did I get the sense that a student was lying about evolution coverage, for example in order to cause trouble for their teacher. Most of the students were fairly religious (a consequence of the sampling method) and seemed very happy about how evolution was treated. One student reported being an agnostic, but expressed reluctance to tell me about the coverage of evolution, fearing that his report would be used against his teacher. I assured him, and all participants, that all interviews are anonymous, and that neither the teachers nor even the district would be identified. In most cases, the inclusion of creationist claims in science classrooms was discussed by students as if it were a perfectly acceptable and appropriate thing to do.

While seemingly unavoidable, my method of sampling by making personal contacts through churches has obvious problems. Rates of religious affiliation are relatively high in the community, even by the standards of the South, and yet only about half of the population attends church. I was able to meet a few people who did not attend a church, but they are extremely underrepresented in my sample. It is not possible to extrapolate from the sample how non-affiliated people generally feel about evolution education. Doubtlessly, some support it or at least do not oppose it. Many of them were raised in a conservative church and retain a negative disposition toward evolution despite current non-affiliation. The only family I interviewed that did not attend a church was supportive of evolution education, but was not willing to announce their position publicly, citing fears of reprisal from an employer if word got out. This same family had recently relocated and was not socially integrated with the population in the town.

While in eastern Tennessee, I also made contacts and interviewed professors at regional colleges, who are involved in educating future teachers. Before becoming a teacher, a student must graduate from a state-licensed teaching program and pass a state test. Teaching programs are a critical link between student and teacher, given that teachers are, of course, former students.

The teachers I met were almost always from the same or a neighboring county to where they taught. After graduating from a regional college or university, they return to middle and high schools to teach the next generation. Depending on how the nature of science, evolutionary theory, and methods of teaching both were covered in a teacher program, teaching colleges could have a profound effect on how evolution is taught in classrooms and whether it is learned. I met with several professors and administrators of teaching colleges, including the head of East Tennessee State University's teacher college and Carson-Newman University, a Baptist-affiliated private college.

I lived in this town for five and a half months, nearly uninterrupted by trips to Nashville. During that time I gained an appreciation of the associations that surround evolution and internalized the ways that evolution is discussed. The most noticeable example of this adjustment concerned use of the word "evolution." I quickly noticed that many of people with whom I spoke in eastern Tennessee physically responded to the word, sometimes shifting uncomfortably or even seeming to wince as if in pain. Such trepidation was in effect even among those who privately confided in me that they accepted evolution as scientifically supported. At one point, I was invited to stand up before a Lion's Club meeting in a Shoney's restaurant to explain my project and ask whether anyone was willing to talk to me about it. I explained that the research was to understand how evolution was taught in schools, and I was startled by a gasp that seemed to suck the air out of the room, followed by the question, "You do realize where you are, right?" By paying attention to these reactions and listening to others, I realized that evolution is not something people discuss in "polite company," meaning around people with whom one does not share a close relationship or know their positions on these kinds of issues. The "e-word" can be said, but requires a kind of gentle gravity. More preferable is talking about it indirectly, as "issues with science education." When I did visit Nashville, to interview someone at the Department of Education or attend the TSTA conference, I was struck by the sensation that the word would get "stuck in my throat." I had internalized the local sensitivity to it, to the point that I would pause, as if developing a stutter, before I could pronounce it out loud.

January – June 2010

In January, I moved back to Nashville to begin the second phase of the research, which would include developing and carrying out structured interviews with students and their teachers in participating schools. I continued church ethnography in Nashville, in order to appreciate differences in church culture between the two sites, and to maintain, to the extent that was possible, the intimacy of my familiarity with the issues. Though the public schools at my eastern Tennessee site never agreed to participate, I was given permission by two private religious schools to conduct interviews in January. I developed an hour long interview which combines tools from educational and cognitive psychology as well as anthropology, to gather information on religious beliefs, understanding of evolution and science, acceptance of evolution and recollection of how it is covered in the science class. In order to make it easier for the reader to refer back to these descriptions later, I describe each part of the structured interview in Appendix I. Following the interview, participants answered two surveys, one on the Nature of Science and one on beliefs about origins. Teachers answered interview questions that were nearly identical to students.

I made two more trips back to East Tennessee in late January, with another graduate student to help me conduct interviews. We interviewed 8th grade students, and their science teacher, at a private Episcopal school, and then returned to interview 9th grade students and their science teacher at a private evangelical school. The approaches of each of these schools to the

topic of evolution were different from one another and from the local public schools. As private schools, these teachers had much more freedom to discuss religious implications of evolution without concerns about church-state violations. The Episcopal school used this opportunity to assert the compatibility between Christian faith and evolution. The evangelical school used it to insist on the incompatibility. While these initial interviews were not especially helpful in understanding how the Science Framework was implemented, given that private schools are not required to cover the state standards, they did allow me to pilot the interviews and surveys, which would be valuable later in the Spring when I conducted research in Metro Nashville Public Schools.

I was able to get formal permission from Metro Nashville Public Schools to do research after applying through a formal process with the district. With this permission, I was left to contact individual schools to make arrangements for conducting interviews. Most metro schools scheduled the interviews for the end of the Spring semester, after the state standardized tests were completed, but a few were conducted earlier.

For the purposes of this study, I concentrated fieldwork in one cluster, including the high school and two of the middle schools. This cluster had among the highest concentrations of white students, at 47% of the student population, compared to 14% Hispanic and 36% black. By comparison the next whitest high school was 38% white and 56% black. One of the middle schools was 69% white and 23% black. The other middle school was roughly evenly split amongst Hispanics, blacks and whites. I chose to work in this particular cluster specifically because of the high numbers of white students, as I felt this population would be most analogous to the populations of students in the other districts in the study. I recognize that churches remain among the most racially segregated institutions. African American church-going students are likely to attend what sociologists of religion refer to as historically black protestant churches. Since there is some evidence to suggest that African American religious communities have responded to the topic of evolution in ways distinct from European American religious communities (Moran 2003), I limited my study to mostly white students. This should certainly not imply that further examination of how black students respond to evolution education is not needed, only that it falls outside the scope of this dissertation²³.

Interviews were conducted in semi-privacy, depending on the availability of space in a given school. I conducted about a quarter of the interviews with students in Metro Nashville Public Schools. The remainder of the interviews were conducted by research assistants recruited from the Sociology and Anthropology Departments at Vanderbilt University, including two upper-level anthropology undergraduates and four graduate students. All were trained in the purpose behind the various portions of the interview, and were instructed in necessary and appropriate follow-up questions. I instructed them to strike a tone that encouraged reflection and openness. They were not to appear judgmental regardless of the answers. Interviewers were neither to express negative or positive responses to questions but instead were to use neutral

²³ There is every reason to predict that evolution is just as controversial among blacks as among whites. For example, I interviewed three biology teachers at one predominantly black Nashville high school, and all reported that the topic of evolution was sensitive in their classrooms, and that many of their students objected to it explicitly. Furthermore, members of historically black churches overwhelmingly report beliefs in biblical inerrancy, just as white evangelical church members do (Matthews, Michael R. 2008. "Science, Worldviews and Education: An Introduction." *Science & Education* 18(6-7):641-66.). Joseph Graves, an African American geneticist has expressed concerns that the high degree of creationist beliefs among black students is a detriment to their ability to pursue careers in scientific fields (Graves, Joseph L., and G. L. Bailey. 2009. "Evolution, religion, and race: critical thinking and the public good." *Forum on Public Policy: A Journal of the Oxford Round Table*.).

terms that encouraged students to continue. Students were only interrupted if they were talking for more than a minute about a topic unrelated to the interview. These interruptions were supposed to be as polite as possible, nudging students to discuss the topics introduced in the questions. Some of the interviewers were more skilled in these regards than others.

Schools were required to arrange for parental consent forms to be sent with qualifying students to be signed, pending agreement and interest. These forms had to have been signed before interviews could be conducted. When the other interviewers and I arrived near the beginning of the school day, we worked with school personnel to find spaces for the interviews, and then arranged a system of communication with either the participating science teacher or the main office to have students sent to us to be interviewed. Ideal interview spaces were rooms where no one would be able to overhear the responses of students, who were promised not to be identified. Due to fear of potential accusations over breach of trust, this ideal room would also have windows so that the interviewer and student participant would be visible at all times. These ideal conditions were not always possible, unfortunately. Particularly in the smaller middle schools, there was limited space. Sometimes two or even three interviews were conducted in the same, albeit large, room. In other cases, the only available rooms were entirely private.

I coordinated the interviewers and worked directly with the school personnel. I also made a point of watching and listening to the interviewers to ensure they were establishing a proper tone, were following up adequately, and had not misinterpreted any of my instructions. At some point during the day, typically during his or her planning period, I would interview the science teacher. All the audio content of interviews was digitally recorded, and interviewers recorded abbreviated responses on data sheets. Interviews took anywhere from 45 minutes to 1 hour and 15 minutes, depending on the length of answers given. Many times interviews were interrupted by a lunch break, or a year-end test, and continued at a later time. In some cases, interviews were begun at the end of one school day and completed at the beginning of the following day.

While living in Nashville, I was also able to more efficiently pursue the necessary interviews and documents needed to reconstruct the development of the evolution component of the Tennessee Science Framework. I conducted archival work at the offices of the State Board of Education, where physical records are kept of Board meetings, including copies of drafts submitted for approval. I interviewed Linda Jordan again, who also gave me copies of her email correspondence during the editing process. I also contacted and interviewed Sharon Tate, an instructor at Peabody College who had been assigned to write the first draft of the Science Framework. The reconstructed account is presented in chapters 4 and 5 of this dissertation.

By the end of the first year of the project, I had conducted ethnographies of churches at two sites in Tennessee, and had interviewed religious leaders and congregants from within a variety of denominations about the issues surrounding evolution and faith. I had tracked down and reconstructed the process by which the Tennessee Science Framework was developed and adopted. I also had observed and shared experience alongside teachers of efforts by the Department of Education to ensure the new standards were correctly implemented. I followed this implementation process to schools in two districts, though I was only able to enjoy the cooperation of one of those districts in understanding the challenges and outcomes of that process. Finally, I developed a structured interview and accompanying survey/questionnaires, which I carried out with students and their teachers in Nashville and, albeit in a much more limited fashion, in the eastern Tennessee town where I worked.

Year 2: July 2010 – July 2011

In the Fall of 2010, I analyzed the survey and other easily quantifiable data from the previous round of interviews. I noticed a few problems with the wording of the surveys, but decided to maintain the instruments in order to ensure comparability with the MNPS data. Specifically, there was some ambiguous wording on one of the multiple choice options on the Belief Survey, which said that organisms have changed a little since creation, but does not specify how much change would qualify as “a little,” encompassing potentially anywhere from very limited change as what occurred from the common ancestor of a horse and a donkey or a wolf and a coyote, as well as substantial change, such as the evolution of land vertebrae from a species of fish.

At around the same time, I began to reconceptualize the meaning of students’ responses. I had developed the instruments in the interview in order to elicit cognitive models from the minds of students. However, examples mounted during the interviews and in later analyses that students seemed to shift from one model to another, logically-incompatible model from day to day and even in the course of minutes. I began to think of the students’ responses as intelligible only insofar as understood in the context of a social interaction between outsider interviewers from Vanderbilt and the student participants. This would be especially important regarding the “Belief Survey,” which I realized was functioning as an opportunity for participants to signal their position on origins, at a time when some of them were still thinking through that position. In spite of these shifts in understanding the instruments, I continued with the methodology I had already established.

The modal level of understanding biological concepts as well as evolutionary theory was extremely low in some of the Metro Nashville schools. This may reflect low levels of engagement from the students, so it is not clear whether the student responses in the interview suggest extremely poor familiarity with evolution (where many students insisted they had never heard of it) or just disinterest from the student participants, who appeared in some instances to be incentivized by teachers to participate in interviews. The notable exception was a magnet high school that demonstrated extremely high levels of understanding. It was clear from the interviews that students at the magnet high were highly engaged in the interview, to the point that students admitted to studying in preparation.

Given my inability to interview larger numbers of public school students at my East Tennessee field site, and the difficult to interpret responses in the metro schools, I spent much of the second year of the project trying to expand the number of participating districts to include one from East Tennessee, and another one from a rural district in Middle Tennessee. I spent most of January and February of 2011 traveling to school districts around the state, talking to administrators and teachers about my project, and asking if they would be interested in participating. I then spent the time from March until June coordinating, preparing for and carrying out research in those districts.

In order to select the two additional districts to participate, I sent a letter of solicitation to the directors of all districts in the state (excluding one that had already refused to participate), in which I explained that participating schools would be compensated with \$2000, and that I wanted to conduct hour-long interviews with around 30 students at each participating school. The letter did not mention that the research would involve evolution. A little under a fourth of the districts responded and scheduled an information meeting. At the meeting, I explained the topic of the research, while emphasizing that I was aware the issue was sensitive and would therefore be treading lightly and working to avoid offense. Nevertheless, after learning the

research involved evolution, most districts declined to participate. It is impossible to say whether districts declined to participate because they were aware that teachers cover creationism or antievolutionist critiques and wished to avoid possible legal troubles, or because they did not want the parents who might disapprove to be reminded that evolution is being taught in their schools, but both explanations are consistent with a conclusion that evolution is not generally accepted in the communities where the schools declined to participate. Indeed, districts in east Tennessee, where the sensitivity around evolution education is highest, withdrew interest three quarters of the time, a rate that was 50% higher than the rest of the state. As a result, the sample of participating schools is clearly biased toward cooperation with state policies. Evidence for this bias, as well as a counter balance to it, comes from the non-participating district where it was clear from interviews with parents, students and some teachers that creationist critiques of evolution were being taught.

Of over 100 letters of solicitation to districts across Tennessee, I was able to find 9 school districts willing to participate. Two of the schools were in east Tennessee, two on the Cumberland Plateau, and four were in the western half, which is predominantly farm country. The ninth district is Metro Nashville, in middle Tennessee. Notably, none of the six counties that border metro Nashville (Davidson County) opted to participate, although five of them (all except Williamson) agreed to meet with me for an informational meeting. I selected three districts from that pool of nine in order to draw my sample for the formal interviews.

I chose one district from east Tennessee and another from rural middle Tennessee. My intention was to sample as broadly as possible without sacrificing the possibility to triangulate factors across the populations. In other words, I have two middle Tennessee districts, one urban, the other rural, and I have two rural Tennessee districts, one in middle Tennessee and the other in east Tennessee. As can be expected from such opportunistic sampling, it was not possible to control for as many factors as was hoped. Obviously, all the districts fall in the jurisdiction of the state of Tennessee. They are limited to state-approved textbooks and are under pressure from state-mandated standards. They are also subject to US and Tennessee laws, regulations and budgets.

The Middle Tennessee district I selected was extremely sparsely populated at less than 40 people per square mile²⁴. The closest city was more than an hour driving distance, and the county seat was far from any interstate, making it fairly isolated. The population is almost entirely white. While only around 12% of children in the county live below the poverty line, the median family income for the county is below that of the state, and nearly 60% of enrolled students are classified by the state as “economically disadvantaged.” Only about 13% of the population above 25 has a bachelor’s degree, though three times as many have some college. There is only one high school, and the senior class is less than 150 students. The small population meant that the district was well represented in the sample, which included one fifth of all of the 10th grade students in the district at the only high school, along with a sixth of all 8th grade students, from two of the middle schools. Half of the population of the county is a member of a church. Of the mainline churches in the area, nearly all are United Methodist. There is one Presbyterian (PCUSA) and one Episcopal Church. One third of the evangelical churches are Baptist, whereas one fifth are Church of Christ. There are also a few Cumberland Presbyterian churches and a couple of Nazarene churches. A smaller proportion are part of charismatic denominations like IPHC, Assembly of God, and Church of God. The remaining one fifth of evangelical churches are not part of a larger denomination. Finally, there is one Catholic Church.

²⁴ In order to prevent identification of the district, precise statistics are rounded or made otherwise less precise.

The administrators in this district were highly interested in participating in the research. When I came to meet with them and talk about the project, they had arranged a large meeting with the principals of the high school and two middle schools, as well as the biology teacher and 8th grade science teachers. This response was in stark contrast to most other districts wherein only one person in the administrator's office was available to meet with me. While members in the meeting agreed that evolution was a sensitive issue, I was told that they believed that I was treading cautiously enough that they did not worry about a backlash from parents. Their willingness to work with me may have been driven, in part, by an interest in the compensation I was offering to schools in a relatively poor district, which they told me they planned to use in order to purchase more science equipment. Regardless of the motivation, this was the easiest of all four of the districts in which I attempted to work. The principals were extremely responsive during the scheduling process and were prepared for the interviews on the day we arrived.

The eastern Tennessee district was much larger than the one in middle Tennessee, which led to some difficulties in executing the project. Most school districts are coterminous with counties. The eastern Tennessee district represents a less common situation, in which a county comprises a city district and a separate district for the surrounding county. East District is the county half of a city/county school split district. Thus, while it is within easy reach of an urban area, East District is rural. Most of the students either personally hunt or fish or have parents who do so, leading to high levels of familiarity with the animals referenced in the interviews. Though rural, the population supports two high schools with student populations over 1000. Like the rural middle Tennessee site, the eastern Tennessee district is almost entirely white, with minorities under 5% of the population. A fifth of the population above 25 has a bachelor's degree. Half has some college education. Incomes are higher here than in the rural middle Tennessee county, on par with the state median. Reflecting the higher population density, there are more church congregations. The distribution of denominations is distinct from rural middle Tennessee. A greater portion of evangelical churches are Baptist and Pentecostal. There are far fewer Churches of Christ. The East Tennessee site hosts two Catholic Churches, one Episcopal Church and as many as six Presbyterian Churches (USA). United Methodist Churches still make up the bulk of mainline congregations, but the proportion is more like 75% than the 90% seen in the Middle Tennessee site. The county is dominated by Baptist churches and a great many independent churches. There is one Catholic cathedral, a Presbyterian (USA) church, a few United Methodist churches and a Christian (Independent) church. Nearly every student interviewed, who attended a church, attended a Baptist or holiness church. None of the participants attended one of the very few liberal mainline churches in the area.

The best time for interviews, for both of the districts was in the late Spring, after state tests. This allowed for only a three week window in which to coordinate times with six different schools, located on opposite ends of the state, on when I could come and spend an hour interviewing each of the 30 students, whose parents gave consent in advance, and their science teacher. That is a total of 180 hours of interviewing in the course of fifteen school days, each of which is seven hours long (105 hours). Clearly, it would have been impossible for me to interview all of those students myself, so I recruited and trained graduate students in the social sciences to help me. By dividing up the students, two or three research assistants and myself were able to interview all 30 students over a period of 1-2 days at each school.

The same protocols were followed for interviews in these districts as had been used in Metro schools the previous year. One major difference was that I was unable to spend time in these communities before or after the interviews. This is particularly true of the Middle

Tennessee district. Located one hour from Nashville, I made day trips to the district in order to conduct interviews, and it was not feasible to spend additional time there. In the East Tennessee district, the other interviewers and I stayed for days at a time at a hotel in the town, making some exploration possible. Nevertheless, I was forced to rely on my previous fieldwork in churches to draw inferences about the churches students reported attending.

To summarize, I conducted a study lasting two years in various field sites in Tennessee in order to document how science standards on evolution are developed and approved in Nashville and implemented in parts of the state with sentiments against teaching evolution. The project traced the effects of human agency on the production of official policy, while noting the breakdown of said policy at the classroom-level, not only by teachers but students as well. I interviewed teachers, administrators and students directly. For some communities, I conducted a number of interviews with parents as well. Students, in particular, are the locus of the ultimate objective of education and standards. They are in the class, from the institution's perspective, in order to learn the curriculum/content. I developed an hour-long, structured interview, combining multiple tasks from education research and the cognitive sciences, so that I could document how students and teachers understand science and evolutionary theory, as well as their religious viewpoint, social environment, and conception of taxonomies of animals. Within Tennessee, I worked specifically in four different school districts. In addition to Metro Nashville Public Schools (MNPS), I worked in a rural district in Middle Tennessee, and two districts in East Tennessee. These districts differed in many aspects: church composition, proximity to urban center, population, history, teachers and administrators. One of the districts in East Tennessee officially declined to participate in the research, such that information on how evolution is taught and responded to by students was collected haphazardly through parents met in one of the many churches I regularly attended. For all of the other districts, I was given permission by administrators to conduct interviews in the school with students and teachers, resulting in recorded, hour-long interviews with nearly 300 students. Throughout the project, including these interviews in schools, I used ethnographic methods to note observations and to reflect on the research itself and the ways that people I encountered responded to my project.

Chapter 2: In the Shadow of Scopes

In this chapter, I will provide a historical account of the conflict over teaching evolution in order to demonstrate the ways that it was shaped by social and political contexts. The chapter begins achronologically, with a summary of the Scopes “Monkey” Trial of 1925, an event which serves as a kind of fulcrum and constant point of reference to the larger conflict in Tennessee (not to mention the United States as a whole). I lead with the Scopes trial for two main reasons. First, it is essential for the reader to have familiarity with events surrounding the Trial in order to appreciate the significance of other historical developments presented in the chapter. Second, as this chapter’s title is meant to suggest, the Scopes Trial looms over evolution education in Tennessee. Locating the Scopes Trial at the beginning of this chapter is thus a kind of analogy for its ongoing relevance.

Following this initial foray, the chapter reaches further back in time to trace the origins of the ideas about evolution and its special connotations in Victorian England. From that point, we move chronologically to see why opposition to the theory eventually emerged in the United States as a byproduct of wider struggles over the expansion of mandatory public education. Despite contemporary association between Christian fundamentalism and antievolutionism, the historical account suggests that fundamentalist arguments against evolution, particularly on the grounds that it contradicted the Bible, were developed *post hoc*, as a means to justify a political alliance with the popular antievolution movement that was growing across the South.

The history then continues with the aftermath of the Scopes Trial and emerging attitudes about what teaching evolution came to *mean* in terms of being modern, scientifically-minded and progressive. As scientific support for evolutionary theory grew alongside concerns over the ability of American students to compete with Soviets, escalating calls for teaching evolution led to efforts from scientific organizations and the National Science Foundation to develop materials and encourage teachers to cover the topic. However, with this expansion of evolution education came an opposing expansion of efforts to undermine the teaching of evolution. As federal courts struck down legislation aimed to mitigate the perceived dangers of evolution instruction, opponents developed newer and increasingly less honest strategies to take its place. The chapter concludes with a reflection on the developments that reiterates my overall thesis—that the societal conflict has preceded and shaped the ideological commitments of both advocates and opponents of teaching evolution.

The Scopes “Monkey” Trial of 1925

It does not seem possible to write a dissertation on evolution education in Tennessee without mentioning the Scopes “Monkey” Trial. The trial took place during the summer of 1925 in Dayton, a town situated between Chattanooga and Knoxville, in the Smokey Mountains of eastern Tennessee. The trial has become a cultural touchstone for issues of church-state separation and the conflict between science and faith up to the present day. Nearly every time the topic of Tennessee and evolution comes up in a national conversation, in newspapers, magazines, blogs, etc., the Scopes trial is invoked. Among proponents of evolution teaching, the Scopes Trial remains a black eye for Tennessee, suggesting a state that is hostile to science and education. The trial has been well covered by historians (Blake 1994; Kidd 2006; Larson 1997; Lienesch 2007), but its resounding importance in the present makes it relevant to describe in this chapter, which aims to give an account of the history of evolution education in Tennessee.

In the decade following World War I, anti-evolutionist sentiment spread throughout the US South. An campaign to oppose teaching evolution in public schools was spearheaded by William Jennings Bryan, a populist and former Presidential candidate. Bryan's campaign ultimately resulted in legislation in several states, including Oklahoma, Florida and Tennessee. In 1925, the Tennessee General Assembly passed the Butler Act, which prohibited "the teaching of the Evolution Theory in all the Universities, Normals and all other public schools of Tennessee, which are supported in whole or in part by the public school funds of the State, and to provide penalties for the violations thereof" ("Butler Act" 1925).

The law attracted the attention of the ACLU, which had been searching for a test case to argue for academic freedom for teachers (Larson 1997). The ACLU posted a notice in the *Chattanooga Times* on April 4, 1925, for a teacher willing to teach evolution in defiance of the law, promising free legal representation in their defense. George W. Rappleyea, a businessman from New York, who had relocated to Dayton, read the notice and saw it as an opportunity to get media attention on Dayton and thereby attract out-of-state investors (Larson 1997). Rappleyea contacted the prosecuting attorneys for Rhea County and asked whether they would prosecute a teacher who was violating the Butler Act. He then contacted a local teacher named John T. Scopes, who agreed to go on trial, though he could not actually remember teaching evolution (Larson 1997).

The Scopes trial, known officially as *The State of Tennessee v. John Thomas Scopes*, began on July 10, 1925, in the Rhea County Courthouse a mere two months after the Butler Act was signed into law. In the weeks leading up to it, the trial had already grown to epic proportions with the recruitment of William Jennings Bryan, a three-time presidential candidate, former Secretary of State, and champion for antievolution laws, to speak for the prosecution. In response, the defense brought in Clarence Darrow, a well-known trial lawyer and associate of the ACLU (Larson 1997). Large crowds turned out to witness the trial, such that the judge, suffocating from the summer heat and fearing the floor of the courtroom would collapse, moved it out to the courthouse lawn. The dramatic climax of the trial was when the defense team ran out of witnesses, after their scientific experts were ruled irrelevant to the court's decision, and Darrow called Bryan himself to the stand. After 7 days of hearings, the Scopes Monkey trial was concluded on July 21, 1925. The jury found John T. Scopes in violation of the Butler Act. He was fined \$100, in accordance with the Act. The fine was eventually overturned, based on a technicality, destroying the hopes of the Defense to appeal the case to a higher court, necessary for challenging the constitutionality of the law (Larson 1997).

The trial received national and international attention, much of it presenting Tennessee, and the South more generally, as home to ignorance and superstition (Larson 1997; Smout 1995). Some of the most colorful and enduring characterizations of the Trial and of Dayton itself came from H. L. Mencken, writing for the *Baltimore Sun*:

The Scopes trial, from the start, has been carried on in a manner exactly fitted to the anti-evolution law and the simian imbecility under it. [...] Darrow [defense attorney for Scopes] has lost this case. It was lost long before he came to Dayton. But it seems to me that he has nevertheless performed a great public service by fighting it to a finish and in a perfectly serious way. Let no one mistake it for comedy, farcical though it may be in all its details. It serves notice on the country that Neanderthal man is organizing in these forlorn backwaters of the land, led by a fanatic, rid of sense and devoid of conscience. Tennessee, challenging him too timorously and too late, now sees its courts converted into camp meetings and its Bill of Rights made a mock of by its sworn officers of the

law. There are other States that had better look to their arsenals before the Hun is at their gates. (Mencken 2006)²⁵

Ultimately, the Butler Act remained Tennessee law until 1967, though it was never again enforced in Court. The law remained popular, such that the two leading candidates for governor in 1926, including incumbent Austin Peay and Hill McAlister, both claimed credit for the Butler Act during their campaigns.²⁶ James R. Neal, who had led the Defense in the Scopes Trial, also ran in the gubernatorial race, but received negligible votes. Neal later campaigned to have the Butler Act repealed by the Tennessee legislature, on the grounds that it restricted the rights of teachers and it “permit[ted] people to make monkeys out of Tennessee” (“New ‘Monkey Trial’ avoided; case laid to firecrackers” 1929), but the bill was unanimously rejected in the Tennessee House of Representatives (“To try teacher on evolution charge” 1929).

Though the Scopes Trial continues to cast a long shadow over the state, it is important not to see it in isolation of other events occurring at the time. In order to understand not merely the Trial but also the contemporary conflict over teaching evolution, it is critical to begin my historical account much earlier. Beginning with the rise of ideas about evolution in the 19th Century, I will trace the struggles that have surrounded it. Moving into the 20th Century, we will see how antievolutionist sentiment emerged and became elaborated, culminating in legislation like the Butler Act. Later in the chapter, we will take a closer look at the repercussions of the Scopes Trial in terms of a developing notion that evolution is a subject that *needs* to be taught in schools.

Evolution and the Origins of the Conflict

To understand how the conflict over evolution emerged and developed into what we see today, we need to go back to the beginnings of the term. A delve into etymology may seem merely pedantic. Most contemporary advocates of teaching evolution have in mind the modern theory of evolution, including both common descent with modification of all living things and the mechanism by which that modification occurs, i.e. Darwin’s theory of natural selection. However, throughout its history and even today, the term is associated with a wide range of shifting ideas, and it can mean different things in different contexts and for different people (Bowler 1975). The polysemy of “evolution,” owed partially to the history of the use of the term, is entirely relevant to the ways people thought about Darwin’s proposal.

According to the *Oxford English Dictionary*, the term “evolution” derives from classical Latin, in which it refers to “rolling out or unfolding” (“evolution, n”). Its earliest recorded use in English, in 1616 C.E., was in the context of military maneuvers, where it meant simply “to move or change position” (“evolution, n”). During the 17th and 18th Century, the term also could be used to mean “unrolling, opening out, or revealing.” As an extension of this meaning, “evolution” also came to be used as a means of describing “development,” specifically in the sense of a process of maturation for an organism. Historian of science Peter Bowler points out that these meanings were somewhat contiguous since many naturalists at that time (e.g. Charles Bonnet) thought of embryological development in terms of “the opening out of parts which already exist in compact form” (Bowler 1975). In many instances, however, this sense of

²⁵ Mencken, H. L. “Battle now over, Mencken sees; Genesis triumphant and ready for new jousts,” *The Baltimore Evening Sun* (July 18, 1925), accessed <<http://www.positiveatheism.org/hist/menck04.htm#SCOPESA>>

²⁶ “Contest close in Tennessee for Governor.” (1926, Aug 06). *The Atlanta Constitution (1881-1945)* Retrieved from <http://search.proquest.com/docview/499743640?accountid=14816>

evolution as unfolding or unrolling was more figurative than literal, as the end result was conceived to be possibly contained as an idea or design within a germ or egg, which undergoes successive changes as it develops into the adult organism (Bowler 1975). Indeed the *OED* gives several examples from the 17th and 18th Centuries in which “evolution” refers to the development of an idea or argument (“evolution, n”). It is important to note that in each of these uses of the term, evolution does not create new forms, but reveals pre-existing forms.

In the 19th Century, “evolution” began to be used to refer to processes of change from simple to complex forms, following logically from earlier uses related to development and embryology. Similar to the way that an embryo develops naturally into the more functional and complex adult form, human institutions also develop and become more complex. Most examples of such usage in the *OED*, dating from the first half of that century, concern the “evolution” of political institutions (“evolution, n”). Eventually, in translations of Comte’s *Positive Philosophy* (Comte and Martineau 1853), and the writings of Spencer (1946), Tylor (1958) and Morgan (1973), human societies in their entirety are postulated to “evolve.” It may be noted that this development comprised a shift from an endpoint that was pre-formed or preordained (e.g. a mature organism) into an endpoint that was merely more complex than its origins. With this turn, “evolution” became a way that a thing (e.g. a society or political institution) could become something altogether new.

Moreover, the new form of an evolving thing was assumed to be not only more complex, but improved. Social evolution was supposed to lead to larger and more advanced societies. Historian of science Peter Bowler, drawing on his deep familiarity with writings of the era (Bowler 1975), notes that Victorians were experiencing widespread societal change linked with industrialization and the economic changes that accompanied it (Bowler 1989). Faced with the uncertainty produced by abandoning traditional orders, Victorian society sought to understand and situate those changes in a grander narrative:

The Victorians sought reassurance through the belief that social evolution was moving in a purposeful direction. The idea of progress became central to their thinking precisely because it offered the hope that current changes might be part of a meaningful historical pattern. (Bowler 1989)

Evolution was further associated with social change due perhaps to a serendipitous similarity with the word “revolution.”²⁷ Living within memory of the French Revolution, several British writers cited in the *OED* contrasted sudden and violent, revolutionary change with “evolution,” as a gradual societal change (“evolution, n”).

When Charles Darwin published *On the Origins of Species*, which laid out his arguments for what would become known as the theory of evolution (Darwin 2003), he never used the word “evolution,” and used the verb “evolved” only once, the final word of the book:

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved. (Darwin 2003)

²⁷ Both “evolution” and “revolution” are derived from the Latin “Volvo,” which means “to roll.” However, they were introduced into the idiom of societal change separately (*OED*, “revolution, n.”)

Darwin may have avoided the term “evolution” at first due to associations with embryology or with societal progress. Nevertheless, others at the time readily applied the term, such that by the sixth edition of *Origins* (1873), Darwin had adopted it as well.

Origins includes several major claims, all of which remain associated with evolutionary theory. The first such claim is that all living species are modified descendants of ancient and extinct species. This idea “descent with modification” was not original to Darwin. In France, both Buffon and Lamarck had argued for the idea, which they called “transmutation” as early as the 18th Century. Erasmus Darwin, the grandfather of Charles Darwin, had also proposed such a process in his poem *Zoonomia*. According to the *OED*, the earliest use of the term “evolution” in connection with this idea comes from the geologist Charles Lyell in 1832, where he characterizes and rejects Lamarck’s theory of transmutation. Though some paleontologists referred to observed patterns of change in the fossil record as “an evolution,” they rejected transmutation as an explanation in favor of progressive creation over time (Bowler 1975).

Darwin’s second major claim was for common descent, meaning that distinct species once shared an ancestor whose lineage had diverged. As the quote above makes clear, Darwin went on to suggest that all or most living things can trace their ancestry eventually to the same source. This theory of common descent was apparently original to Darwin, who sketched the first phylogenetic tree of life in a notebook in 1842 next to the words, “I think.” *Origins* presents several lines of facts that both support Darwin’s theory of common descent and are explained through it: the geographical distribution of species, morphological similarities in comparative embryology, rudimentary organs, fossil progression, and the patterns of similarities among species that makes taxonomy possible (Darwin 2003). Within a decade, this theory of common descent, known widely as “evolution” though also called “Darwinism,” was accepted by most British naturalists (Bowler 1984). Today, it is accepted by the entire scientific community.

Darwin also postulated a mechanism to explain how such “modification” had occurred—natural selection. The principle of natural selection is based on an analogy with artificial selection, a common practice among gentlemen in Victorian England whereby a person would select individual of a domesticated species of animal to breed based on whether they possess desired characteristics. Darwin claimed that an analogical process occurs naturally in the wild. Because more individuals are born than are able to survive and reproduce, individuals within the same species have to compete with one another over limited resources. These individuals differ according to certain traits, some of which affect their chance of surviving and reproducing. As a result of the competition, those individuals with traits that afforded them the greatest success are passed along to a new generation, while those with traits that were liabilities for competition would not be passed along. The overall effect of this principle is that populations of species would preserve helpful traits and eliminate harmful traits with every generation.

While Darwin appears to have been the first to work out the principle of natural selection, he shared recognition for its discovery with Alfred Russell Wallace, whose paper on the mechanism was read on the same day as Darwin’s own paper. Unlike the first two theories mentioned above, Darwin’s theory of natural selection, which was frequently referred to simply as “Darwinism,” was not widely accepted for half a century. Prior to the discovery of genetics, natural selection suffered a fatal flaw—Darwin was unable to account for the introduction of new variation in a population—and was viewed as inadequate for explaining many examples of change over time (Bowler 1984). In fact, Darwin’s theory about how evolution actually occurs was rivaled by neo-Lamarckianism and saltationism in the early 20th Century (cf. Caullery 1916). Even today, there are biologists who dispute the centrality of natural selection in driving

evolutionary change, arguing that other mechanisms play a greater role, such as lateral gene transfer, symbiosis, genetic drift and allopatric speciation.

At the time that Darwin introduced respectability to an evolutionary account of the origin of species, there were no creationists, at least not in the sense we mean today. The *OED* notes the use of “creationist” in 1820 to mean its contemporary opposite, “a person who attempts to explain the creation of the world in scientific terms” (*OED* 2011). At least as early as 18233, “creationist” was contrasted with “traducianist” as a rival theological explanation for the soul (*OED* 2011). Charles Darwin is attributed by the *OED* of using the term to refer to proponents of creationism (as opposed to evolution) in a letter written to J.D. Hooker in 1856, though it is not clear what Darwin meant, “You give all the facts so clearly and fully, that it is impossible to help speculating on the subject; but it drives me to despair, for I cannot gulp down your continent; and not being able to do so gives, in my eyes, the multiple creationists an awful triumph” (*OED* 2011). The first clear use of creationist as opposed to evolutionist does not appear until 1913 in an article in *The Biblical World* by a theologian and Old Testament scholar: “The great task of the scientist is to discover the origins of things. The battle which raged between evolutionists and creationists has left the evolutionists in possession of the field” (Smith 1913). It was used a few years later in the same sense during a paper read before the AAAS (Caullery 1916). Before a great many people began to espouse evolution, no one apparently had the need to refer to the people who rejected it in favor of creation. The identifiers—evolutionist and creationist—were established by being opposed.

Opposition to evolution did not arise immediately from a perceived conflict between scriptural accounts of creation and the evolutionary accounts, but rather in response to the ways Darwin’s theories were employed and used by scientists and others to advance certain ideas. Then as now, evolution is synecdoche for a host of ideas and ideologies. Part of the appeal of evolution for Victorians, and likely a factor in its formulation (Bowler 1984), was born out of the observation and awareness of changes occurring all around, and attempts to understand and situate those changes in a grander narrative:

The Victorians sought reassurance through the belief that social evolution was moving in a purposeful direction. The idea of progress became central to their thinking precisely because it offered the hope that current changes might be part of a meaningful historical pattern. (Bowler 1989)

Bowler claims that Victorian society was fascinated with the past, related to tensions created by rapid technological progress experienced during the Industrial Revolution. “Recognition of change inevitably generated a concern for the future” (Bowler 1989). In order to ease those tensions, Victorians invented a narrative of progress: “Radical thinkers, including Mill, felt that the past was dead in the sense that it could no longer be looked upon as a source of authority” (Bowler 1989). Darwin’s theories on evolution seemed to legitimate these views of social progress. As it was told by Victorians, the story of evolution slips easily between the emergence of humans from a primal past to the emergence of the modern world from a medieval or primitive world. It is thus fundamentally a story about progress and improvement: old vs. new, simple vs. complex, primitive vs. advanced, superstitious vs. rational. This slippage also occurs in the story of Darwin’s discovery of evolution, and the efforts of Darwinians at promoting his ideas. The story includes not only a case for the reality of evolution but also a case for the inductive method of science (now known simply as *the* scientific method) and for scientific explanations over religious ones (Bowler 1989). Given these associations, it ought not surprise us that the conservatives who were skeptical of the so-called “progress” they saw were motivated

to seek out problems with evolution, and thus vicariously undermine their liberal opponents (Bowler 1989).

Even more, already in the late Nineteenth century, evolution was being co-opted by a rising class of professional scientists like T. H. Huxley to usurp the traditional power of the church over knowledge (Bowler 2007). Not only does it provide an alternative account of human origins from that of the Bible, but it does so based on an epistemology that bypasses church and scriptural authority altogether. Moreover, evolution—the emergence of newer, improved forms over time—is a perfect analogy for progress, of human society as well as scientific knowledge (Bowler 1989). For creationists, as well, evolution education has its own set of bundled ideas. In contradicting the Genesis creation account, it represents an overreach of modern science, which, like the hubris of the Tower of Babel or even of Lucifer himself, attempts to place human reason on par with God, inviting His wrath. By posing purely naturalistic causes for the origins of humankind, it is an example not merely of naturalism but of atheism, since God plays no role in the account. Finally, by proposing animals rather than angels as human brethren, it ties humankind inextricably with the natural world and with the flesh. Like Original Sin, evolution casts us out of Paradise, and into a cold, cruel world.

It was not merely agnostics like Huxley who saw promise in evolutionary accounts. Most Protestant churches at the time embraced an eschatology known as post-millennialism, which held that Christian civilization was in the midst of building God’s kingdom on earth, following the fulfillment of apocalyptic prophecy in the fall of the Roman Empire in 476 C.E. (Bowler 2007). This view of history was aided by Higher Criticism, a literary approach that viewed the Bible as a historical document rather than the inspired Word of God. It suggested that the Bible ought to be read as a collection of allegories that recorded the efforts of humans to communicate with and understand God, but that many of the events described may have been invented or embellished. Many progressive Christians embraced the idea of evolution, such as Ernest William Barnes and Charles Raven, who preached about the compatibility between evolution and Christian faith, and particularly saw in evolution confirmation of a divine plan of improvement from lowly origins (Bowler 2007). Post-millennialism was also vindicated by the evidence of progress demonstrated by the industrial revolution, colonial efforts in sub-Saharan Africa to bring civilization, and the successes of modern science and technology in improving people’s lives (Bowler 2007).

The Fundamentalist movement emerged in the early 20th century as an outgrowth of the conservative reaction to these liberals, which they accused of compromising on the fundamentals of the faith. It was born in the North of the United States, where modernism was strongest, and thus prompted more opposition. Most of the South was uninterested in the movement, likely because modernism was not seen as a threat there (Lienesch 2007). The movement asserted certain “fundamentals” to the Christian faith that included the Virgin birth, the Divinity of Christ, and the inerrancy of scripture (Marsden 1980). By emphasizing these fundamentals, especially the doctrine of scriptural inerrancy, these conservatives implied that they represented a more authentic and truer form of Christianity than the dominant liberals. Discussion of evolution in *The Fundamentals*, a set of essays that served as the founding documents for the movement, was ambivalent. While there were certainly fundamentalists opposed to evolution, many of the authors of *The Fundamentals*, and many people who would consider themselves “fundamentalist,” accepted some aspects of evolution, usually in the form of theistic evolution, wherein God guided the process and used it to create species (Lienesch 2007; Numbers 2006).

The main target of attack by these authors was Higher Criticism (Lienesch 2007; Marsden 1980; Numbers 2006).

This initial ambivalence of fundamentalists to evolution began to be replaced by antagonism in the second decade of the 20th century, nearly half a century after *Origins* was published. At the time, the scientific community had begun to increasingly criticize Darwin's principal mechanism of evolution—natural selection (Numbers 2006). While organic evolution was overwhelmingly accepted by these same scientists, the inability of Darwin's mechanism to account for the introduction of new variation into populations was regarded as a fatal flaw (Bowler 1993). Many scientists rejected Darwin's mechanism for evolution in favor of neo-Lamarckism or saltationism—a theory that genetic mutations drove evolution (Bowler 1993). Criticism from the scientific community about Darwin's theory of natural selection was misinterpreted as criticism of the theory of common descent and seen by many fundamentalists as a precursor to the eventual rejection of Darwin's theories by modern science (Numbers 2006). If the predictions were correct, it would suggest that the liberal Christians who had embraced evolution and its progressivist undertones were on the wrong side of scientific history. Seizing on these signs that the Darwinian view was crumbling, they latched onto creation apologetics, such as the arguments of Harry Rimmer and George McCready Price (Numbers 2006), which focused on problems with Darwin's theory at the time, buttressed by quotes from scientists.

Rise of the Antievolution Movement

Many historians have written about the conflict over evolution in schools (e.g. Bowler 2007; Larson 1997; Lienesch 2007; Moran 2003; Numbers 2006; Shapiro 2008), and these histories help us to understand how and why a movement against teaching evolution emerged. It would be a mistake to claim that the movement was a direct response to the specter of evolution itself. After all, opposition to teaching evolution did not appear until the 1920s, half a century after most scientists had accepted evolutionary accounts. Moreover, the history teaches us that evolution was not an inevitable enemy of fundamentalism that resulted from inherent contradictions between fundamentalist claims of biblical inerrancy and evolutionary accounts of human origins, but rather the product of a specific history in which several factors coalesced and gave it support (Lienesch 2007).

The antievolution movement, which was independent of the Fundamentalist movement, at least at first, began to grow right around the time of the First World War. The atrocities of the War called into question the narrative of progress in Christian civilization (Numbers 2006), which was itself vicariously linked to evolution, as noted above (Bowler 2007). As scientific criticism of Darwinism mounted, at least one pioneer of young-earth creationism, George McCready Price, collected these criticisms and published several books outlining an argument that the geological record was actually evidence of the worldwide Flood described in the *Book of Genesis*. At the time, these criticisms of evolution were somewhat valid, as few transitional species had been recovered from the fossil record, and the genetic evidence for common descent had yet to be discovered.

It is conceivable that conservative Christians at the time could have been opposed to the idea of evolution without taking much interest in whether and how it was taught in schools (Israel 2004; Lienesch 2007; Shapiro 2008). Larson notes that the rise of public schooling in the early 20th century would have increasingly exposed children in conservative homes to the teaching of evolution (1997). However, historians who focused on Tennessee explicitly, have found much

support for the view that the antievolution movement was fueled by anger over public schooling itself, and not specifically from the evolution content.

The US Constitution says nothing about schools, as the very idea of popular schooling did not arise until progressives like Dewey began pressing for it in the late 19th and early 20th centuries (Nasaw 1981). This expansion was initiated by progressives at the turn of the 19th Century, reflecting an interest in rehabilitating urban slums, bringing social mobility that comes with education as well as information about sanitation (Shapiro 2008). While mass schooling was pioneered in states like Massachusetts, it eventually spread to places like rural Tennessee. The fact that the federal government has no Constitutional authority to regulate education has complicated efforts to expand public schooling and later to promote national standards of education. The authority to construct schools and mandate attendance fell on the states, who passed most administrative control and costs to local districts. State governments played a basically supportive role in public schooling, but did not require districts to teach specific topics until the standards-based reform movement gathered steam more recently.

In many parts of the country, the expansion of public schools evoked resentment, both due to costs to the public, but also the loss of children's labor for families (Israel 2004; Keith 1995; Shapiro 2008). Furthermore, the focus on urban problems in many textbooks, offended many rural people (Shapiro 2008). Shapiro claims that part of the support for antievolution laws came directly from offense taken from Hunter's *Civic Biology*, which had been adopted by the state of Tennessee for use in high schools and which was named in the Scopes trial as the textbook Scopes used. The textbook advocates eugenics as well as evolution (Hunter 1914; Larson 1997; Shapiro 2008), which is notable given that, in his writings, Bryan was explicitly concerned with evolutionary ethics and eugenics (Bryan 1922; Bryan and Bryan 1925; Hunter 1914; Shapiro 2008). Shapiro supports his arguments with letters from textbook reviewers and from the public, whose concerns frequently focus on this other content (2008).

Keith's history of rural Tennesseans living in the Upper Cumberland ends with a discussion of the Scopes Trial. She notes that the progressive reforms of the period were seen by these Tennesseans as an assault on the way of life of family patriarchs, who she argues were accustomed to exercising great control over their families: "If the Tennessee Monkey Law held any symbolic meaning on the local level, it was a regional reaction to decades of reform culminating in a loss of local control over education" (Keith, 1995: 203, as quoted in Shapiro 2008). These ideas are echoed by another historian, Charles Israel, whose book *Before Scopes* (2004), investigates Tennessee education in the decades leading up to the Scopes Trial of 1925. According to Israel, the feeling among many people in Tennessee, since the Reconstruction that followed the Civil War, is that they have had to fight a battle with outsiders over the education of their children. Religious leaders in the state only came to accept public schooling in light of the "home rule compromise," wherein local communities were permitted to decide what children learn in schools (Israel 2004).

Amidst this festering anger over the expansion of schools came William Jennings Bryan. Known as the "Great Commoner," a former Secretary of State, and three-time Democratic candidate for President, Bryan was not a fundamentalist, but rather a moderate (Lienesch 2007). The topic of evolution served as a lightning rod for the widespread resentment people felt, igniting popular support for Bryan's crusade against evolution in schools (Israel 2004; Larson 1997). It undergirded legislation to limit the teaching of evolution, including Tennessee's Butler Act, which culminated in the infamous Scopes "Monkey" Trial.

Bryan came to evolution as a specific topic after hearing about the effects of colleges, and especially college professors, on young people (Bryan 1922). After reading Benjamin Kidd's antievolutionary diatribe *The Science of Power* (Kidd 1918), which tied German militarism during World War I to evolutionism²⁸, Bryan became convinced that evolution was the source of all evil in the modern world (Lienesch 2007). Soon after, he began delivering a lecture titled "The Menace of Darwinism," which presented evolution as a philosophy that condemned democracy, denied the existence of a personal and revealed God, destroyed morality and celebrated war (Lienesch 2007). The lecture was delivered widely and transcripts and pamphlets based upon it were broadcast more widely still. According to Lienesch, the lecture had immense influence, bringing the attention to mass audiences for the first time (2007).

William Jennings Bryan focused much of his rhetoric about the threat of evolution on the reported effects of evolution teaching on the faith of American youth. Notably, Bryan's main argument against teaching evolution was based not merely on such threats, but on democratic ideals: noting that the vast majority of the public did not accept evolution, Bryan argued that it was not fair that they should be made to pay for its teaching through their tax dollars in public institutions, including universities and public schools (Numbers 2006). In his public speeches, Bryan cited letters and reports of personal visits from college students who had told him that college professors had destroyed their faith. The curricular culprits were many, including modern philosophy and biblical criticism as well as evolution (Lienesch 2007). Before World War I, college education was reserved for a select few. Most programs were actually seminaries, and most colleges religiously oriented. After the War, colleges had begun to change. They became more secular, especially as state colleges were created to compete with religious colleges. Furthermore, they were much more widely attended. As more occupations were professionalized, and educational demands increased, more young people were attending (Lienesch 2007).

By the time Bryan's antievolution campaign was in full swing, the public's attention had been diverted entirely away from education itself and instead onto this one topic. That the two issues—evolution and public schooling—were so closely associated, is made especially clear with the fact that the Butler Act, which made it illegal to teach evolution in public schools, was passed at the same time as Governor Peay's education bill that expanded public education throughout the state. Indeed, the cooperation of many legislators on the education bill seems to have been conditional on passage of the antievolution bill (Armstrong 1929). From this perspective, the antievolution movement is less an attempt by religious extremists to subvert science in order to support their antiquated views and more a kind of resistance by parents and community members against what they perceived as an invading force to undermine traditional authority, corrupt their children and change their culture.

While some noted fundamentalists, like A. C. Dixon, recognized evolution as a threat early, the majority first heard about the issue from William Jennings Bryan. Many fundamentalist leaders, like W.B. Riley, saw in antievolutionism an issue that had the potential to unite fundamentalists and expand the movement, particularly in the South where an absence of liberal theological institutions meant little concern about Higher Criticism (Lienesch 2007). The picture that emerges is something like a Venn Diagram, wherein antievolutionism and fundamentalism begin as two separate, but overlapping circles, which merge over time until the two are nearly inextricable. While antievolution sentiment existed apart from fundamentalism, especially in the South, the movement benefitted immensely from fundamentalist energy,

²⁸ Kid's argument was based on a conflation of "Social Darwinism," as exemplified in Nietzschean philosophy, with "Darwinism," as evolution by the process of natural selection was known at the time.

organization and ability to motivate members to political action (Lienesch 2007). At the same time, antievolutionism, along with prohibitionism, gave fundamentalist leaders an issue they could use to unite denominations and take advantage of networks of activists that grew up around concern over evolution (Lienesch 2007).

Fundamentalist leaders recognized in evolution certain advantages over other targets related to secularism and modernism (Lienesch 2007). Whereas secularism was restricted to the religious sphere, and naturalism, materialism and skepticism were philosophical and abstract, evolution was something concrete that people could imagine. As Lienesch says, “Blaming Darwin may not have had the rhetorical power of blaming the devil, but in an increasingly secular society, it was more convincing to a lot of people” (2007). Moreover, evolution could be connected with war, immorality and godlessness in a way that was easy for people to grasp (Lienesch 2007). The value of evolution as a bogeyman would aid the fundamentalists in their ongoing efforts to spread their movement and turn the tide of liberalism in churches. By associating evolution with societal evils, the fundamentalists vicariously attributed those evils also to their theological competitors.

Once fundamentalist leaders had recognized the usefulness of evolution as an issue, Lienesch reports that they faced the task of honing their message on evolution to appeal to as many different groups as possible. They did this principally through public debate (Lienesch 2007). In order to appeal to the sensibilities of various groups, their claims and criticism frequently shifted contextually, making it virtually impossible for historians to identify any single motive driving antievolutionists. As a result, arguments and claims about evolution were often contradictory. Whereas Bryan was motivated by Progressive goals and linked evolution with Social Darwinism and thus opposition to these goals, others in the movement were politically or socially conservative and opposed evolution on the grounds that they saw it as practically synonymous with progressivism (Lienesch 2007). While many African American religious leaders opposed evolution because of its associations with scientific racism (Moran 2003), white Southern racists opposed it because it implied that whites and blacks come from the same family tree (Lienesch 2007).

Much of the character of fundamentalist rhetoric that survived up into the 21st Century was shaped by the alliance of fundamentalist elites with the prohibition movement and the anti-evolution movement. Fundamentalists took up the topic of evolution for practical reasons, and *then* constructed arguments to convince others that evolution education should be opposed (Lienesch 2007). One of the most intriguing examples of this was an argument developed to make evolution seem more relevant to Christians who did not see themselves as fundamentalist. In order to do so, they needed to find ways to connect a fairly arcane story from deep in the Old Testament to Jesus Christ. By emphasizing Christ as redemption from the Curse of sin, the discourse of fundamentalism drew attention to this Curse, linking it genetically through the first literal humans—Adam and Eve—who committed Original Sin by disobeying God in the Garden of Eden, as described in *Genesis* 1-3. This same message exists in sermons and through organizations like the Institute for Creation Research, Answers in Genesis and Apologetics Press, all of which draw a direct connection from the historical act of disobedience to the reality of being a Sinner and therefore in need of Christ’s salvation²⁹.

²⁹ All three of these organizations produce publications and engage in a range of public outreach to assert that evolution is false and the creation account in *Genesis* 1-3 is historical, and an emphasis on the importance of recognizing the condition of sin and necessity of devotion to Jesus Christ permeates all such efforts.

In conclusion, historians who have looked at the antievolution movement have mainly accepted that the apparent incompatibility between literal readings of Genesis and evolutionary theory was sufficient to incite the movement. However, beneath this current is another line of thinking which takes into account how people think about and respond to power and authority. In this line, people may support, ignore or fight against the teaching of evolution in schools not simply because of religious beliefs, but due to considerations of politics, influence and identity. Conservative Christians find fault in evolution because liberal Christians find it useful. Rural people dislike evolution education because it comes along with state-imposed public schools and urban-focused textbooks. In each case, religious people did not have to dislike evolution. They were persuaded to do so given a particular situation and set of relations. People learned to reject evolution. More importantly, they learned that they had to reject it. Likewise, students today must be taught that evolution is a danger. And they reject it, not because they do not understand it (though they may not), nor because they do not believe it has evidence, but because they know that they must reject it. The next section will look more closely at the process to which antievolutionists seem to have been responding.

Rise of Efforts to Teach Evolution

The Scopes Trial was the first of many court decisions on how evolution can be covered in schools. It is also the most symbolic. Unlike other decisions such as *Epperson v. Arkansas* (1968), *McLean v. Arkansas* (1982), *Edwards v. Aguillard* (1987), and, most recently, *Kitzmiller v. Dover Area School District* (2005), the Scopes decision came out in favor of antievolutionists. Also unlike these other famous trials, it had no legal consequences for antievolution laws. Contrary to popular belief, largely promulgated by journalists and dramatizations of the trial like *Inherit the Wind*, fundamentalism and its antievolutionist arm was not defeated in the Scopes Trial (Larson 1997). Even after the trial, antievolution laws in Tennessee, Arkansas, Louisiana, Oklahoma and Florida remained in effect for decades (Moore 2002). Meanwhile textbook publishers removed practically all references to evolution due to concerns over controversy (Bergman 2003; Lienesch 2007; Numbers 2006). The negative press generated by the trial did not prevent the passage of similar legislation in Mississippi in 1926 and Arkansas in 1928. Though Arkansas' antievolution law was the last to be adopted until the 1970s, activists were not retreat during the lacuna, but simply changed their strategies. Rather than attempt to influence legislative bodies, activists turned their focus to local school boards and sought to regain legitimacy by creating their own scientific organizations (Numbers 2006).

Nevertheless, the Scopes Trial served as a pivot point in the discourse on evolution education. Prior to Scopes, evolution was a compelling and controversial idea, inviting lively debate in the *New York Times*, for example. It was also increasingly being taught in universities and high schools, as we see from the reaction of Bryan and other antievolutionists to it. However, there was little sense among proponents of evolution that the theory *needed* to be taught. In fact, the ACLU and the Defense in the Scopes case never argued that evolution ought to be taught, but rather that a teacher ought to have the academic freedom to teach it, should he decide (Larson 1997).

A sense of the importance of teaching evolution only began to be formulated during the coverage of the Scopes Trial, and in its aftermath. Coverage and later rememberings of the Trial had a much larger impact as part of the cultural imaginary than might be predicted based on the legal consequences. Throughout the press coverage, the Tennesseans of Dayton were thoroughly "othered" (Said 1978; Smout 1995). Through the writings of Mencken and others, creationists

were linked to southern fundamentalism, and both were portrayed as based in ignorance and barbarism (Smout 1995). Creationists were described as imbeciles and compared to Neandertals and Huns for their opposition to evolution, and, by extension, modern science (Mencken 2006 [1925]). In defining antievolutionists as the Other, in this way, consumers of the coverage were primed to take the opposite view on evolution: if the yokels and ignoramuses wanted to *not* teach evolution, then modern, educated people ought to want to teach it.

Another outcome of the Trial and its tellings came from the portrayal of John T. Scopes. In reporting during the Trial, Scopes is described as a kind of hero, willing to sacrifice himself in order to defy an unjust prohibition. Scopes became a symbol for the conscientiousness of teachers, who were determined to impart knowledge as part of their duty. Though John Scopes may not have actually taught evolution, he went on to support it in his fame after his trial (Scopes and Presley 1967). These processes continued through later dramatizations of the Scopes trial, in the form of the play *Inherit the Wind* (Muni et al. 1955) and its multiple film adaptations, which wrote the trial into the popular imagination as a showdown between the courageous forces of modern science and the cowardice and fears of religious superstition. The scars of the “Monkey” trial were apparent ever afterward, as efforts to repeal the Butler Act made constant reference to the embarrassment the antievolution statute brought upon Tennessee (Webb 2012).

Even in the near aftermath of *Scopes v. the State of Tennessee*, there was evidence for the beginnings of a quiet counter antievolutionist movement among teachers and others in Tennessee who saw the Scopes Trial and the Butler Act as black stains on the state. In 1929, freelance journalist Orland Kay Armstrong travelled from “one end of the state to the other” and documented how the “Commonwealth evades the famous Monkey Law.” Writing in *The North American Review*, Armstrong summarizes what he learned talking to teachers and university professors a mere four years after the Trial:

...the theory of Evolution is bootlegged into the teaching of science in Tennessee. Instructors of science cheerfully admit that the great cause of learning, including education in scientific matters, is going merrily ahead in their State, and that no fool monkey law could stop it. (Armstrong 1929: 139)

This imagery of “bootlegging” science in Tennessee is worth noting. Doubtlessly the term would have had special significance to readers in 1929, in the midst of Prohibition. Like the antievolution law, Prohibition was passed as a moral program, deemed necessary to keep evil at bay. And yet it was also quite unpopular and widely circumvented. Bootleggers were smugglers of alcohol. Though technically lawbreakers, bootleggers were also something like folk heroes, evading the authorities in order to satisfy demands. By equating Tennessee teachers with bootleggers, Armstrong insinuates a similar kind of status for them. Rather than smuggle alcohol, they smuggle in science to quench a thirst for knowledge.

Armstrong’s confidantes explained to him how they were able to get around the Butler Act through some creative semantics. First, according to “one of the ranking members of the State Normal School,” teachers substituted the word “development” for “evolution” in their instruction. As we will see in Chapter 5, this strategy has resonances in evolution education today. The second strategy was to present the theory of evolution in a way that does not violate the letter of the law. Recall that the Butler act made it unlawful “to teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals.” To get around this prohibition, one Tennessee teacher points out:

...no modern evolutionist teaches that we descended from 'lower orders of life'. It is agreed among reputable scientists that man evolved parallel to other forms and that he is as old as all other species. As to his kinship with them—that, of course, cannot be denied, and we cannot teach without teaching it. But technically the law could not touch us because of the way it is worded. (Armstrong 1929: 140)

According to Armstrong, these teachers cited three reasons for their endeavor to teach evolution in spite of the law. First, "because Tennessee now bears the stigma of being a backward and ignorant State generally." Second, because they were offended by the "game of log-rolling politics" that led to passage of the Act. And finally, because "the Scopes case was pounced upon by outsiders on both sides of the fence to give it the appearance of a gigantic tournament of right against wrong, of religion against atheism" (Armstrong 1929: 141). This last issue was of greatest concern to the teachers:

In the eyes of the mass of people in Tennessee, William Jennings Bryan came down to champion the cause of Fundamentalism and hence religion and morality, and Darrow *et al.* came down to do battle for atheism and the powers of darkness.

"And that left us holding the sack," gloomily recounted a teacher of science in one of the teachers' colleges. ["Did you notice that mighty few of the science teachers of Tennessee testified at the trial? It wasn't because they weren't burning with desire to tell the truth, the whole truth and nothing but the truth. It was because it meant educational suicide. They tried to subpoena me, but I could not be found..."] (Armstrong 1929: 142)

In other words, many of these Tennessee teachers were willing to subvert the law in the interest of "science," though they were nevertheless fully aware of a pervasive social current that equated their decision to teach evolution with irreligion. They were thus entirely unwilling to publicly declare that decision. The sense that evolution needed to be taught would remain mostly dormant for several decades, stewing beneath the surface in the midst of larger social changes. Despite these currents, in 1932, when 30 biology professors were asked about the topics most important to teach in high school biology, they ranked evolution among the topics that deserved the least attention (Caldwell and Weller 1932; Troost 1968).

During the decades after Scopes, scientific understandings of evolution were progressing under a new paradigm—the modern evolutionary synthesis—incorporating the new field of population genetics with Darwinian selection. As noted above, earlier forays into genetics had been seen in opposition to Darwin's theory, offering an alternative theory of evolution by saltation, wherein mutations produce "hopeful monsters" that end up as new species (e.g. Kellogg 1907; for a contemporary discussion of the theory of saltationism, see Theißen). In 1930, pioneering biostatistician Ronald Fisher published *The Genetical Theory of Natural Selection*, which argued that Mendelian genetics actually validates Darwin's mechanism (Fisher 1930). The emergence of the modern evolutionary synthesis invalidated most of the criticism against Darwinism, while also putting it on firmer evidentiary ground within modern science, complete with testable models of shifting gene frequencies that further validated natural selection as a mechanism for change. These ideas continued to develop in biology, in the work of J.D.S. Haldane, Theodosius Dobzhansky, G.G. Simpson, and Ernst Mayr. The modern synthesis eventually reached popular audiences after 1942, through Julian Huxley's *Evolution: the Modern Synthesis* (Huxley 1942). These advances in biological theory, in concert with advances in paleontology such as carbon-14 dating methods and new fossil discoveries, meant that the scientific case for evolution grew substantially in the decades following the Scopes Trial.

Public calls for more teaching would come later, amidst a more general push for more rigorous science education, as an element of the Cold War and the space race with the U.S.S.R. The launch of Sputnik 1 in 1957, the first artificial satellite to orbit the earth, was interpreted as proof of a deficit in the education systems of the U.S., and provoked a strong response from the National Science Foundation to improve science education, with the explicit aim of attracting more students to careers in science (Audet and Jordan 2003; Nelkin 1984). The first educational programs out of NSF, the Physical Science Study Committee (PSSC) focused on creating films to communicate physics concepts, aimed at students who showed an aptitude for the subject (Nelkin 1984). The success of the PSSC laid the groundwork for later educational reforms, particularly inquiry-based science education, which sought to emphasize the process of scientific inquiry rather than merely the study of facts (Audet and Jordan 2003; Audet and Jordan 2005; Nelkin 1984).

Around this time, growing awareness among professional biologists of a growing gap between the state of the field and high school curricula led to increasing calls for an overhaul of how biology is taught in high schools. In 1958, the American Academy for the Advancement of Science held a symposium on biology education. At the symposium, microbiologist W. H. Johnson argued that evolution deserves more attention in high schools, but that many biologists have mistakenly assumed that the public accepted the scientific consensus on evolution at that time (Johnson 1958). Another paper, delivered by an Illinois high school teacher, outlined the challenges faced by teachers who wish to teach it, citing religious opposition alongside the conceptual difficulties of learning it and a lack of adequate teaching materials (Hunter 1958). The issues introduced at that symposium, some of which were published in *The American Biology Teacher*, a journal aimed at biology education professionals, seem to have attracted the attention of biologists, who began to increasingly express an interest in the topic.

The year 1959 marked the centennial anniversary of the publication of Darwin's *On the Origin of Species*, and was an occasion for conferences and celebrations organized in countries around the world, but particularly in England and the United States. The largest such conference was the Darwin Centennial Celebration, hosted by the University of Chicago. Among the panels organized for the event was the National Conference of High School Biology Teachers, comprising 63 high school teachers, selected from among 260 teachers nominated by directors of NSF summer institutes for teacher training. During the event, the teachers were invited to talks by leading scientists such as Hermann J. Muller (geneticist), Theodosius Dobzhansky (geneticist and evolutionary biologist), George Gaylord Simpson (paleontologist), Julian Huxley (evolutionary biologist) and Edgar Anderson (botanist), all of whom discussed the lasting importance of Darwin's ideas for biology and modern science, and each of whom appealed to the teachers to cover evolution in their classrooms (Mayfield, Gowin and Boyajian 1960; Smocovitis 1999). The most enduring example of this appeal was a paper by Hermann Muller, which would later be published in the journal *School Science and Mathematics*, titled "One hundred years without Darwin are enough" (Muller 1959).

Following the Celebration, the teachers involved were asked to write brief papers on their impressions. Those reactions were collected and analyzed alongside records from discussions in the various panels, and then published as an article in *The American Biology Teacher* (Mayfield, Gowin and Boyajian 1960), as well as a 30-page packet mailed to biology teachers across the country (Smocovitis 1999). That article summarizes the advances in evolutionary theory that ought to be included in biology classrooms, and it notes the challenges that come with teaching

evolution, including the difficulty of accessing textbooks and materials that adequately cover evolution and the religious opposition to teaching it (Mayfield, Gowin and Boyajian 1960).

The first of these problems would be addressed by a new initiative funded by the NSF and developed through the American Institute of Biological Sciences. Known as the Biological Sciences Curriculum Studies, it would publish a set of biology textbooks in 1963 that were widely adopted across the nation, in part because they were heavily subsidized (Nelkin 1984). Evolution was featured prominently in BSCS, reflecting the new interest in its teaching. However, it was unable to address the concerns about evolution as a threat to religious communities, and this oversight would lead to a major backlash within a decade of their implementation, as discussed in the next section.

The Centennial Celebration received national attention, including renewed interest in Tennessee where evolution was officially prohibited. One of the attendees at the University of Chicago was Professor James J. Friauf, a biology professor at Vanderbilt University who was serving as arrangements chairman for the upcoming Tennessee Academy of Science conference in Nashville (Webb 2012). A local reporter for the *Tennessean* attended a meeting by Professor Friauf and wrote an article pointing out the incongruity between enthusiasm for evolution among professional biologists and the state's official antievolution policy, which quoted Friauf extensively, saying that the law harmed education but was fortunately unenforced (Webb 2012). The article got the attention of faculty at the University of Tennessee, including Professor Arthur W. Jones, who was apparently inspired to found the Tennessee Committee for Science and Education in 1960, whose sole purpose was to repeal the Butler Act (Webb 2012). Jones was able to secure support from the Tennessee Academy of Science, who agreed that the Act was harmful and embarrassing to the state. With backing from the Academy, the Committee launched several efforts to introduce bills to repeal the Act, in 1960, 1962 and then again in 1967, but without support from the legislature. Opposition to evolution remained strong in Tennessee. It would take the threat of legal action before the policy would change.

Antievolutionism's Search for Legitimacy

The renewed emphasis on evolution in the BSCS was dismaying to many people who saw evolution as a threat, particularly to the faith of Christian children. By this point in time, the fundamentalist arguments about the necessity of reading the *Book of Genesis* as a literal historical record that was incompatible with evolution had been incorporated by conservative seminaries and from there into churches across the nation (Marsden 1980; Numbers 2006). Whereas evolution had been ignored or downplayed for decades, the new BSCS textbooks emphasized it like nothing before. They therefore sought out a new strategy to counteract the effects of evolution education.

The strategy they ultimately adopted is known as creation science or scientific creationism (Numbers 2006). Though it is often dismissed as simply creationism dressed up to appear scientific, such caricatures gloss over the important shift in thinking represented by creation science (Toumey 1991). Creationism is an explicitly religious belief that draws support almost entirely from biblical scripture without any pretense of deference to scientific epistemology. Creation science, in contrast, recognized the privileged place of science for legitimating knowledge claims in this modern age. Whereas creationists were content to draw moral lessons and theology from *Genesis*, creation scientists read scripture as historically reliable presentations of past events upon which to base explanations of geological and fossil findings (Toumey 1994).

The seminal creation science book was *Genesis Flood* (Whitcomb and Morris 1961), which basically recycled arguments that George McCready Price used in the first quarter of the century (see 1913; 1923; 1926). When *Genesis Flood* was published, the leading association for evangelical scientists—American Scientific Affiliation—fully embraced mainstream geology and accepted a very old earth (Numbers 2006). Nevertheless, so-called creation science was embraced by a good number of evangelicals and the young earth and flood geology that it claimed were scientific became practically doctrinal in theologically conservative churches over the next several decades (Numbers 2006).

It is possible that creation science would have remained obscure were it not for a new legal development. Throughout most of the 1960s, evolution remained unlawful to teach in Tennessee, Arkansas, Louisiana, Oklahoma and Florida, despite the fact that schools in those states had adopted the BSCS textbooks that included evolution. The contradiction between textbooks and laws was destined to cause conflict. Then in 1967, Gary Lindle Scott, a teacher at Jacksboro High School in Campbell County Tennessee, was fired for teaching evolution in violation of the law ("Monkey Law' Ousts Tennessee Teacher" 1967; Webb 2012). Scott was a new science teacher from Detroit, who seemed to have been unaware of the law when a student asked him about the origins of humans. When he "gave a general description of the Darwinian view," it was "met by a gasp" from the students, and Scott was later told by his principal "not to mention the evolution of man" ("Monkey Law' Ousts Tennessee Teacher" 1967). Though Scott claims to have thereafter "scrupulously avoided the topic," word of the event seems to have attracted attention of "a group of preachers," one of whom reported being told by "some students" that Scott had been teaching them that "the Bible was just a myth or a fairy tale." These preachers then contacted a member of the school board, who summarily removed Mr. Scott from his job ("Monkey Law' Ousts Tennessee Teacher" 1967). In response, Scott hired an attorney to redress the incident. However, within weeks, his case had attracted the attention of the ACLU and the National Education Association, who pledged to pay his legal fees. Facing the threat of another "monkey trial," the Tennessee legislature reintroduced a bill to repeal the Butler Act, which passed after only 3 minutes of discussion and was signed into law only 2 days later (Webb 2012).

Though the impending Scott case in Tennessee resulted in the repeal of the state's antievolution statute, it was decided out of court, and thus similar laws in other states remained in effect. The very next year, however, another case did go all the way to the Supreme Court. *Epperson v. Arkansas* (1968) was initiated by Susan Epperson, an Arkansas teacher whose district had adopted the BSCS textbooks. She noted that her state's anti-evolution law forbade her from teaching the textbooks she was supposed to use. The outcome of the court decision was that state laws forbidding the teaching of evolution were ruled unconstitutional.

Again, the large contingents of people who viewed evolution as anathema to their faith watched these legal developments, alongside the expansion of the BSCS textbooks, with great trepidation. Less than five years after the Supreme Court had struck down antievolution laws, concerned citizens began to draft new bills that required "balanced treatment," requiring teachers to spend as much time on creation as was spent covering evolution. Tennessee was part of an early wave to adopt these equal-time laws, and actually used the explicitly religious language of *Genesis* and creationism in the wording of the law. Tennessee's own Supreme Court overturned the law merely 3 years after it was adopted, citing violations of the state's own constitution's guarantees of separation of church and state.

Later equal-time laws, in other states, like Arkansas and Louisiana avoided such religious language by adopting the term “creation science.” This strategy depended, of course, on claiming the existence of scientific evidence against evolution or for young earth creation, and *Genesis Flood* purported to supply that evidence. One of the book’s authors, Henry Morris, gained enough support to found a center dedicated to creation science, which is still active today—the Institute for Creation Research (Numbers 2006). These laws were not as clearly violations of the First Amendment’s Establishment Clause, but federal courts ultimately ruled them unconstitutional based on the sectarian intent of the law-makers, first by a federal district court in *McLean vs. Arkansas* 1982, and later by the Supreme Court in *Aguillard vs. Edwards* 1987.

Antievolution organizations responded to these rulings by turning to a new strategy, teaching about a “scientific” theory called Intelligent Design, which was basically a modern rendition of Paley’s pre-Darwinian argument for God based on the appearance of design in the world. Advocates for Intelligent Design recognized the need for antievolution legislation to appear divorced from any religious motivation and thus presumed not to identify the designer (Scott and Branch 2009). Thus, unlike creationism or creation science, Intelligent Design does not make direct reference to the Bible.

Defining Intelligent Design is difficult, perhaps by design (Forrest and Gross 2007). By most accounts, the central claim of proponents of Intelligent Design is that there is scientific evidence that an intelligent designer must be invoked to explain the origin and development of life on earth. However, the exact meaning and extent of the claims shifts depending on the argument of proponents. For example, scholars working within the scientific establishment claim that the intelligent designer referred to by the theory is not necessarily a supernatural being, but may instead be extra-terrestrial. However, other proponents argue that mainstream scientists ignore the evidence for design based on an unjustified commitment to natural explanations in science, implying that the hypothesized designer is supernatural (Johnson 1997b; Johnson 2000).

This is the historical context in which state standards for what ought to be taught in science were being adopted across the country. The idea of standards-based reform is rooted in values of conformity, predictability and accountability in education. It is essentially the technocratic answer to the problem identified in *A Nation at Risk* (1983): that education in our nation is on the decline compared to other developed nations. National scientific organizations like the National Research Council (NRC) and the American Association for the Advancement of Science (AAAS) have developed *recommended* national standards (AAAS 1993; NRC 1996, respectively), which are sometimes used as a basis for state standards. As professional scientific and mathematics organizations began producing recommendations for standards, states across the country began to adopt them. The largest boost came in 1994, with the re-authorization of the Elementary and Secondary Education Act, which required all states to have standards. This approach to education got another boost from the No Child Left Behind Act (2000), which required states to adopt standards and test students to ensure they are mastering those standards (Audet and Jordan 2003).

No Child Left Behind (NCLB) constituted a bold effort by the federal government to expand its role in education. Conservatives at the time feared it would open the way to a federally mandated curriculum, which could include such controversial topics as sex education and evolution. One U.S. Senator, Rick Santorum, a Republican from Pennsylvania, attempted to add the so-called “Santorum Amendment,” which singled out biological evolution as a subject that generates continuing controversy. The amendment was approved in the Senate, but later

removed from the bill itself in a House committee. It was later added to a conference report summarizing the purpose of the NCLB bill. While this inclusion had no legal force, it has been cited as support for teaching Intelligent Design as a viable scientific alternative to evolution (Meyer and Campbell 2004).

Citing the “Santorum Amendment,” a school board in Dover, Pennsylvania approved the use of supplementary materials in 2004 that advocated Intelligent Design, and required teachers to read a statement about the questionable scientific status of evolutionary theory before their classes (Humes 2007; Slack 2007). These actions were strongly opposed by most of the science faculty and several parents, leading to a trial in Federal court: *Kitzmiller v. Dover*. In the end, the court ruled that Intelligent Design was religiously based and thus violated the First Amendment of the U.S. Constitution.

In the aftermath of these various court cases—*Kitzmiller v. Dover*, *Edwards v. Aguillard*, *McLean v. Arkansas* and *Epperson v. Arkansas*—it is important to keep in mind that the consequences of these trials were never merely legal. In the courtroom, important boundary work for science was being performed (Fuller 2006; Lambert 2006; Lynch 2006a; Lynch 2006b). In *McLean v. Arkansas* (1981), for example, philosopher of science Michael Ruse served as an expert witness to define the criteria by which something can be said to be scientific (Lynch 2006b), though his criteria were criticized by other scholars in his field (Fuller 2006). According to Ruse, these are the essential characteristics of science:

1. It is guided by natural law;
2. It has to be explanatory by reference to natural law;
3. It is testable against the empirical world;
4. Its conclusions are tentative, i.e. are not necessarily the final word; and
5. It is falsifiable. (as quoted from Lynch 2006b)

These criteria were used to establish that creation science, as noted in the Arkansas equal time law, was merely pseudoscientific whereas evolution was real science. Notably, the first two of these criteria were later targeted by proponents of Intelligent Design as unnecessarily excluding supernatural causation by fiat rather than doing so empirically (Johnson 1997b; Johnson 2000). This same point was later made by a different expert witness in the *Kitzmiller v. Dover* case. Steven Fuller, a social epistemologist and scholar of sociological studies of science, was invited to testify by the defendants in Dover to support Intelligent Design (Fuller 2006). Fuller’s testimony was ultimately less useful for the Defense in *Kitzmiller v. Dover* than Ruse’s had been for the Plaintiffs in *McLean v. Arkansas*, but it nevertheless raised issues that continued to be debated for years afterward (e.g. Pennock and Ruse 2008).

In response to the ruling on Intelligent Design in *Kitzmiller v. Dover*, antievolutionists turned to a new strategy, even more difficult to define. Its opponents have dubbed it “teach the controversy” or “teach the weaknesses.” Like Intelligent Design, this strategy does not explicitly reference the Bible or anything identifiably religious in nature. Unlike Intelligent Design, it does not identify an alternative to evolutionary theory, but is instead focused on casting doubt on the scientific status of evolutionary theory among students and the larger public by insinuating that the theory has scientific weaknesses. People who have no religious objection to evolution could still be convinced that it is a “theory in crisis.” Presumably, the hope among advocates is that, once doubt has been cast on evolutionary accounts, more explicitly creationist accounts will seem more believable.

It is difficult to overstate the depth of subterfuge involved in crafting this newest anti-evolution strategy. When Hedy Weinberg, director of the Tennessee branch of the ACLU,

attempted to convince Tennessee lawmakers to reject one of these bills when it was introduced in February of 2011, she was hard pressed to show that it was actually creationist. Weinberg attempted to make the connection by pointing out that the draft of the Academic Freedom bill came from the Discovery Institute, an antievolution and intelligent design think tank based in Seattle. However, the Tennessee bill's sponsor pointed out that the website for the Discovery Institute (www.discovery.org) makes no reference to religion or creationism. Though the bill was tabled that year due to negative media attention, it was resurrected a year later and easily passed. This so-called "Academic Freedom" law will be discussed further in the Conclusion of this dissertation.

The Rise of Evolution Standards

The most recent chapter in this tit-for-tat battle has manifested in calls for greater or "more rigorous" coverage of evolution in state science education standards. Such calls for teaching evolution almost inevitably begin by deploring statistics that show that evolution is not widely accepted among the public. For example, in the United States, according to polls carried out over the last decade, less than half of the population agrees with evolutionary accounts of human origins (Carlson 2005; Jones 2005; Plutzer and Berkman 2008). One such poll, published in *Science*, compared developed nations and found that the US is second only to Turkey for rates of belief in direct, divine creation (Miller, Scott and Okamoto 2006). In their concluding remarks to the article, the authors wrote:

These results should be troubling for science educators at all levels. Basic concepts of evolution should be taught in middle school, high school, and college life sciences courses and the growing number of adults who are uncertain about these ideas suggests that current science instruction is not effective. (Miller, Scott and Okamoto 2006).

As part of that effort, for over a decade, scholars have published grades for states based on how evolution is covered on their standards (Lerner 2000; Mead and Mates 2009b). Articles link weak standards with fundamentalism, arguing that factors such as evangelical church attendance predict how evolution is treated in standards (Gibson 2004; Gross 2000; Lerner 2000; Mead and Mates 2009b). The association with "anti-science" fundamentalists effectively shames states into adopting stronger evolution standards. These efforts have been quite successful. Of those states receiving an "F" on the report card in 2000, almost all had strengthened their standards, earning higher grades in 2009 (Mead and Mates 2009b). In Tennessee, where the Scopes Trial still carries strong associations, the Education Commissioner responded to the state's F grade by asking the science coordinator specifically to improve coverage of evolution in the Science Framework that would be adopted in 2009. State officials wanted to attract high tech jobs to their state and did not want to risk appearing to be weak on science education, regardless of what residents actually believe about evolution.

The Fordham Foundation and its associated scholars are not alone in insinuating that evolution standards are indicative of overall attitudes about science. Bruce Alberts and Jay B. Labov, of the National Academy of Sciences, published an article in *Cell Biology* (2004) detailing the efforts of the National Academy of Sciences regarding the issue of teaching evolution. Such efforts include releasing public statements regarding certain controversies, publishing reports, mostly aimed at science teachers, and encouraging members of the Academy to speak out publicly against attempts to undermine evolution education. Through most of the paper, the authors are silent about the reason the reader would want to support evolution education. Then, at the end of the paper they write:

Cell and molecular biologists have provided some of the most compelling evidence to support the theory of evolution and should therefore be among those who raise their voices the loudest to support science curricula that help students understand the processes of evolution. As scientists, we also should make it our responsibility to present the evidence for biological evolution to *all* of our students, especially in introductory courses. Most students who enroll in our introductory courses will use them as their terminal courses in science. At least some of those students will go on to careers as teachers or as public servants who will be asked to make decisions about whether to allow nonscientific approaches to teaching evolution to appear in science curricula. It is *our* responsibility to equip them with the knowledge and understanding of science that they will need to confront such challenges.

At base, in this reasoning, is the fact that evolution is supported by “compelling evidence” (Alberts and Labov 2004). Because of that evidence, scientists have a “responsibility” to ensure that the idea is taught as *science*. In the last few sentences, Alberts and Labov draw a cause and effect relationship between teaching evolution to students in introductory biology courses and decisions by students-cum-teachers to allow creationism in their classrooms. According to the logic, if students learn about and understand evolution in college, if they are equipped with the “knowledge and understanding of science,” then they will be able to “confront such challenges,” specifically by choosing to teach the evidence for evolutionary theory.

Even as these scientists have drawn a causal relationship from evolution standards and public rates of acceptance, they have also drawn the causation in the opposite direction by suggesting that opposition to evolution leads to weaker standards. Gibson (2004) looks at state-level data in order to test the hypothesis that “moral factors” determine evolution standards rather than socioeconomic factors. States were graded according to how “evolution-friendly” their science standards were. The grades were checked against “evangelical adherence” in a regression analysis. Gibson concluded, based on Lerner’s grades (2000), that rate of attendance at evangelical churches are much better predictors of evolution standards than other factors. To explain the pattern, they predicted that people shape policy according to their beliefs and values. Chapters 4 and 5 of this dissertation undermine Gibson’s argument, but for now it is sufficient to note that it has been convincing. Tennessee’s evangelical adherence was placed at 40%, among 5 other states to have rates in the 40s. Since Tennessee received an F in Lerner’s Report, it fit well within the pattern reported by Gibson.

Taken together, these claims would suggest a chicken and egg problem. If public support for evolution education leads to the adoption of strong evolution standards, and strong evolution standards are needed to build public support for evolution education, then what is to be done in a state where the majority of people reject evolution? Anticipating this conundrum, the foreword by the Fordham Foundation to Lerner’s report on state science standards notes:

To be sure, state standards do not single-handedly determine what is taught and learned in U.S. schools. Many factors come into play, including the selection of textbooks, the adequacy of teachers’ own knowledge, the organization of the curriculum (*e.g.*, how much time is devoted to science), what is included on statewide tests, and whether the tests’ results bring consequences for children, teachers, schools, or others. We’re also mindful that some states with low marks for academic standards have nonetheless embraced bold and imaginative education reform strategies that appear to be bearing fruit. Standards are obviously not the whole story. (Lerner 2000)

However, it continues, “If a state's standards are unsatisfactory, some of its other reform efforts are apt to be less likely to succeed, maybe even futile. That is why standards matter—and why we have gone to considerable pains to have them carefully evaluated.”

Other arguments have been put forth to draw weaker links between standards and acceptance. For example, Skoog and Bilica explicitly mention the psychological effect the presence of evolution in the standards may have on members of the public (Skoog and Bilica 2002). Mead and Mates (2009a) argue that including evolution in science standards makes it more likely that teachers will cover it. In particular, they provide cover for teaching who want to include it, which gives them an extra tool for convincing parents and administrators that it should be included. Their argument rings with anecdotes from teachers who support evolution education. In my research, several teachers claimed that they were able to point to the standards in defense of teaching evolution. However, Plutzer and Berkman’s poll data and analysis compared teacher behavior regarding evolution instruction with state standards and found no relationship (Berkman and Plutzer 2010). It is possible, in other words, these teachers who want to teach evolution will find ways of doing so regardless of weak standards.

Thus we see that justifications for including evolution in science standards range from stressing the scientific significance of evolutionary theory to suggestions that standards lead to teaching, which lead to acceptance and public support. Regardless of the specific justifications given for including evolution in standards, however, it remains the attention of these advocates has had a substantial impact. As will be seen in Chapter 4, the authors of the Tennessee Science Framework were aware of the criticism that would come if evolution were omitted or downplayed in the document. Increased political attention to evolution education has resulted in a situation in which its inclusion indexes scientific literacy and being modern. At the same time, however, antievolution sentiment makes public support for evolution education by politicians and other political figures into a risky venture.

Creationism Then and Now

Looking back at this history of the origins of antievolution sentiments in the light of contemporary times, certain ironies emerge. First, opposition to evolution was fueled initially by scientific criticism of Darwin’s mechanism, which suffered from a lack of a viable theory of inheritance. Lay evolution critics could draw on these scientists for material in attacking evolution. Furthermore, physical evidence, like “missing links” between apes and humans, was still largely lacking at the time. In these regards, the claims of antievolutionists that evolution was a theory in crisis were not far-fetched in the first quarter of the 20th century. At the time, it was not altogether unreasonable to say that presenting evolution to students as fact was premature. Contrast this with the present, when most of the claims of these original antievolutionists continue to be asserted despite the fact that all such criticism has completely disappeared among scientists. Hominid fossils abound, representing a nearly continuous chain of human evolution since our ancestors split with chimpanzees around 6 million years ago. Since the discovery of DNA in the 1940s and the subsequent Modern Synthesis of genetics with Darwinian theory, issues with Darwin’s mechanism have disappeared. Furthermore, genetics serves as yet another line of evidence that substantiates evolutionary accounts. Whereas early antievolutionists were not far from mainstream science with their claims, today’s antievolutionists are forced to reassert long-discredited claims, ignore reams of evidence, and misrepresent questions over details of evolution as “gaps in the theory” (Branch, Scott and Rosenau 2010; NAS and IOM 2008).

Second, early antievolutionists mistakenly equated Darwinism with Social Darwinism, which they associated with immorality, calls for war, and justifications for ending social welfare programs. Bryan was particularly moved by such arguments, believing that Christians should oppose war and support the poor (Larson 1997; Numbers 2006). Today's antievolutionists use a variation of these claims, asserting that Darwin's ideas inspired Hitler and the Holocaust based on Hitler's own claims to have read *Origin of Species* (e.g. Johnson 1997b; Scott 2009). The criticism, of course, stems from the defensible argument that, if the principle of natural selection were allowed to guide public policy and were carried to its logical conclusions, it could be used to justify policies that seek to eliminate deleterious or undesirable genes from human populations, either directly (e.g. forced sterilizations or executions) or indirectly (e.g. eliminating food or medical aid for the poor). Indeed, many scientists in Britain, Germany and the United States were supportive or sympathetic to eugenics, which was based on such ideas, in the 1920s and 30s. For example, Cold Harbor Laboratories in New York State was founded as a eugenics research base, and eugenics was discussed positively in many of the most popular high school biology textbooks in the early 1920s, including Hunter's *Civic Biology*, allegedly used by John Scopes in the "Monkey" trial (Marks 2009; Shapiro 2008).

Nevertheless, scientists following World War II completely repudiated eugenics along with Social Darwinism (Marks 1996; Marks 2009). Whereas Bryan could point directly to Darwinian ideas being used to justify Social Darwinism, antievolutionists today must argue completely in historical context. The difference in situations is huge. In Bryan's day, it seemed to many observers that evolution leads inevitably to such policies. If this were true, it would serve as a reasonable argument against evolution education. However, in today's world, we see that evolution does not necessarily lead in this direction given that evolution has only become more accepted by the scientific community even while Social Darwinism, Eugenics and even Scientific Racism have been completely rejected. Ironically, today both anti-evolutionism and Social Darwinian policies (e.g. ending welfare programs, a hawkish attitude toward war) are associated mostly with the political Right. When anti-evolutionists of today make connections between Darwin and Hitler, it can only be made in the spirit of character assassination, with the implication that if Darwin caused the Holocaust, then why should we teach his ideas to children? Whereas the first argument is compelling, the second is based on a logical fallacy.

Third, the motivation for opposing evolution education was based on the belief that learning about evolution leads students to abandon their faith. Bryan used mostly anecdotal evidence to support this claim, and most of the anecdotal evidence came from students who felt that their faith had been attacked, though the fact that they were speaking to Bryan at all implies that they had recovered. Recognizing the value of claims backed up by science, Bryan relied extensively on the findings of psychologist James H. Leuba (Leuba 1916) that students increasingly abandoned their Christian faith as they progressed through college (15% in their freshmen year, 45% by the time they graduated) and that nearly half of faculty in sciences and social sciences were atheist or agnostic. Since the 1920s, a plethora of studies have been conducted revisiting whether educational attainment has a negative effect on religiosity. The results are mixed overall, with many studies reporting decreased belief in the Bible as literal truth, but also noting that church attendance is often highest among the most educated (Johnson 1997a; Sherkat 1998). McFarland and colleagues have noted that denominational background plays a major role in the effects of education on religiosity, with evangelical and black Protestants actually experiencing a positive relationship between educational attainment and religiosity (McFarland, Wright and Weakliem 2011). McFarland and colleagues explain

observed differences among Protestant traditions in terms of “network closure,” writing that evangelical communities tend to close off opportunities for members to be exposed to alternative ideas, and provide ways for members to reinforce faith when exposure takes place (McFarland, Wright and Weakliem 2011). Even if college education was eroding Christian faith in the 1920s, the problem appears to have been mitigated, as demonstrated in Chapter 7.

Conclusion: Evolutionism and Creationism as Frenemies

Even as antievolution strategies have morphed and persisted over the last century, so too have calls for teaching evolution. In fact, when the entirety of these developments is seen in historical context, it is difficult to miss the mutualistic relationship between them. As evolution is increasingly taught, antievolutionists move to restrict or undermine it, which in turn makes proponents of evolution education even more determined that it be taught. Through a review of the history of the conflict between advocates of teaching evolution and their creationist opponents, we see that the conflict cannot be understood as simply ideological. The respective positions and the parameters of the debate have emerged and been elaborated through interaction. Efforts to oppose evolution education have changed in the course of nearly a century from a crude and explicitly religious prohibition against evolution (obvious to students, parents and teachers) to a highly sophisticated, and rather unscrupulous, campaign to change public opinion, without more than the tiniest hint of religious motivation. This history is reflected in the uneasiness with which evangelicals subscribe to intelligent design. It does not identify the Christian God as the designer, and it accepts mainstream geologic timelines, so it falls short of a position of biblical inerrancy deemed necessary by most evangelicals.³⁰ Nevertheless, it is the best hope for anyone who believes evolution is a dangerous idea and that teaching it should be opposed. In many ways, the antievolution movement has evolved into a different species entirely, as unrecognizable by creationists as by most other people. Efforts to promote evolution in schools have backfired: rather than defeat creationism, they have caused it to evolve into a far more virulent form.

Meanwhile, the idea that evolution needs to be taught emerged slowly and only after prolonged interaction with efforts to stifle it. When Bryan’s antievolution crusade began after the First World War, many teachers and professors had begun teaching parts of Darwin’s theories, but doing so was assigned little importance or urgency. After the Butler Act and the Scopes Trial, more teachers took an interest in including it in their classrooms in defiance of the law, and were seen as a kind of folk hero for science. Eventually, as the science of evolution matured and demands for more science education escalated, biologists took more interest in how much evolution was taught. Made aware of a deficit in evolution education, these biologists began to promote its teaching more and more. Then, with the passage of new laws that would restrict time given to evolution, these proponents elaborated even more the arguments for including it. Eventually, as science standards were developed, proponents saw them as an answer to the long-running problem of people not believing in evolution. The contemporary situation is thus one in which a state’s reputation for being supportive of science and education became tied to the attention given by that state to evolution in their standards.

In the past, as today in Tennessee, there is a wide range of opinion on teaching evolution, and not everyone weighs in. Nevertheless, a relatively small community of people who have networking and organizational support, can have a lasting impact on public policy, as when

³⁰ <http://www.answersingenesis.org/articles/nab2/intelligent-design-movement-christian>

science-minded educators successfully got evolution included in high school biology standards in 1994, with an ever-strengthening centrality in the standards ever since. As we will see in Chapter 5, even a relatively small group of citizen opposed to evolution education can have an effect. For example, when a group of parents in Brentwood were organized into a phone and email campaign targeting administrators and members of the State Board of Education to protest the expansion of evolution coverage into lower grades in the 2009 Framework, it resulted in the substitution of the phrase "change over time" for "evolution," amidst other amendments that weakened the clarity of Standard 5's focus on evolutionary theory. We will examine the processes involved in the development of this Framework in Chapters 4 and 5. Before then, it is necessary to take a closer look at the lived experience of people in Tennessee at the time the research was conducted.

Post-script: Reclaiming Scopes

Even as the Scopes Trial was historicized, fictionalized and mythologized to the point that it came to stand-in for the triumph of evolution over creationism in schools, the sentiment that inspired the anti-evolution movement remained ingrained in the region throughout the 20th century. Considering modern day Dayton helps to make clear the complicated relationship members of the community have with the Scopes Trial, and the ways the Trial have continued to shape the town. Dayton is home to Bryan College, founded not many years after the Trial, and dedicated to promoting a Christian and Biblical worldview, including a biology department committed to young earth creationism. In addition, the courtyard of Rhea County Courthouse boasts a statue to William Jennings Bryan. There are no such landmarks honoring Clarence Darrow, head attorney for the Defense. The basement of the courthouse houses a museum for the trial, including historical photographs and memorabilia sold at the trial. The city's public library holds a kind of scrap book of articles published in local newspapers (mostly *Chattanooga Times Free Press*) about the trial, beginning in the 1970s and continuing until 1994. Bryan College also houses an archive of materials on the trial.

In recent years, the details surrounding the Scopes Trial have returned to the fore with the rise of a series of so-called "academic freedom" bills. For decades the Rhea County Courthouse has staged re-enactments of the trial held each year on the weekend falling closest to the anniversary of the trial. These reenactments were, for a while, based on actual court transcripts, though the historical society of Rhea County, who stages the reenactments have also used fictionalized accounts like *Inherit the Wind*. The annual reenactments in Dayton are accompanied by a kind of low-key festival in the lawn of the Rhea County Courthouse, site of the historical trial. This festival comprises multiple booths or tents hocking fair-style food—funnel cakes, hot dogs, fried kudzu, cider—as well as souvenirs like t-shirts and post cards.

When I visited in August 2010 on the evening of the re-enactment, it was raining. It was not, therefore, possible for me to infer how well attended the event generally is. I found four booths, three of which were already closed, and only a handful of people. However, the performance, held inside the old courthouse, had a fairly large audience of around 100 people. On this particular anniversary, I was able to witness the second season-running of a play on the Scopes Trial called "One Hot Summer," written by a local man named Mr. Curtis Lipps.

The play itself is held in the actual courtroom, on the upper level of the courthouse. It retold the story of the Scopes Trial in a way that both corrected some of the inaccuracies from *Inherit the Wind*, but also recast the roles of major players, essentially inverting the cultural imagining of the Trial. It tells the story of how men in Dayton conspired to bring a media circus

to the town in order to profit from the extra business. The entertainment value came partially from a sort of buffoon character who appeared to suffer from mental disabilities and who frequently misunderstood questions posed to him. However, the main thrust of entertainment came from the character of H. L. Mencken, depicted as a loud-mouthed, know-it-all, who was more interested in making the residents of Dayton look ignorant than in getting facts correct.

One scene in particular traded entirely in this currency. Mencken seeks after a backwoods preacher, presumably for the purpose of highlighting the kinds of ignorant things such a man would say. During the encounter between Mencken and the preacher, the latter repeatedly undermines Mencken's efforts by proving to be more educated than expected. For example, when Mencken asks him whether he can read, the preacher asks whether he needs someone to read English, Hebrew or Greek. The audience in attendance is audibly amused by this exchange, and the message is clear: the true ignoramus is Mencken and the other outside reporters he represents. There can be no mistaking how the performers, producers and much of the audience feel about the subject of evolution—opposition to it is perfectly reasonable, support for it is based in arrogance (against the good people of Rhea County and against God Himself).

John T. Scopes' extremely limited agency in the affair is highlighted (he is playing tennis when he is asked to be the Defendant and seems happy to go along with whatever the men have planned) until the final act when he is giving his closing words before the judge. At that point, Scopes gives his longest line in the performance about the importance of Academic Freedom. The significance of this telling is only really apparent in light of the newest efforts to undermine evolution education in the state. A so-called Academic Freedom bill was introduced in Tennessee legislature for several years before eventually being passed in 2012. The language of the law protected teachers who wished to present "scientific strengths and weaknesses" of certain "controversial" scientific theories, including biological evolution. In effect then, the law is something like an inverse of the Butler Act which punished teachers for teaching an idea they felt compelled by their duty to scientific truth to cover. The Academic Freedom law signals that "the shoe is on the other foot," so to speak. By invoking John T. Scopes' dedication to academic freedom, advocates of the law are able to suggest that the current restrictions on teachers to discuss creation science, Intelligent Design theory, or other supposed weaknesses of evolutionary theory are like the Butler Act, bullying conscientious teachers from doing what they think is best to educate the next generation.

After the final act, the cast members and the playwright are presented to the audience and thanked for the performance. As people begin to steam out of the courtroom, they hang around to answer questions. The actor who had played Mencken, a wiry man with dark brown hair and a moustache, was a most vociferous spokesman against the widespread inaccuracies perpetrated by *Inherit the Wind*. Listening to him talk to several people after the show, I learned he was a member of the local historical society. I stopped an older man identified as the playwright as he was leaving to learn about how and why he had written it. The man, Curtis Lipps, had lived in Dayton for most of his life. He was retired, but tried to stay active, and was especially interested in the history of the town. He told me that the historical society that puts on the annual re-enactment wanted to do something more entertaining than simply read the court transcripts, so he had volunteered to write a script. He told me that wrote the play in a single evening, being already, of course, familiar with the story.

Chapter 3: The Public Nature of Private Belief

The goal of this chapter is to rescue the conception of the evolution-creation conflict from a realm of ideas and pull it into a social realm, replete with identities, commitments, and relationships among people and things. This move is necessary to understand why the conflict exists at all. As the history presented in Chapter 2 demonstrated, it cannot be explained as an inevitable outcome of a clash of ideas. Furthermore, the controversy has, at least until recently, been restricted almost entirely to the United States. When I worked in Mexico, a nation every bit as “religious” as the U.S., I found myself several times in a situation in which I was explaining to someone why teaching evolution was controversial in the States. Apparent contradictions between the creation account in *Genesis* and the scientific account of evolution are not necessarily obvious to people. Even in this country, where most people are aware of the controversy, there are many Christians who insist that evolution and creation are compatible. Ultimately the conflict belongs to a particular social and political situation, which emerged in a very particular historical context, as described in the previous chapter.

Whereas chapter two focused on the historical events through which this controversy emerged over the course of the 20th Century, this chapter will focus on the quotidian phenomena associated with “beliefs” about evolution. The discourse on evolution and creation is obsessed with beliefs—of the public, of teachers, of students—and how those beliefs might change. There are many who explicitly do not want students to “believe in” or accept evolution, and thus possibly also abandon their belief in the truth of scripture. And there are those who want students to understand that the scientific evidence is strongly behind evolutionary theory, such that any reasonable person ought to accept it as true in all likelihood. In each case, the stakes of the debate are how people choose to *believe*.

This chapter is organized into four main sections. In the first section, I will explain how the conflict over teaching evolution has been principally understood throughout its history as fundamentally about beliefs, which is to say what people think in their minds about what is true. The second section will review the ways that anthropologists, going back to Tylor and Durkheim, have theorized about beliefs, particularly in religious contexts. For the most part, anthropological approaches have downplayed belief and focused instead on practices like religious rituals. Much more recent insights from anthropologists studying Christian communities have sought to develop new understandings of belief that focus on practice and experience rather than cognitive objects in people’s minds. In the third section, I will attempt to apply these insights as I present ethnographic notes on religious life in my field site in eastern Tennessee. Rather than simply and stably residing in people’s heads, where they would be difficult to access, I will show that beliefs are made manifest and public through a range of activities that include group prayer, Bible studies, praise and worship, and expressions of hostility to evolution. The fourth section of the chapter will be concerned with developing and explaining a theory of belief that is inconsistent with these ethnographic observations, over a century of insights from anthropology, and the thesis of the dissertation. It will be illustrated through my own personal experience interacting with self-identified creationists.

Evolution-Creation: Conflicts over Beliefs

As the reader may recall from the historical account, early opposition to teaching evolution stemmed from concerns over its effect on religious belief. In his 1922 *New York Times* article “God and Evolution,” Bryan rhetorically asks his readers, “Is it not more rational to

believe in creation of man by separate act of God than to believe in evolution without a particle of evidence?” (Bryan 1922). After ridiculing evolution in the first half of the article—as a mere guess, without evidentiary support and contrary to the creation account in the Bible—Bryan laments the almost mystical power of “Darwinism” to displace spiritual truth: “Evolution seems to close the heart of some to the plainest spiritual truths while it opens the mind to the wildest of guesses advanced in the name of science” (Bryan 1922). It is this power over belief, and not merely the falseness of evolution, that Bryan most forcefully decries: “The objection to Darwinism is that it is *harmful*, as well as groundless. It entirely changes one’s view of life and undermines faith in the Bible” (Bryan 1922: 1, italics in original). He then elaborates on how this occurs:

If a man accepts Darwinism, or evolution applied to man, and is consistent, he rejects the miracle and the supernatural as impossible. He commences with the first chapter of Genesis and blots out the Bible story of man’s creation, not because the evidence is insufficient, but because the miracle is inconsistent with evolution. If he is consistent, he will go through the Old Testament step by step and cut out all the miracles and all the supernatural. He will then take up the New Testament and cut out all the supernatural—the virgin birth of Christ, His miracles and His resurrection, leaving the Bible a story book without binding authority upon the conscience of man. (Bryan 1922:1)

Notably, the reason Bryan gives for Darwinism displacing Biblical belief is out of a pursuit for internal consistency, wherein various beliefs cannot contradict one another. Bryan admits that people’s beliefs are not necessarily consistent, a reality he compares to hypocrisy. In spite of this caveat, however, Bryan returns repeatedly to the “the effect of Darwinism” as though it is inevitable:

Evolution naturally leads to agnosticism and, if continued, finally to atheism. Those who teach Darwinism are undermining the faith of Christians; they are raising questions about the Bible as an authoritative source of truth; they are teaching materialistic views that rob the life of the young of spiritual values. (Bryan 1922: 11)

Bryan cites two forms of evidence for these “effects of Darwinism.” In a section titled “Darwin’s Agnosticism,” Bryan explains that as “a young man he [Darwin] *believed in* the Bible; just before his death he declared that he *did not believe* that there had ever been any revelation; that banished the Bible as the inspired Word of God and, with it, the Christ of whom the Bible tells” (Bryan 1922: 1, italics added). Based on this account, Bryan concludes:

This is Darwinism. This is Darwin’s own testimony against himself. If Darwinism could make an agnostic of Darwin, what is its effect likely to be upon students to whom Darwinism is taught at the very age when they are throwing off parental authority and becoming independent? (Bryan 1922: 1)

The other evidence he cites comes from a book by Professor Leuba, a psychologist at Bryn Mawr College, presenting findings from a study of American college students, scientists, professors and other Americans on their beliefs about God and immortality. That book reports a correlation between education level and unbelief in a personal God (Leuba 1916). Bryan mentions particularly statistics from that study that demonstrate disbelief in God increases steadily through college experience, from 15% among freshmen, to 45% among upper classmen (Bryan 1922). While this study does not credit evolution or Darwinism with the rise in disbelief, the connection is made vicariously by Bryan: college professors are teaching the students and these professors believe in evolution.

We see therefore that Bryan's concerns are all about beliefs, specifically the effect that Darwinism, itself a set of beliefs, has on the beliefs in the minds of young people. Ideas about evolution are portrayed to have a corrosive effect on belief in God and the authority of the Bible. These same concerns continue into the present day, reflecting a more general concern with "belief" within Protestant faith traditions in the U.S. As a recent example, Kevin Shrum, a Baptist minister in East Nashville, wrote an opinion piece for *The Tennessean* titled "Today, belief is a challenge." In the article, Shrum recalls a distant past during which it was "impossible not to believe" in a Judeo-Christian worldview, and contrasts it with the present, in which it is "nearly impossible to believe." At the heart of the shift, Shrum places "the publications of Nietzsche and Darwin suggesting a Godless, mechanistic world" (Shrum 2016: 11A)

Polls concerned about beliefs regarding evolution reveal a nearly fetishistic fixation. For example, the most recent report from a Gallup poll on evolution, presented under the title "In U.S., 42% Believe Creationist View of Human Origins," includes a graph showing how beliefs about evolution or creation have shifted over the last decade (Newport 2014). The results of such polls are discussed in new articles and blogs, indicating no small degree of significance. Such polls have a long history. Recall that Bryan cited a study from the 1910s that reported beliefs among college students, professors and scientists.

The obsession is shared not only by participants in the discourse and its public spectators, but also by science education researchers. In the earliest study I found on evolution teaching in Tennessee, the author reported results from a questionnaire conducted with students and teachers in the state regarding their beliefs (Fletcher 1976). The study was centrally concerned with beliefs, as is demonstrated in his "Summary and Conclusions" section, which summarizes the percentages of his sample who believe or do not believe in various things, including the point that "a majority (78.2%) of respondents believe that the Bible is a historically accurate document but are divided in opinion as to its scientific accuracy" (Fletcher 1976: 20). In an argument that is nearly the inverse of Bryan's claims about Darwinism from a half century earlier, Fletcher explains how certain religious beliefs can be a problem:

One of the most difficult problems which has faced mankind for many centuries has been the tendency to follow a thinking pattern which is teleological in nature, that is, to believe that all things including natural phenomena are determined by an over-all purpose in nature and all things are directed toward a definite purpose of end. The belief in a God-controlled universe is not the problem as much as the inflexibility in position taken by those who choose to determine what the purpose really is. When groups of individuals decide that they know what is right and refuse to allow any form of new evidence to be considered they will stubbornly defend their thinking at all costs. (Fletcher 1976: 6)

Just as Bryan charged that Darwinism destroys belief in a personal God, Fletcher sees belief in a personal God as closing people off to learning about and accepting evolution.

As an anthropologist, this obsession with beliefs presents an interesting, but ultimately useful challenge. In order to give an account of this situation it is essential to establish what it actually means to believe. Is belief a psychological state? Or is belief instead more like an allegiance to a position? Do beliefs follow rational arguments and evidence? Or do people formulate arguments and interpret evidence in order to support the reasonableness of their beliefs? Beginning with Durkheim, anthropologists have emphasized the study of rituals and religious activity rather than beliefs. By the 1970s, the very notion of belief was being rejected by most anthropologists of religion as being too imprecise and impossible to study empirically. Only in the last couple of decades has the emerging field of the anthropology of Christianity

confronted the nature of belief in light of its problems. In the next section, I will present this history of anthropological thinking in order to introduce the approach to belief that I ultimately adopted in this dissertation. This review serves two main purposes. First, it demonstrates the long precedent in anthropology to seek out the behavioral dimensions of religious belief. Second, it identifies important insights gleaned through this effort.

Anthropology of Belief

Just what does "belief" mean in a religious context? Of all the problems surrounding attempts to conduct anthropological analysis of religion this is the one that has perhaps been most troublesome and therefore the most often avoided, usually by relegating it to psychology, that raffish outcast discipline to which social anthropologists are forever consigning phenomena they are unable to deal with within the framework of a denatured Durkheimianism. But the problem will not go away, it is not "merely" psychological (nothing social is), and no anthropological theory of religion which fails to attack it is worthy of the name. (Geertz 1973b: 109)

Beliefs, particularly the relatively bizarre type of beliefs classified as "religious," have long held a central place in scholarly studies of religion. In the 19th Century the Myth and Ritual school examined beliefs, equated with myth, alongside rituals, and saw the two as intimately connected, reflections of one another, with some debate over which was primary (Bell 2009). Frazer, for example, catalogued myths from around the world, searching for common elements shared across diverse cultures as insights into the nature of religion (Frazer 1894). For Tylor, ritual was merely an expression of religious beliefs, and his definition of religion as belief in spiritual beings makes no mention of religious practices (Tylor 1958 [1872]). By contrast, Robertson Smith argued that rites were primary and more resilient to change over time. Though the debate between myth and ritual was never settled, early 20th Century theorists like Durkheim, Mauss, Radcliffe-Brown and Malinowski preferred to emphasize the latter (Bell 2009).

In his classic work on religion, Durkheim noted two basic categories of religious phenomena: beliefs and rites (Durkheim 2001 [1912]). The feature that distinguishes rites from other actions is their reference to religious beliefs, which are themselves defined by reference to a division between two mutually distinct classes: the sacred and the profane. In turn, rites fundamentally proscribe means of demarcating the sacred and of dividing the sacred from the profane:

Sacred things are those things protected and isolated by prohibitions; profane things are those things to which such prohibitions apply and which must keep their distance from what is sacred. Religious beliefs are representations that express the nature of sacred things and the relations they sustain among themselves or with profane things. Finally, rites are rules of conduct that prescribe how man must conduct himself with sacred things. (2001: 40)

Though Durkheim includes both beliefs and practices in his definition of religion, he clearly regards the latter more important than the former. After all, the distinction made between sacred and profane is not simply a conceptual one, but instead a classificatory *act*, carried out through behavior, by the way that places, things, people, texts, etc. are *treated*. Furthermore, Durkheim dedicated most of the book to deconstructing various aspects of rituals practiced among Australian aboriginal groups.

In the concluding chapter of his book, Durkheim summarizes his central thesis, that religious experience is an experience of collective effervescence, the sensation of being part of

something larger than the individual self (Durkheim 2001). In summarizing this point, he directly criticizes the tendency among most religious scholars at the time to privilege belief over action in studies of religion. He supports this criticism with two arguments. First, for religious believers, the most important thing about their religion is not the knowledge it provides but rather its transformative effects on their lives. Religion does not explain, but rather tells people how to act, how to live. Second, a belief is a part of an individual and could not therefore elevate the individual beyond himself. In other words, religion has a real effect on people, so the source of its effects could not be beliefs. Its effects come from society:

The first article in every creed is the belief in salvation by faith. But it is hard to see how a mere idea could have this efficacy. An idea is in reality only a part of ourselves; then how could it confer upon us powers superior to those which we have of our own nature? [...] From the mere fact that we consider an object worthy of being loved and sought after, it does not follow that we feel ourselves stronger afterwards; it is also necessary that this object set free energies superior to these which we ordinarily have at our command and also that we have some means of making these enter into us and unite themselves to our interior lives. Now for that, it is not enough that we think of them; it is also indispensable that we place ourselves within their sphere of action, and that we set ourselves where we may best feel their influence; in a word, it is necessary that we act, and that we repeat the acts thus necessary every time we feel the need of renewing their effects. From this point of view, it is readily seen how that group of regularly repeated acts which form the cult get their importance. (Durkheim 2001: 313)

In summary, beliefs, as privately held ideas, are without staying power. Religious experience and the maintenance of religion over time depend on practice.

This sentiment, privileging the social act over private belief, was carried into British social anthropology by Radcliffe-Brown, who is credited with founding the structural functionalist school, which dominated the field for nearly half a century. In his Henry Meyers Lecture on “Religion and Society,” for example, Radcliffe-Brown outlines an approach to religion that he directly traces to Durkheim, alongside the Old Testament scholar and professor of divinity William Robertson-Smith and the French Catholic theologian Alfred Loisy. He contrasts this approach with an earlier, evolutionist approach to studying religion:

...there is a tendency to treat belief as primary: rites are considered as the results of beliefs. They [Anthropologists] therefore concentrate their attention on trying to explain the beliefs by hypotheses as to how they may have been formed and adopted. [...] If we must talk in terms of cause and effect, I would rather hold the view that the belief in a surviving soul is not the cause but the effect of the rites. Actually the cause-effect analysis is misleading. What really happens is that the rites and the justifying or rationalizing beliefs develop together as parts of a coherent whole. But in this development it is action or the need of action that controls or determines belief rather than the other way about. (Radcliffe-Brown 1945: 34)

The approach he advocates is reflective of the central concerns of structural functionalism: to locate the “meaning” of various institutions in their social effects or functions. Regarding rituals, Radcliffe-Brown said that their social function was “obvious,” specifically, by solemnly expressing certain sentiments, “the rites reaffirm, renew and strengthen those sentiments on which the social solidarity depends” (Radcliffe-Brown 1945: 38). Not surprisingly, these ideas ran throughout Radcliffe-Brown’s scholarship, appearing as early as his 1922 publication of *Andaman Islanders*, itself written in 1906. In a later chapter of that

ethnography, the young Radcliffe-Brown demonstrates his approach through an examination of several Andaman rituals. While discussing a series of rituals involving fire and hibiscus, he explains the importance of religious practice, as well as why beliefs could not be maintained without such practice:

The social value of a thing (such as fire) is a matter of immediate experience to every member of the society, but the individual does not of necessity consciously and directly realise that value. He is made to realise it indirectly through the belief, impressed upon him by tradition, that the thing in question affords protection against danger. A belief or sentiment which finds regular outlet in action is a very different thing from a belief which rarely or never influences conduct. Thus, though the Andaman Islander might have a vague realisation of the value of *Hibiscus*, for example, that would be something very different from the result on the mind of the individual of the regular use of the leaves of that tree in initiation ceremonies as a protection against unseen dangers. So that the protective uses of such things are really rites or ceremonies by means of which the individual is made to realise (1) his own dependence on the society and its possessions, and (2) the social value of the things in question. (Radcliffe-Brown 1922: 264)

Note that Radcliffe-Brown contrasts beliefs rooted in action from those that are not. The latter is "vague," whereas the former is explicit. An individual may hold a private belief, in Radcliffe-Brown's conception, but such a belief lacks power or social importance.

Contemporary to Radcliffe-Brown, another version of functionalism was developed by Malinowski, which demurred somewhat from the Durkheimian focus on society. Whereas Radcliffe-Brown primarily sought to understand institutions with reference to how they helped to maintain social structures, Malinowski sought for explanations much more in terms of how various institutions met the psychological needs of the individuals participating in them³¹. In the clearest example of this approach, Malinowski theorized that people resort to magical rites in situations in which they cannot rely entirely on their skills and knowledge, when forces beyond their control largely determine the outcomes. In these situations, people perform magical rituals in order to allay their anxieties in the face of the uncertainties. Given this attention to individual minds, it is interesting to examine Malinowski's ideas on beliefs.

Whereas many American anthropologists at the time (e.g. Kluckhohn 1942)³² conceptualized myth as basically synonymous with belief, Malinowski had in mind a more nuanced relationship in his classic treatise on myth (Malinowski 1954 [1926]). Malinowski is explicit about the relationships between myth and belief, myth and ritual, and ritual and belief. Ritual is based in belief; myth supports belief, and ritual supports myth, myth being seen as the source of the ritual. There is no linear, causal relationship; the three are mutually reinforcing:

There is no important magic, no ceremony, no ritual without belief; and the belief is spun out into accounts of concrete precedent. The union is very intimate, for myth is not only

³¹ The distinction between the approaches of Radcliffe-Brown and Malinowski is often exaggerated. Radcliffe-Brown agreed that anthropologists ought to pay attention both to the effects of certain institutions on individuals and on society as a whole (Radcliffe-Brown 1945: 40). Likewise, Malinowski's analysis of the Kula Ring included its larger effects on Trobriand society, and not only its effects on individuals. Thus the contrast here reflects the primary interest of these theorists rather than the totality of their scholarship.

³² American anthropologists at the time remained in the myth-ritual vein throughout much of the early 20th Century, observing a connection between myth and ritual, but disagreeing over the nature of that relationship. When Kluckhohn attempted to advance the discipline in a paper from 1942, he basically adopted a functionalist theory most similar to Malinowski's theory of magic to allay anxiety, but extended to myth and rituals more generally.

looked upon as a commentary of additional information, but it is a warrant, a charter, and often even a practical guide to the activities with which it is connected. On the other hand the rituals, ceremonies, customs, and social organization contain at times direct references to myth, and they are regarded as the results of mythical event. The cultural fact is a monument in which the myth is embodied; while the myth is believed to be the real cause which has brought about the moral rule, the social grouping, the rite, or the custom. (Malinowski 1954: 29)

Notably, Malinowski does not say that myth is belief, but rather that myths express, enhance and codify beliefs. The distinction is actually quite important in light of his larger argument regarding myths, and it foreshadows an approach to belief I will adopt in this research:

Studied alive, myth, as we shall see, is not symbolic, but a direct expression of its subject matter; it is not an explanation in satisfaction of a scientific interest, but a narrative resurrection of a primeval reality, told in satisfaction of deep religious wants, moral cravings, social submissions, assertions, even practical requirements. Myth fulfills in primitive culture an indispensable function: it *expresses, enhances, and codifies belief*; it safeguards and enforces morality; it vouches for the efficiency of ritual and contains practical rules for the guidance of man. Myth is thus a vital ingredient of human civilization; it is not an idle tale, but a hard-worked active force; it is not an intellectual explanation or an artistic imagery, but a pragmatic charter of primitive faith and moral wisdom. (Malinowski 1954: 19, italics added)

Malinowski argued that myths should not be rendered as "mummified priestly wisdom," but are instead "alive." By these terms, Malinowski meant to criticize the notion of recording myths in books and then studying them as texts, saying that:

...this point of view would be fatal to efficient field work, for it would make the observer satisfied with the mere writing down of narratives. The intellectual nature of a story is exhausted with its text, but the functional, cultural, and pragmatic aspect of any native tale is manifested as much in its enactment, embodiment, and contextual relations as in the text. It is easier to write down the story than to observe the diffuse, complex ways in which it enters into life, or to study its function by the observation of the vast social and cultural realities into which it enters. And this is the reason why we have so many texts and why we know so little about the very nature of myth. (Malinowski 1954: 34)

According to Malinowski, the textual content of a recorded myth is inadequate. The text may be an expression of a belief, but that belief is hollow outside of the social context in which the myth is told. Following Malinowski's point, internal, propositional beliefs are not nearly as important as the ways those beliefs are actually proposed. Any number of myths, in a variety of forms may well be present in the minds of his "natives," but Malinowski has the brilliance to ask why *this* individual told *that* particular version of the myth at *this* specific time? His answer, generally stated is that the myth is invoked as a "social charter," used to justify, not to explain but rather to explain away (Malinowski 1954). Crucially, myth is neither belief nor a collection of ideas, but is instead a practice, most relevant when it is being *performed*. Like Durkheim and Radcliffe-Brown, Malinowski ultimately emphasized the practice of telling a myth or expressing a belief as being more powerful, and sociologically relevant, than beliefs that exist in private minds.

The emphasis of anthropology on practice rather than internal belief is demonstrated again with the theoretical innovations and divisions that began to emerge after World War II. With the changes that accompanied struggles for colonial independence and the rise of new

nationalisms throughout the former colonies, anthropologists increasingly criticized the ahistorical functionalist approach that dominated the first half of the century. This is seen clearly in the Manchester school, represented typically by Max Gluckman and other anthropologists working in post-War Africa (Eriksen and Nielsen 2001), though it was felt on both sides of the Atlantic. For example, Clifford Geertz, only a year after earning his doctorate, wrote an article published in *American Anthropologist* that noted the inability of functionalism to account for crises of efficacy in which old institutions no longer accomplish their old functions (Geertz 1957):

...the tendency has been consistently to stress the harmonizing, integrating, and psychologically supportive aspects of religious patterns rather than the disruptive, disintegrative, and psychologically disturbing aspects; to demonstrate the manner in which religion preserves social and psychological structure rather than the manner in which it destroys or transforms it. (32)

Given these criticisms, a plethora of new theoretical schools arose in the 1950s and 60s, which are retroactively broadly categorized into two groups: materialist (notably the neo-evolutionism of White and Steward, the cultural materialism of Harris, and the biological determinism of Wilson's sociobiology) and idealist (including Lévi-Strauss' structuralism, the symbolic and interpretivist approaches of Turner, Douglas, and Geertz, as well as ethnoscience). Despite their respective foci—material vs. ideational—neither of these two broad groups turned attention toward beliefs. Given their overarching focus on seeking out explanations for social and cultural forms in terms of environmental, biological or economic causes, the materialist theorists tended to dismiss ideological explanations, which might be related to beliefs, as mere surface-features of deeper phenomena. Thus these scholars were content to continue to ignore or downplay beliefs in favor of more measurable, behavioral aspects of the institutions they studied, albeit more blatantly than their forebears.

It is much more surprising that, while the theories in the second group were explicitly focused on ideas and meanings, they were not necessarily focused on the beliefs among those they studied. Each of these three schools of thought was oriented differently to the question of belief. Lévi-Strauss' structuralism directed analysis toward myth and cultural categories, searching for underlying patterns that might offer clues as to the structure of human minds. Regardless of his generalized statements, Lévi-Strauss' actual approach, contrary to Malinowski's recommendations, analyzed myths as texts, which could be mapped out and broken into binary elements (cf. Lévi-Strauss 1955). In "Harelips and Twins: the splitting of a myth," for example, Lévi-Strauss spoke of multiple versions of certain myths which he compared across multiple groups spread throughout the Americas, but did not take into account the social contexts under which they were collected, nor by whom they were told (Lévi-Strauss 1979). His interest was not in whether, how or why anyone *believed* these myths, but rather in what their structural elements revealed.

Ethnoscience, from which would eventually spring cognitive anthropology, arose during the early 1960s in response to growing awareness of and concerns over the tendency of anthropologists to impose Western concepts on other cultures. From its beginning, the approach was centrally interested in human psychology, and particularly the ways that humans in different cultures conceived and perceived their worlds in terms of their own native concepts and categories (Sturtevant 1964). It was impossible, according to advocates of ethnoscience, to understand them using only the concepts of Western anthropology. As a corrective to this tendency, scholars who took up the banner of ethnoscience sought systematic methods by which

to elicit and document the ways that their subjects thought and believed. They drew on cognitive psychology, itself still in its infancy, as well as on structural linguistics for this purpose (Sturtevant 1964).

Under ethnoscience and cognitive anthropology, for the first time since Tylor we have an anthropological approach with a central interest in beliefs. One advantage to such an approach is that it was finally possible to take seriously what people are thinking about when they engage in religious behavior. Over the next several decades, new cognitive theories of religion would be developed that considered a possibility that had previously been ignored (Atran 2002; Boyer 2001; Guthrie 1980). What if the purpose of ritual was not to communicate to oneself or to the larger community? What if people were actually conducting the rituals for the reasons they themselves claimed—to communicate with the gods and spirits that they believed to be around them? That spirits might be interlocutors seems like an obvious notion, and yet it has critical implications for the relationship between beliefs and practices. I will revisit this idea later in this chapter, but for now it is sufficient merely to consider that the “social” or “public” aspects of practice and belief are greatly enlarged when a host of additional persons are added to the landscape. Actions performed without any other humans present may be observed by spirits. When deities are invisible, all-knowing or even capable of reading your thoughts, then there is no longer a private realm at all.

Despite its promises, the story of the cognitive approach is nevertheless consistent with the overall tendency of the field, albeit as a negative example. From the beginning ethnoscience and cognitive anthropology were met with criticism from other anthropologists. This criticism was practically invited by the scholars. In making their methods and analysis explicit, indeed by affirming that their claims were dependent on those methods, the limitations of their methods were obvious, in contrast to the “old ethnography,” which hung its claims on the authority of the ethnographer. Beset on all sides, ethnoscience, the “new ethnography,” eventually disintegrated. Some of the earlier advocates, such as Steven Tyler, eventually adopted a more post-modern stance resigned to the unknowability of other people. In the end, the weakness of the approach was not located in its attention to psychology, but *exclusive* attention to it. In this way, then, the approach was the exception that proved the rule. By reversing the long-standing tendency in anthropology to privilege practice over belief, cognitive anthropology failed to employ the insights gained by their anthropological forebears. By attributing causal power to these internal phenomena—thought processes, mental models, categories, concepts, beliefs, etc.—they effectively fetishized them, and in so doing lost track of the social aspects of human life and experience.

The last of the theoretical schools to emerge during this time period was symbolic anthropology, centered around two paragons of the approach—Victor Turner and Clifford Geertz. Though symbolic anthropology makes reference to an ideational realm concerned with meaning and interpretation, its focus of analysis is public ritual. In the opening chapter of *The Forest of Symbols*, Turner defines ritual as “prescribed behavior for occasions not given over to technological routine, *having reference to beliefs in mystical beings or powers*” (Turner 1967: 19), echoing Durkheim’s definition of ritual. Immediately after his definition, Turner claims that rituals can be broken down into smaller units, the smallest of which is the symbol. He then defines a symbol as “a thing regarded by general consent as naturally typifying or representing or recalling something by possession of analogous qualities or by association in fact or thought” (1967: 19). The principal concern he evinces thereafter is the interpretation of these symbols.

It is tempting to read Turner's approach as being essentially about discovering the beliefs to which rituals refer. He does not discuss the point further, and the proximity of the discussion of symbols and the importance Turner assigns them may suggest such a reading. After all, the excerpt from Turner just presented seems to invite a parallel between rituals, which reference beliefs, and symbols, which reference "something." Furthermore, given that rituals are themselves made up of symbols, logic suggests that symbols are, in some way, referring either to beliefs or to the subunits of belief.

There is some support for the idea that Turner's ritual symbols refer to or express beliefs. After noting some etymological connections between the Ndembu term for "symbol" and a verb that means "to make visible, to reveal," Turner remarks, "One aspect of the process of ritual symbolization among the Ndembu is, therefore, to make visible, audible, and tangible beliefs, ideas, values, sentiments, and psychological dispositions that cannot directly be perceived" (1967: 50). However, it becomes clear throughout the text that Turner is not proposing a straightforward relationship in which rituals simply express beliefs. Following up on this last passage, Turner reflects his functionalist roots, noting that, "By exposing their ill-feeling in a ritual context to beneficial ritual forces, individuals are purged of rebellious wishes and emotions and willingly conform once more to the public mores" (50). While potentially dangerous feelings or beliefs may be expressed through ritual, this is only one aspect of certain rituals, and does not constitute a more general theory.

In the end, such a reading of Turner, wherein ritual simply expresses belief, is simply not borne out. First, his discussion of tracing the meaning of these symbols reveals it to be something extra-individual, manifest throughout the social system and yet not necessarily manifest in the thoughts or speech of specific individuals. Turner outlines three kinds of data useful for inferring the properties or meanings of ritual symbols: "1) observable form and external characteristics, 2) interpretations offered by specialists and by laymen, 3) significant contexts largely worked out by the anthropologist" (1967: 20). These three forms of data, or sources of meaning may be more concisely stated as 1) the symbol itself, 2) what people say about it, and 3) how they act around it. According to Turner, none of these sources reveals the meaning of the symbol on its own. Indeed, the implication that the meanings of rituals exist somewhat independently of the individuals who participate in them, and the insinuation that they may in fact only be discoverable by a sharp-eyed anthropologist such as Turner, has prompted some scholars to ask for whom the ritual symbols are performed when no anthropologist is present (Bell 2009; Sperber 1975).

Second, Turner refers later in the book to specific "beliefs" which are not presented as interpretations, but actually as symbols in and of themselves. For example, after listing several beliefs connected to one ritual, including "the belief that a novice would go mad if she saw the milk tree on the day of her separation ritual," Turner says, "...all of these *are items of symbolic behavior* for which the Ndembu themselves can give no satisfactory interpretation" (1967: 33, italics mine). Contrary to his original definition of ritual, and in stark contrast to the notion that rituals can be interpreted as expressions of belief, as the myth-ritualists sometimes claimed, Turner is suggesting that a statement of belief is itself a kind of symbolic behavior that requires its own interpretation. This approach, as we will see, foreshadows more recent approaches.

Despite being primarily and explicitly about ideas and meanings, Turner's symbolic approach directs attention entirely at ritual behavior and physical symbols, in an effort to uncover their referents. While these referents are framed as ideas, they are demonstrably not beliefs. In contrast to the myth-ritualists before him, Turner was not especially interested in

explaining the relationship between rituals and particular religious beliefs. Instead, he was interested in discussing the ways these rituals (as well as beliefs) reflected and expressed social structure and tensions, as well as their function in alleviating those tensions. His theory of ritual, thus is ultimately functionalist.

Turner and Geertz tend to be grouped together under the heading “symbolic and interpretive anthropology,” though the latter assigned far more weight to what was going on in the heads of his informants than the former. Unlike Turner, for whom the meaning of ritual existed at a level beyond the grasp of most participants, Geertz is interested both in how individuals think about the world [worldview] and the effects of those ways of thinking on their moods and motivation [ethos], all of which are (at least partially) psychological phenomena. Geertz was the first anthropologist since Tylor to develop a theory of religion that included a prominent role for belief, and represents the clearest effort to achieve a balance between belief and practice. His definition of religion is well-known:

...a system of symbols which acts to establish powerful, pervasive, and long-lasting moods and motivations [ethos] in men by formulating conceptions of a general order of existence [worldview] and clothing these conceptions with such an aura of factuality that the moods and motivations seem uniquely realistic. (Geertz 1973b: 90)

Notably, Geertz says nothing about the specific content of religious beliefs, disavowing Tylor's spiritual beings and even Durkheim's sacred / profane distinction. As a result, the definition includes cultural systems not normally considered to be religious, such as science and political ideology (e.g. Asad 1983). Geertz presents the phenomenon as one in which worldview and ethos, beliefs and practices, swirl around and reinforce one another. According to Geertz, humans convince themselves that religious ideas are factual by observing and taking part in rituals, which reify those ideas. At the same time, they conduct these rituals because it makes sense to do so according to the worldview (Geertz 1973b).

Yet the most interesting part of his theory for this discussion is not this circular account of beliefs and rituals, itself foreshadowed already in the writings of Radcliffe-Brown. It is instead his discussion of how people confront a reality that seems to contradict their understanding. Discussing the appearance of a toadstool at his Javanese field site, which grew five times faster than an ordinary toadstool, Geertz explains the bafflement it evoked of his interlocutors:

It threatened their most general ability to understand the world, raised the uncomfortable question of whether the beliefs which they held about nature were workable, the standards of truth they used valid. (Geertz 1973: 101)

Contrasting his point with that of Tylor, Geertz claims that people are not compelled to use their beliefs to explain things, but instead “to convince themselves that the phenomena were explainable within the accepted scheme of things” (Geertz 1973: 101). This desire for a sensible order is in play not merely for baffling physical phenomena, but also for the experience of suffering and moral injustice (Geertz 1973). Each of these phenomena threatens our conceptions of order and coherence, ways of thinking and being in the world. In this way, Geertz foreshadows a comment made by Rosaldo more than a decade later: “For Calvinists and Ilongots alike, the problem of meaning resides in practice, not theory. The dilemma for both groups involves the practical matter of how to live with one’s beliefs, rather than the logical puzzlement produced by abstruse doctrine” (Rosaldo 1993).

The central assumption of symbolic anthropology—that rituals or culture can be broken into symbolic elements and interpreted for an underlying meaning—has been seriously questioned. Bell, for example, characterized these symbolic accounts as relating the actions of

ritual actors to the thoughts of anthropologists, who use the actions as a means of developing and illustrating their own interpretations of the society or culture they are studying (Bell 2009). In *Rethinking Symbolism* (1975), Sperber strongly criticized Turner's efforts to decode ritual, suggesting that his exegesis would be alien to most of the actual participants in these rituals, even by Turner's own omission. Sperber pays particular attention to the atypicality of Mushona, Turner's key informant among the Ndembu:

We would be mistaken in imagining that Mushona was content purely and simply to transmit a body of knowledge that he himself had received [...] Mushona is a marginal in his own society. His interest in the exegesis of symbols extends far beyond that of other Ndembu, just as Turner's interest in this area far exceeds that of his colleagues. From their encounter emerged a body of work on symbolism of an exceptional richness.

(Sperber 1975: 19)

Sperber's ironic prose here is meant to emphasize a disconnect between the "meaning" Turner produces and the participants' own experience of these rituals activities. Citing examples wherein ritual participants have either no interpretation or vastly variable interpretations of rituals, even while having extensive knowledge and agreement about *how* rituals must be performed, Bell and Sperber ultimately argue that ritual and belief are only tangentially related. Sperber goes on to argue that rituals are a red herring for anthropological understanding, and proposes a cognitive approach instead (Sperber 1975; Sperber 1985). In contrast, Bell seems to take the tendency of anthropological thinking about religion to its logical destination when she concludes that studies of ritualized behaviors ought to focus on the social activities themselves rather than focus on beliefs (Bell 1997; Bell 2009).

To summarize the development of anthropological thinking about belief, it began with Durkheim's acknowledgement that beliefs are part of religion while simultaneously turning his attention to religious practice, specifically ritual. Based on this focus, anthropologists ever afterward have arrived at crucial insights regarding belief. Radcliffe-Brown continued to focus on practice, justified further with his point that the relevance of beliefs is directly tied to whether they are manifested through action. Because beliefs are maintained through practices that reference them, privately held beliefs are not merely irrelevant to the anthropologist, but are unlikely to be taken seriously even by those individuals who entertain them. Whereas most scholars at the time were treating myth as basically analogous to belief, Malinowski argued for an examination of myth as itself a kind of activity. Myths are not mere texts (nor collections of propositions); instead myths are told, performed and invoked. The social contexts in which they are evoked, and the *ways* they are told reflect those contexts. An echo of this idea comes through in Turner when he notes that statements of beliefs are themselves symbols that can be interpreted. Finally, Geertz introduces the idea that beliefs are something that people live with, not merely a part of some abstract realm, but rather a part of daily life, of ways of understanding the world constantly buffeted by their actual experience of the world. These collected insights, amassed for over half a century constitute an approach to belief that is inherently practical. The pieces were present for a new examination of beliefs, and yet the full realization of this approach to belief did not occur. Instead, the field took a hard turn against belief entirely.

The Problem(s) of Belief

Beginning in the 1970s, the status of "belief" among anthropologists, philosophers and other scholars of religion became endangered. The earliest comprehensive critique of belief comes from Rodney Needham, whose *Belief, Language and Experience* (1973) recommended the abandonment of the concept entirely from academic study. Following Needham, a number of

authors have referred to a “problem of belief.” The problems described tend to differ from one author to the next, though all are related. Most of them coalesce around the inherent unknowability of beliefs as internal phenomena, but focus on different aspects—semantic, epistemological and phenomenological. I will discuss each of these aspects below.

Needham’s primary criticism of belief was semantic, aimed at its imprecise and shifting meanings, which undermines a presumed natural/universal category it is often assumed to be (Needham 1972). He points out, for example, that the term “belief” is difficult to translate into most languages. After a lengthy discussion of the difficulty of translating “belief” into Nuer, he presents a nearly exhaustive list of examples from indigenous languages across the globe, where belief is associated in meaning with words like “to obey” and “to trust” and other such words. Needham goes on to examine the semantic history of “believe” in Germanic languages such as English, demonstrating again how its meanings have shifted.

In a similar argument, Ruel traces the history of the concept of belief in the West. He begins by examining its cognate in the Hebrew language, as found in the Old Testament, followed by its cognate in Greek, as found in the New Testament, and then its shifting meaning in English throughout the Protestant Reformation and down to the present (Ruel 2008). His exposition suggests that anthropologists and other scholars of religion have focused excessively on beliefs due to an unwarranted and ethnocentric assumption. Given the specificity of this history, it is possible, if not likely that “belief” is a concept highly specific to modern, Western, Protestant societies (Ruel 2008). Accordingly, Ruel warns that anthropologists should not assume its central importance in non-Western societies.

As Needham also points out, many notable philosophers, from Hume to Wittgenstein have expressed puzzlement over the nature of beliefs (Needham 1972). Even in the context of modern English, several meanings of “belief” exist, contributing to more confusion. One meaning of “believe” is to contrast it with “know” and introduce a subjunctive phrase indicating doubt about a given proposition. For example, if I say that I believe I left my keys on the table, then I am allowing for the possibility that I am wrong. Whereas if I say that I know that I left them on the table, I am indicating certainty that the keys are there. However, references to beliefs found in traditional ethnographies usually meant something else. When Evans-Pritchard said that the Azande believe that some people are witches and can harm others through a special internal organ (Evans-Pritchard 1976 [1937]), he did not mean to suggest that his informants expressed some doubt that witches actually exist, but that he *himself* was certain that they do not. Thus one may use the term “believe” in order to cast doubt on a proposition held as true by others³³. Finally, I may also use “believe” not to cast any doubt at all, but merely to acknowledge that, while there are people who may disagree, I myself have a great deal of certainty of its truth, or that I have a great deal of trust in the authority that espouses it. When I say that I believe in evolution or climate change, or when I say, “I believe you,” I am not trying to suggest doubt but instead to dispel it. The potential for confusion has even prompted many advocates of teaching evolution to recommend that teachers avoid saying that they “believe in evolution,” since it suggests equivocation on the facticity of evolution. Instead, according to this line of reasoning, people should say that they “accept” the scientific evidence for evolution.

The second prong of Needham’s critique of belief was the impossibility of empirically establishing whether a person, or worse a group of people, really believe something in the strong sense of regarding that thing as being true. As internal phenomena, beliefs are inaccessible to

³³ In this sense, the use of the term “belief” could even be considered political, in that it casts doubt on competing claims to truth.

others. Thus, even if it could be agreed that other people have a word that can be accurately translated as “belief” as we currently understand it, then it would still be impossible to know whether their experience of believing was analogous to our own (Needham 1972). This aspect of the problem of belief has been echoed by various authors (Bell 2009; Rappaport 1999; Sperber 1975). For example, Sperber’s epidemiological approach, discussed in chapter 1, recognizes two kinds of representations—public and mental. Beliefs are considered by Sperber to be a kind of mental representations, which cannot be observed or known unless first transfigured into public representations, such as belief statements. Belief statements may be considered among the least ambiguous public action contrived to express and communicate one’s beliefs (Sperber 1996). However, belief statements are not the same as beliefs. First, statements can be recorded, lending the appearance of stasis, whereas beliefs are as ephemeral as any thought. Second, statements may intentionally or unintentionally misrepresent beliefs. It is therefore problematic to make claims about what others believe. At best, according to Needham and others, we can say what someone claims to believe, but not that they believe it (Needham 1972).

Rappaport has noted that the inaccessibility of internal belief is a problem not only for social researchers, but for people more generally (Rappaport 1999). Due to the internal nature of belief, no one can ever be certain what other people actually believe. Rappaport proposed, as a solution, that attention ought to be given to what he called “acceptance” rather than belief itself. Whereas belief is internal and unknowable, acceptance is demonstrated publicly through participation in rituals. In fact, according to Rappaport, the main purpose of ritual is to display to others that the participants accept certain obligations and commitments. According to Rappaport, performing rituals:

...logically entails the establishment of convention, the sealing of social contract, the construction of the integrated conventional orders we shall call Logoi...the investment of whatever it encodes with morality, the construction of time and eternity; the representation of a paradigm of creation, the generation of the concept of the sacred and the sanctification of conventional order, the generation of theories of the occult, the evocation of numinous experience, the awareness of the divine, the grasp of the holy, and the construction of orders of meaning transcending the semantic. (1999: 27)

For Rappaport, this act of acceptance is the basis of morality. By contrast, belief is mostly irrelevant in a social context (1999).

The final aspect of the problem posed by belief stems from the anthropologist’s own beliefs. In line with the meaning of “believe” outlined above, anthropologists tend not to believe in those things they label “beliefs” in their subjects. Indeed, in many cases, it is the very fact that a subject believes something the ethnographer finds strange that attracts his attention in the first place (Sperber 1975). The difference between what ethnographers and their subjects regard as true constitutes an impermeable barrier to truly understanding. As Engelke observed, ethnographers are eager to avoid the “embarrassing possibility” that the people they are studying could have anything to say about the ethnographer’s reality (Engelke 2002). The ethnographer always remains, necessarily, outside of subjects’ heads, able to imagine but never experience their world nor fully take it seriously. Notably, this point has been made by Brian Howell, an evangelical Christian anthropologist who studies Christian communities (Howell 2007). Howell argues that he actually has a unique perspective on Christianity, which allows him to study Christian groups in a way that an atheist or agnostic ethnographer would not. Specifically, he

holds the same beliefs as they, which allows him to bridge the divide between ethnographer and ethnographed in a way not possible by others³⁴.

Given the problematic status of belief in anthropology, alongside the centrality of “belief” to evangelical discourse and the evolution-creation debate, I find myself in agreement with Kirsch who observed, “In general nowadays, it seems problematic for anthropologists to work with the notion of “belief,” although it is equally difficult to work without it” (Kirsch 2004). The solution taken by many anthropologists, as we have seen, is to look at the behavioral manifestations of belief (Bell 2009). Rappaport’s focus on “acceptance,” as a socially observable phenomenon whereby actions performed (and witnessed) in public spaces signaled particular obligations to others (1999) could be seen in this light. Along similar lines, Day talks about “performative belief,” referring to the observation that people will proclaim different beliefs in different contexts, throwing into doubt the notion that stable beliefs exist in the mind (Day 2010). For Day, beliefs only exist as pronouncements in particular contexts, an understanding that is evocative of Malinowski’s theory of myth. Independently of what propositions people actually entertain, they may assert particular beliefs to index a particular identity or for some other social effect.

Downplaying the centrality of beliefs in favor of social practices has paid demonstrable dividends in elucidating certain practices, especially those that appear on the surface to be all about belief. For example, Bielo studied a men’s Bible study group in a Lutheran church in Michigan, noting that group bible study participants routinely failed to arrive at a consensus on the meaning of the texts under study (Bielo 2008). Through examples of actual discourse among the participants regarding the meaning of particular texts, Bielo is able to contrast their failure to resolve the meaning of those texts from their establishment of a distinct identity as Lutherans and their beliefs about the scripture itself. Bielo even proposes that the ambiguity of the text facilitated the process because it permitted the continued assertion that the scripture is coherent and infallible as a whole. The article could be an example of what Bell (1992) was calling for regarding ritual. If the group studies were not producing consensual meanings for texts, then it stands to reason that such meanings were neither the goal of the studies nor are even presumed by participants to be accessible to them.

This focus on the public instantiations of belief does not merely serve to bring it into the purview of the social sciences, but it also leads to insights on how “beliefs” are relevant to identity, politics and evolution education. During my fieldwork, I observed how beliefs are performed through not only speech, but through attending a particular church, the display of merchandise like t-shirts, cards, posters, Bibles and jewelry, and participation in missionary and ministry activities, all of which display commitment to a set of beliefs. And as beliefs are performed through these acts, the performers acquire particular identities.

The Inseparability of Faith and Works

The solutions to the problem of belief are promising, but they are ultimately unsatisfactory in themselves because they do not seem to take the issue of belief entirely seriously. After all, a tension between beliefs and practices, or faith and works, runs through Christian traditions going back to the early church. A call to emphasize the doctrine of salvation by faith through the grace of God was among the most enduring elements of Protestantism and

³⁴ I emailed Howell in order to learn whether he felt that atheist ethnographers had any hope of studying believers, given that they do not believe the same things. His position in his reply was not that Christians are better at studying other Christians, only that they offer a new perspective which is equally valuable.

its criticisms of the Catholic Church. Simply focusing on practices seems to ignore the history and to ignore the words of Christians today. Long before the Protestant Reformation criticized the Catholic Church for excessive attention to “works,” such as performing sacraments, in place of faith, several of the books of the New Testament touched on the topic.

A survey of these early writings seem to confirm for the early Christians something that Durkheim and Radcliffe-Brown argued nearly two millennia later—beliefs cannot exist as mere mental phenomena, but must instead be set into practice. This point is illustrated repeatedly through stories of characters who must make a choice about expressing their beliefs. One story in particular emphasizes the importance of their decision to assert these beliefs. Though the four canonical gospels all provide accounts of Jesus’ ministry and death, they differ with regard to the inclusion of certain events. For example, only half of them include such iconic events as the “sermon on the mount” or Jesus’ virgin birth. It is notable therefore that all four of the gospels refer to a series of events following soon after the arrest of Jesus in which one of Jesus’ disciples, named Peter, publicly “denies” Jesus three times. The denial was predicted by Jesus beforehand, and thus serves to demonstrate the truth of his prophecies, but it also suggests something about what is expected of a Christian. It was not sufficient merely for Peter to *think in his mind* that Jesus was the savior. Rather he had to publicly affirm his belief.

The issue of the relationship between faith and action was discussed most explicitly in the epistle attributed to James:

What good is it, my brothers and sisters, if someone claims to have faith but has no deeds? Can such faith save them? Suppose a brother or a sister is without clothes and daily food. If one of you says to them, “Go in peace; keep warm and well fed,” but does nothing about their physical needs, what good is it? In the same way, faith by itself, if it is not accompanied by action, is dead.

But someone will say, “You have faith; I have deeds.”

Show me your faith without deeds, and I will show you my faith by my deeds. (*James* 2:14-18, NIV)

This passage has received a great deal of attention among theologians, but I do not mean to rehash long-running debates on matters of salvation. Instead, I want to draw attention to an idea James puts forward, which offers a way forward in theorizing belief. Many commenters have noted that the second to the last verse in the above quote seems like it should say, “You have deeds, I have faith” to make sense with what James says in the preceding verse. He has, after all, just been criticizing a hypothetical person who claims to have faith but who does not perform deeds that reflect that faith. This verse therefore would be expected to be an objection raised by that hypothetical person, but instead it makes a claim that actually seems to caricature James’ own position. The prevailing interpretation, according to *BibleGateway*, citing IVP New Testament Commentaries, is that James chose this wording to emphasize that his point is not that deeds are preferable to faith, but instead that faith and deeds cannot be separated. The distinction between James’ point and the approach to belief taken by anthropologists and philosophers may seem to be subtle, but it is actually critical. It is not the case that a person can have faith or beliefs inside of their heads and simply not engage in practices that manifest those beliefs. Instead, believing and acting on belief *are the same thing*.

Many anthropologists who work in Christian communities have attempted to parse out better how their subjects talk about belief and faith. Luhrmann warns against thinking of beliefs as digital objects—either present or absent—in the minds of different people. Instead, she argues that they must be actively maintained through particular practices such as prayer (Luhrmann

2012b). As another example, Howell refers to a distinction between belief and commitment (Howell 2007). Lest his argument be confused with Rappaport's, Howell uses the term beliefs as a synonym to creeds, referring to points of doctrine, theological positions, interpretation of scripture and liturgical minutiae. These "beliefs" are not mental objects at all, but instead texts that "believers" are called upon to publicly affirm. By contrast, he uses the term "commitment" to refer to the strength with which people engage in practical activities like prayer, Bible-reading and evangelism (Howell 2007).

Elisha argues something very similar to Howell, conceiving of beliefs as essentially creedal, ritually recited when called to do so (Elisha 2008). He claims that the Christians he studies talk about "faith" more often than "belief," and insists that the difference is the agency responsible. Whereas people can "believe" of their own volition, reciting the creeds whenever questioned, faith comes from God, by His grace. Elisha describes faith as "moral ambition," which is experienced as radical intersubjectivity, wherein the faithful become "subjects of a moral force not entirely of themselves" (Elisha 2008: 64). Though humans cannot make themselves faithful, they can engage in certain practices, such as Bible studies and other devotions, to cultivate "moral ambitions and dispositions associated with idealized notions of Christian faith (59).

To summarize this section, we have seen that a purely mental notion of belief has substantial problems. The solution that has been pursued the most in the past has been to focus attention on activity and social interaction. An alternative and supplementary approach considers beliefs not as mental objects, but a kind of activity characterized in response to other information. In the next section of this chapter, I will recall a number of ethnographic observations at my field site in eastern Tennessee, where I spent six months. Such practices as church attendance, missionary and ministerial activities, language (including marked types of speech such as prayer, preaching and witnessing), and the acquisition and display of particular merchandise (like t-shirts, coffee cups, signs, stickers, pins, jewelry as well as books, tracts, and videos) comprise ways that people signal their commitment to certain beliefs, but many may also be ways of believing in and of themselves.

The Public Nature of "Private" Faith

In the course of this doctoral project, I spent more than 7 months conducting ethnography in a district in East Tennessee, which I will refer to as Scotsboro for the sake of convenience. According to the 2010 Religion data in Social Explorer, around half of the people in Scotsboro attend a Christian church. I visited around a quarter of the roughly 80 churches listed by the local Chamber of Commerce at least once. I attempted to visit at least one church of each denomination represented in the town. For several of the churches, I attended multiple times, even weekly. I interviewed at least a dozen local religious leaders, typically called pastors, preachers or ministers, representing most major Christian denominations present—Baptist, Pentecostal, United Methodist, Episcopal, Church of Christ and Presbyterian (USA). I discussed the topic of evolution at length with all of them, and even formed personal relationships with a number of them. In addition to religious leaders, I met with people in the pews, had conversations in church basements and parking lots, and visited many in their homes.

Following several months of this ethnographic work, I was struck by what seemed to be a contradiction within Protestantism. Since the Reformation, Protestants have proclaimed the doctrine of *sola fide*, or salvation through faith alone, in contrast to the emphasis on sacraments and "works" of Roman Catholicism. This emphasis remains today in Scotsboro, where I heard

references to Romans 3:28 “Therefore we conclude that a man is justified by faith without the deeds of the law” (KJV), the clearest scriptural justification for the *sola fide* doctrine, in sermons and Adult Sunday school classrooms. Baptists, like most Protestants, insisted on the personal and private nature of the relationship between believer and divine.

What I found to be so striking was that this supposedly personal and private relationship with God was held up seemingly endlessly for public consumption in Baptist and other churches. For example, conversion occurs as a public spectacle. Prayers are public and vocal, marking the beginning and end to worship services and public meetings alike. Meanwhile fluency and skill at prayer serves as an index for the seriousness and commitment of the speaker. Attendance at church is closely monitored. People carry dog-eared copies of Bibles and display a variety of Christian merchandise such as t-shirts, coffee mugs, yard signs, and bumper stickers. Believers “witness” to unbelievers. Indeed, the most private individuals that I encountered, those with no interest in the proclamation of their beliefs to other people in their community, were people who did not identify as Christian or whose beliefs were incongruent with those of the publicly prominent and culturally hegemonic Baptists.

However, this suggestion of a contradiction is based on a notion of belief as a privately held mental object, as noted in the previous discussion. If we instead adopt a perspective that sees believing as an act in itself, then these activities can be studied as ways of practicing belief, of believing. In the words of James, “Show me your faith without deeds, and I will show you my faith by my deeds. (*James 2:18*, NIV). Therefore this section is dedicated to cataloguing and discussing the many demonstrations of faith one encounters in a community like Scotsboro.

Church Attendance

The first and most ubiquitous faithful deed is going to church. Christian believers in Scotsboro engage in a variety of church-based activities, including not only morning Sunday worship service, but also Sunday evening services and Wednesday evening services, in addition to adult Sunday school, Bible study and other events. The church is quite obviously the center of the faith community, and attendance or non-attendance is noted by all. I frequently heard people in churches contrasting themselves with other people who chose to spend Sundays doing other things. For example, one Sunday morning as an Adult Sunday School class was about to begin, the leader of the class was talking to the 30-something married couples who showed up for the class about coming to church when he made a disparaging reference to people going to Walmart on Sunday morning. These others were simultaneously morally suspicious and pitiable, demonstrably unhealthy in their relationship with God. It was clear that people who attended church paid close attention to whether others attended as well.

It was clear that church attendance was read as an index of moral character. While visiting a private evangelical school in the area, I asked one man, a middle-aged transplant from the Northeastern U.S. whose northerly origins were clear from his dialect, whether he felt welcomed in Scotsboro. He said that one of his neighbors had told him that when he first moved into town they had watched him to see “what kind of person” he was. He brought his family to a Baptist church, enrolled his child in a Christian school (where I met him) and did not drink, and so they responded positively. I was told more than once that when meeting someone it is common to ask where the other person goes to church, and this claim was consistent with my

own experience as well.³⁵ Several small business owners told me that church membership is necessary to the viability of their business, both because of networking possibilities but also because people are more likely to trust a church-goer. Though these reports may seem cynical, they were not related in a cynical way, as though they attended church merely to gain these benefits. Instead they were couched in expressions of the good Christian values of the wider community.

People did not merely attend church to show others their moral commitment. In many cases, people presented their weekly efforts to show up in the pews as a challenge they felt personally committed to meeting. While sitting in the pews, I would often overhear people talking with another. It was pretty rare to hear any of the church attendees talking about religious beliefs. Instead they would talk about their kids and work and family crises, and they would especially talk about reasons for missing church. The most common excuse I heard for missing church was going to a football game in Knoxville, but there was always a tone of contrition when expressing the cause of absence. These people were trying to commit themselves to coming to church, and meeting that commitment is an act of believing. One way that people believe is by simply showing up to church on Sunday and sitting through the service.

Just as important as attending church is the choice of church attended. While very few people told me that members of other denominations were not Christians, most were aware of differences among churches. Eliciting attitudes about differences among Christian churches was quite difficult, though it is not possible for me to say precisely why. I occasionally heard the sentiment that it was better for a person to attend *any* church than *no* church, but there were hints that people nevertheless placed different churches on a hierarchy of preferability. For example, while informally interviewing a kindergarten teacher and member of the teacher's union, I was told that the school administration paid attention to whether teachers attended church and discouraged non-attendance. I asked the teacher whether it mattered to the administration which church a teacher attended. She told me "no," that it wouldn't matter. Familiar with attitudes toward certain groups, I asked, "So it wouldn't matter even if it were Jehovah's Witness?" The teacher, a middle-aged blonde woman, thought about that for several seconds and then admitted that a Jehovah's Witness would not be considered as appropriate. Following up, I asked if any other churches would be considered not Christian enough. She was unable to produce specific names of church denominations on her own, so I began naming off various groups, and she thought about each one before answering. Her answers were consistent with what I had heard from others.

The hierarchy among churches was Baptist-centric, though I heard it from non-Baptists as well. Churches and denominations could be grouped into folk-categories, which seemed to be most salient when either judging another person or deciding on whether to attend a different church. This taxonomical hierarchy reflects the church categories I described in Chapter 1—Bible, Spirit, Mainline/Liberal, and Catholic—albeit with the inclusion of one additional category—the Unmentionables. The similarity is not coincidental, as I aimed to employ an emic understanding of churches in my analysis, and I borrowed language I heard from people to produce my labels for these churches. The divisions among categories reflect a combination of attitudes toward scriptural inerrancy, worship style, and political and historical divisions, some of which were more salient for people than others.

³⁵ Another question, asked of people who grew up in the area is which high school they attended. There are two high schools, one East and one West, and they index socioeconomic background, since wealthier families reside on the West side of town.

Foremost, people recognized a distinction between Christian churches (including Bible, Spirit, Mainline and Catholic) and what would be called Pseudo-Christian churches, if anyone were actually comfortable mentioning them. These Unmentionables included Jehovah's Witnesses, Seventh Day Adventists and Mormons. All were described by evangelical pastors as cults that hold to one blasphemous idea or another. In conversation, if a person were to identify their home church as belonging to this category, the conversation would likely end in uncomfortable silence. In many cases, it may be worse than not attending a church since at least in that case, the person could be seen to be searching for a spiritual home, so that an invitation to one's own church would be appropriate. A member of one of these Unmentionables already has a spiritual home, albeit one seen as inappropriate. Each of the groups in this category is represented by only a single church in the town. Despite belonging to the same folk-category, each of them is equally antagonistic toward other Unmentionables. Notably, despite deep theological divides, each of these groups generally follows the characteristics of Bible churches, as they regard scripture as inerrant and "spiritual gifts" as unavailable to most in this day and age. They were just as adamant about interpreting the Bible literally as are most Baptist churches, and differences in service-style and rhetoric were not obvious to me at first.

The next division would come between Catholics and Protestants (including Bible, Spirit and Mainline). In the past, Catholics would have been lumped with other Unmentionables, but antipapal attitudes have changed. While no one I met regarded Catholics as anything other than Christian, it was nevertheless recognized that they are different. It went without saying that a Catholic is unlikely to visit a non-Catholic church and vice versa. However, the difference in state beliefs and attitudes was really quite small, to the point that the line between Catholic and the next category I found—Mainline Protestant—was not absolute. Indeed, the Mainline Christians I met seemed the most likely of any to visit a Catholic Mass, and a Catholic would likely feel more-or-less at home in certain Mainline churches³⁶, in terms of worship style. According to the acting Episcopal minister, the Catholic Church in town was actually invited and partially supported by the Episcopal Church.

The next division, between the more liberal Mainline churches and the more conservative Evangelical churches, is widely used by sociologists of religion. Deep historical, theological, and political disagreements exist between them. Mainline denominations include most of the older denominations, and tend to be theologically moderate or even liberal. They include Presbyterian (PC-USA), Evangelical Lutheran Church of America (ELCA), Episcopal, and United Methodist (UMC). Mainline churches were regarded by several of my Baptist contacts as "not taking the Bible seriously enough," which is to say that they are only a step above Catholic and Unmentionable churches. All of these denominations allow female pastors, and have released public statements affirming the compatibility of evolutionary accounts of origin and Christian faith. On another point of similarity, the Catholic Church too has made such a statement. Despite the more liberal positions taken by the governing bodies of these denominations, members of these churches were not necessarily politically liberal. For example, many of the Episcopalians with whom I spoke disagreed with the position of U.S. Episcopal authorities on issues like gay marriage. The most common Mainline denomination in Scotsboro was the United Methodist Church, a "big tent" denomination that appeals to both evangelicals and mainline Protestants. In terms of service-style, the Mainline churches were less formal and structured than Catholic masses. Presbyterian and Methodist churches in particular both followed a similar structure to Baptist services, including formal dress and the singing of traditional hymns. It may be

³⁶ Specifically Episcopal and Lutheran Churches.

mentioned that these various mainline denominations technically disagreed with one another regarding particular points of theology. However, I rarely encountered people in the pews who were aware of these points of disagreement. For example, the Presbyterian church officially affirms a theological position of predestination, and yet many members of the church disagreed with that idea.

Those denominations that social scientists call “Evangelical” basically include all other Protestant churches, including those calling themselves “non-denominational.” Evangelical culture includes not only a unique view of the world, set of textual and other practices, and language, but also an explicit identity. Evangelicals consider themselves to be “True Christians” who “take the Bible seriously.” They contrast themselves not only with what they see as a foreign majority culture, but also with “lukewarm Christians” who compromise with the secular world. While not all have adopted the term “evangelical” to describe themselves, they nevertheless identify with the worldview and ethos here described. They agree, for example, on the source of authority, known as the Word. The Word is not the same as the Bible, it is important to note. It is possibly better thought of in terms of the Holy Spirit, what Harding equates with the language of fundamentalism itself (Harding 2000) along with the textual ideology that undergirds orientation toward the Bible (Bielo 2008). A person’s prestige is measured among evangelicals as the degree to which he or she is obedient to God’s Word.

The evangelical Christians I encountered in East Tennessee often presented to me a particular view of the world and existence, which they called “Biblical” or “Christ-centered” and explicitly contrasted with the “materialist” worldview of the society in which they locate themselves. This “Biblical worldview,” which Brian Malley refers to as an interpretive tradition, is typically described by them and outsiders as “literalist,” though it is not a straightforward translation of “the Bible” which is itself resistant to such an approach due to multiple, ambivalent messages (Bielo 2009; Malley 2004). Rather, it is a construct, which has emerged within a particular history and political situation, and which serves to establish a unique cultural identity. Within the Bible, many portions, such as the dietary laws of Leviticus, are virtually ignored or downplayed, whereas particular, culturally significant passages about homosexuality, drinking, and interactions between ancient Israelites and surrounding cultures are deemed especially important. This interpretive tradition has been shaped by political factors, such as the campaigns against alcoholism in the early 20th Century, civil rights, gay rights, abortion rights and other trends toward social liberalism. One central aspect of this view is the position that the creation story contained in the first few chapters of *Genesis*, the first book of the Bible, happened as they are described in history. This position on *Genesis* 1-3 likewise emerged in a very particular context, as noted in Chapter 2.

While social scientists typically treat “Evangelical” as a single category, a further distinction is recognized by people in Scotsboro between “Spirit” churches and “Bible” churches. The principle theological difference between these groups is attitude toward “gifts of the spirit,” especially speaking in tongues (glossolalia) and faith healing, with Spirit churches recognizing these gifts, not merely as possible, but even critical signs of salvation. By contrast, Bible churches disavow such gifts, and tend to value pastoral and scriptural authority.³⁷ Among what I term Bible churches, such as most Baptists, Lutheran Missouri Synod, Presbyterian Church of America and Churches of Christ, personal authority comes principally through knowledge of the Bible, by quoting scripture, knowing Hebrew or Greek, and/or a seminary

³⁷ Though some independent Baptists, in particular small churches located out in the rural mountains, permit speaking tongues and faith healing.

education. Among “spirit” churches, including International Pentecostal Holiness Church, other charismatics, and Renewalists, personal authority is more fundamentally based in spiritual gifts and apparent experience of the divine. All refer back to the Word.

Praise and Worship

In the previous sub-section, I focused on the act of physically going to church to attend some service. Beyond mere attendance, however, it is important to realize that once a person is in the pews, they are confronted with the service itself, which includes at a minimum group prayer, a venue for sharing concerns, hymn-singing, collections and a sermon. Other possible activities include communion, a children’s story, invitation to come to the altar for healing or to accept Jesus, recitation of creeds, and call and response. Each of these things is a social act and an experience of confrontation with beliefs. In this sub-section, I intend to discuss the experiential aspects of belief that accompany actually being in a church service.

In a spirit church, a live band plays songs of praise while people respond by closing their eyes, holding their arms in the air, singing along, and swaying to the music. The pastor speaks melodically into a microphone in between songs, while the band continues to play for ambiance, and he calls his congregation to give praise to God for what He does in our lives and for Jesus’ healing love, “The devil will try to make you bitter, but you can’t let it, because it’ll take your joy, which will take your praise and rob you of your power.” It is important to consider this connection between praise and power. Congregants give praise through the response mentioned above. Their praise is an invitation to the Holy Spirit to dwell among them, to fill them with faith, to move them to speak out. Activities of praise accomplish two things. First, for those participating in it, it makes God seem intimate and real because it addresses Him directly. Second, it communicates to other people that you believe.

These acts of praise have a cumulative, contagious effect that energizes the congregation, the band and the pastor. As the levels of intensity rise, people cry, they shout, “Praise be to Jesus!” Their experience of growing intensity is described as “electricity,” but it is attributed to the presence of the Spirit. They seek out this experience, which makes God feel present among them (Luhrmann 2012b; Saunders 1995). For a believer, the experience is confirmation, which can be embraced and celebrated. For someone who is full of doubt about the reality of God, or who rejects it altogether, the experience of a Pentecostal service confronts that doubt and skepticism, and it demands a response. Thus, my strategy in these moments was to allow these sensations to flow over me, meditating on the sensation, sometimes allowing it to move me to tears. In the back of mind, especially afterward, I think about Durkheim and the “collective effervescence,” of a misrecognition of the feelings of empowerment that accompanies being part of a group engaged in a collective action. For those who choose to believe, participation in a service focused on praise and worship, such as can be found in a Spirit church, is the most visceral way to believe.

Other church services include elements of praise and worship, albeit less powerful, in the singing of hymns, recitation of creeds and call and response, in which the minister or pastor reads a passage and everyone else in the sanctuary reads out-loud another passage that responds to the previous. Call-and-response is a form of liturgy used mostly in mainline churches, but also occasionally in Bible churches. In all of these examples, the individual participant is expected to read or recite from memory some proposition in tandem with everyone around them. These are effectively rituals as Rappaport defines the term: “the performance of more or less invariant sequences of formal acts and utterances not entirely encoded by the performers” (Rappaport 1999: 27). In other words, by participating in these liturgical acts, people are signaling

commitment to the conventional, ontological and moral order on which the rituals are based. Nevertheless, as Rappaport also notes, the participants may make these statements without actually believing them.

Baptist churches are increasingly embracing a praise and worship emphasis in their services. This is particularly true for younger pastors. However, many people, and especially older pastors, mentioned an altogether different style based around a “fire and brimstone” sermon intended to bring people “under conviction.” The idea of “conviction” is to make others aware of a problem with their eternal souls and thus motivate them to seek out a solution in the form of accepting Jesus as personal lord and savior. Susan Harding claims that this involves five major rhetorical moves: “equating his present listener with the listeners in his stories; defining the listener as lost; defining the speaker as saved; transforming his narrative listeners into speakers; exhorting his present listener to speak” (cite Harding: 171). Harding argues that engagement with and adoption of this rhetoric is the essence of conversion to this brand of Christianity. A fire and brimstone sermon follows these same basic moves, and I have little to add to Harding’s analysis. What is nevertheless most relevant about these sermons is their engagement with the listener at a level that challenges how they believe.

The terms “fire and brimstone,” obviously evoke the threat of Hell, or eternal damnation awaiting anyone who is not saved, and there is certainly an element of fear-mongering in such sermons. However, there is also the construction of guilt. The listener is told that he is a sinner, that the wage of sin is death, and that he deserves his punishment, but that God committed the ultimate sacrifice of coming to earth, living a perfect life, and then being tortured and suffering a painful death all so that the listener can escape his deserved punishment and gain the kingdom of heaven. Confronted with this epic narrative with oneself at the heart, it feels like refusing to accept Jesus is the most ungrateful possible choice. Much like in the Spirit church discussed above, there is a visceral dimension to the experience. Listening to the preacher, at times I felt the pit of guilt in my stomach. It feels like what Harding described as conviction, when the Spirit of the Word moves through a person and calls them to accept Jesus as savior. The unsaved listener is given the impression that the sermon is all about them. The fire and brimstone message, and the act of confronting it, is something that individuals sit through week after week, long after they accept Jesus. In fact, people in the pews at these Baptist churches expressed to me that they really appreciate this type of sermon as something they need to hear. Like a shot at the doctor’s office or a cavity filling at the dentist, there is a sense that a fire and brimstone sermon is unpleasant but necessary for spiritual health. In this sense, committing oneself to attending the worship service each week and thereby subjecting oneself to such a sermon is itself an act of believing.

In addition to worship services, people also commit themselves to attending classes in churches such as Adult Sunday School and Bible Studies. There are also evening classes on various topics. For example, Focus on the Family has produced a DVD course called the Truth Project, which is designed to be watched as a group over the course of multiple weekly meetings. In his ethnography of a megachurch in Knoxville, Elisha describes an insight he had after he asked men in Sunday School class about the repetition in the workbook they were using. Elisha wondered how they could motivate themselves to go through it every week when it was just making the same points over and over. In their response to him, the men distinguished between knowing the material, and actually living it. It is not the case that someone simply gets saved and thus becomes a good Christian. Instead, it is a process of becoming, “the only way one advances along the journey is by practicing ‘spiritual disciplines’, such as Bible study, worship, and

prayer, with the goal of embodying spirituality, not in an abstract sense, but in the literal sense of embodying ‘the Spirit’” (Elisha 2008: 62).

Prayer

Tanya Luhrmann did ethnographic research at Vineyard churches in California and Chicago, focusing on personal prayer practices. For Luhrmann’s interlocutors, prayer is a skill that requires practice and training, particularly in order to train oneself to recognize certain thoughts as coming from God (cite Luhrmann). The kind of prayer on which Luhrmann focused is typically done in private, away from distractions that make it more difficult to hear God talking. In the church and other public meetings I attended during my fieldwork, a much more common form of prayer is conducted in large groups. All church services include spoken prayer, typically near the beginning of the service, following calls for people to tell their concerns, and at the very end of the service. In Scotsboro, in fact, spoken prayer in groups initiated and concluded most public meetings, including Lion’s Club meetings and school board meetings, as well as any event hosted by or through a church. Spoken group prayer employs similar skills as personal prayers, but has very different purposes. These prayers are necessarily unscripted, though they follow predictable patterns. Being extemporaneous they are difficult for an outsider to fake, as I learned when invited to “lead the prayer” on several occasions.

As opposed to a private prayer, or even a “moment of silence” in which people present in the same place are supposed to say a prayer to themselves, spoken group prayers are voiced loud enough for everyone present to hear. Generally they are led by a pastor or another person taking an active role in the church, as the prayer leader is typically in a position to be speaking to everyone when the prayer begins. Some prayers are preceded by, “Let us pray,” or something similar. Others simply begin, “Dear Lord/God/Jesus.” During the prayer, everyone present is expected to lower their head, close their eyes, and stay still and silent. In smaller groups, when practical, participants often hold hands in a circle during the prayer. The prayer leader addresses God directly, using one of several possible names, including Jehovah, Jesus, God, Lord, etc., and the pronouns “you” and “your.” He or she takes the role of speaker for the entire group, using first person plural pronouns (e.g. we, us, our) and rarely the singular “I.” The prayers are apparently spontaneous, following no liturgy, but they are also structured according to schema that is widely shared among churchgoers. In Baptist churches, prayers are addressed to Lord Jesus, with requests punctuated by “please” and observations delivered within the frame of “Lord, I thank you for...” These public prayers are always concluded with the word “Amen,” and other participants will sometimes also say, “amen,” after the leader has done so.

In addition to the many opportunities to lead prayer inside and outside of church, some people choose to take part in prayer groups, which meet together for the purpose of sustained prayer. Many churches have a group, typically constituted mostly of women, who gather together in order to pray about special concerns outside of the service. A major role for a pastor is to minister to members of the congregation, which always involve leading a prayer at some point. Some of the larger churches even have prayer hotlines, wherein a person can call about a concern and talk to someone who will lead them in a prayer that addresses the concern.

Once, after a service at a large Baptist church, I was talking to a man I had met previously, a Christian Jew in his fifties whom I will call Saul. He was going to his Men’s Prayer Group that meets each week, and I he invited me to come with him. I followed him across the church’s campus, to an annex. When we opened the door, it was clear that we were arriving late. It is relatively dark inside, and it took my eyes several moments to adjust from the bright sunlight outside. Five men were seated in a circle, already praying. Four of the men are older, retirement

age, but one looks no older than 18. The room felt much too small for the seven of us. It had traditional-style furniture, including upholstered chairs and a bureau with fixtures. The men ended their prayer in order to meet me and introduce themselves. I learned that the young man had recently returned from a missionary trip to China.

I sat down in a pale blue wingback chair on the edge of the circle and, when they learned that I was not “saved,” the group devoted the next 10 minutes or so to telling me about the saving power of Jesus. When it became clear that I was not going to accept Jesus as my personal savior at that point, the men returned to the activity that our entrance had interrupted. The activity would be best described as a “rolling prayer.” One man begins a spoken prayer, delivered in a low volume but loud enough for everyone in the room to hear. When he has finished, rather than saying “Amen,” which is the customary way to conclude a prayer, the man next to him takes over, and then passes the role of leading the prayer to the next man, in a circle. The prayer session continued for at least half an hour, sometimes ended with “amen,” but soon after rejoined with another round of praying. As I listened, I wondered about what else was being communicated through the choice of words and the particular concerns mentioned by each. Working in Chiapas, Mexico, Akesha Baron (2004) wrote about the ways Tzotzil women in a Protestant community were able to use spoken prayer in order to express feelings and tensions that were not otherwise permissible to discuss, as for example a relationship between a young woman and her mother-in-law. Baron observes:

It was not unusual in situations that I observed for simultaneous prayer to be used to communicate messages to other people. Speech is nominally addressed to God, but virtually always heard and understood by a human audience. For example, prayer provides a way for family members to express tensions to each other. (Baron 2004: 258)

As I listened to the men formulate their prayers, I imagined that they were putting their own thoughtfulness on display, and trying to outdo one another. The young missionary brought up current events in the world, asking God to give people strength in overcoming natural disasters. Another man prayed about crises in our nation, and asked God to give our leaders wisdom. Nearly everyone prayed for people they knew in the church who were having difficult times. I also was referred to several times during the prayer, with requests that Jesus open my heart and share his love. Throughout the experience, I was struck by the curiosity of the format of communication in which we were engaged. The participants addressed their prayers to God, so they referred to other people present in the third person. Because the order of speaking was dictated by our arrangement in a circle, and because a person could only speak during his turn, it would not have been acceptable for me to respond to what was said. Furthermore, as the prayer itself was framed as a group message from us to God, my presence in the circle seemed to suggest that I too was praying for God to open my heart.

When the circle comes around to me to take over leading the prayer, I smile and shake my head. They skip me and pick up with the man to my left. Leading prayer requires a degree of skill and a sincerity that is difficult to fake. For those who are able to do so successfully, leading prayer entails some benefits. The first set of benefits comes through earned prestige and recognition of skill in prayer, thoughtfulness in including specific concerns in the prayer, and the strength of faith implied by all of the above. The second set comes through being in the position to be speaking for the group, implying a degree of trust and suggesting the authority to represent the views of everyone. At the same time, a person asked to lead the prayer is under a great deal of pressure for these same reasons.³⁸ In my own experience, prayer is the most difficult of

³⁸ <http://www.christianitytoday.com/le/2014/fall/leading-in-prayer.html>

church-related activities for me to do. I have no problem clasping my hands or closing my eyes and bowing my head. I don't have a problem reciting the Lord's Prayer. The thing I find impossible is actually speaking extemporaneously as though I am addressing God or Jesus. It is in this respect that prayer can be seen as a form of believing, in which one must confront some reality and respond in an appropriate way. For a person who believes that God is listening when we speak to Him, prayer feels like a dialogue (Luhmann 2012b). For others, it can be awkward or feel like acting, insincere. The experience of prayer, therefore, is a kind of measure of belief, a theme I would develop further in the next section of this chapter.

Evangelizing

I was asked about my salvation status at least once per week while in the field, so the experience related above was not isolated. As a visitor to evangelical churches, my presence inspired many people³⁹ to witness to me. Witnessing is a practice in which a person tells his story of being "saved" to someone who is not saved. The idea is to serve as a witness of the power of Jesus, and to spread the gospel or "Good News" of salvation, in order to convince the listener that he or she needs to have a relationship with Jesus. When done effectively, witnessing brings the listener under conviction, such that she begins to think of herself as being "lost" and thus in need of the saving power of Jesus. Evangelization as an activity is highly respected and promoted in Protestant churches, and Baptist churches especially. Missionaries, who devote their time and resources to spend time in other countries (typically in Central America for those I met) spreading the gospel, are celebrated when they visit a church in the U.S. What they do is regarded as being the most important thing for Christians to do. However, it was the voiced expectation that all Christians ought to be evangelizing or witnessing to people whenever they have a chance. This central concern was evident in the concept of "Ministries," which were organizations or services run by the church for the explicit purpose of attracting people to the church and ensuring that they knew about the gospel.

Even after I had been hearing the emphasis on evangelization in church services, through announcements related to ministries, through calls in the sermon to spread the Word, and through special collections taken up for missionaries in the field, I did not fully appreciate how strong the expectation was until one night while having dinner with a pastor and his family. His wife began to tell a story about a woman at her work whom she had known for a number of years. One day, the woman came up to her with a radiance. She learned that the woman had recently been saved and was very excited about it. She was telling everyone she knew about the glory of God and Jesus' love. When she saw the preacher's wife, she asked her why she hadn't told her about Jesus. Doubtlessly, the woman was not trying to be accusatory or to make her feel bad. The question seems to have simply been intended to convey her excitement. Nevertheless, the pastor's wife began to choke up as she told this story. The comment made her feel terrible guilt. As a Christian, she saw it as her duty to spread the gospel. After all, eternal souls were at stake, damned to hellfire without Jesus' intercession. This was not a thing about which one could afford to be lackadaisical. And yet here was this woman with whom she worked and saw regularly, but to whom she had neglected to share the most important news ever. The encounter impressed upon this preacher's wife the critical importance of taking every opportunity to witness.

Accordingly, several of the people I met in Baptist churches felt moved to share the good news. One Sunday at another large Baptist church, I was stopped by a man as I was leaving the church, literally walking through the door. The man wore a suit, and his position in the lobby

³⁹ I am not sure why my evangelizers were always older white men, but I can think of no exceptions.

suggested that he served as an usher or greeter for the church. Before the service he would have been greeting people as they walked in and handing them the program for the service. After the service, he was shaking hands and offering blessings as people filed out of the sanctuary. When he saw me, he apparently recognized that I was a visitor, and so he asked me what had brought me to church. When I told him that I was doing research, he immediately asked whether I had given my life to Jesus. This is a question I was accustomed to hearing but nevertheless dreaded because I had not discovered a way of responding that did not immediately result in proselytization. I suppose I could answer that I'd rather not say, but such a response would be understood to mean that I have not. After all, a person who *has truly* given his or her life to Jesus, would not deny or hide that commitment. I answered, "No, I haven't." He gave me a worried smile and then began to tell me about Christ's loving salvation. At some point he asked if I had read the Gospel of John. I told him honestly that I'd had a hard time getting through it, and that I like the other Gospels better. He told me that John was his favorite. He placed a pocket-sized, bound copy of the Book of John into my hand, telling me to read and pray over it, and that doing so would allow Jesus to come into my heart. I thanked him and left, wondering how successful such an approach would actually be.

Rites of Conversion

Evangelical Christians talk about "being saved," as a kind of critical moment experienced between an individual and God. In order to be saved, I and others were told to go somewhere private and pray to Jesus, asking him to come into my heart and deliver me from my sin. Harding, who analyzed born-again conversion narratives among fundamentalist Christians in the 1980s, noted that people recalled being brought "under conviction," which they described as feeling guilty, frightened or uneasy with the realization of being a sinner in need of salvation (Harding 1987). This experience may occur in the presence of others, but it tends to be described in terms of a confrontation between oneself and God. The moment in which one gives their life over to Jesus, comprising a choice to live according to God's will, is a personal one. The moment of choice, and the experience of peace that comes with salvation soon after making it, is referred to as "being saved," and is regarded as a moment of conversion, when one becomes a Christian. Notwithstanding these ways of talking about conversion, there is still one remaining thing to do—get baptized. Various denominations disagree about the status of one's soul who has accepted Jesus as a lord and savior and yet has not been baptized, but all include the ceremony as important. Most churches do not hold baptisms on every Sunday. During my field work, lasting six months, I only witnessed one baptism. The following description comes from my notes:

I am sitting near the back of a large Baptist church, shaped roughly like a baseball diamond, with two entrances in the two back corners, and a large stage-like altar at the front. A father in front of me is urging his son, who looks to be around 9 years old, to go to the altar during the call. The boy looks sober, serious, as though he has thought long and hard about the decision he is about to make. He stands up and walks up the nearest aisle, joining at least a dozen other people. They stand in front of the church while the pastor approaches each in turn, asking them if they are ready to accept Jesus. At last they are led behind the stage, and up some steps that are not visible to emerge back in view of the congregation in a room behind glass, located about 15 feet above the altar. The pastor is standing there, in a large tub that is about 4 foot deep with transparent walls, filled with water. Those who will be baptized stand in line out of view, approaching him one at a time. They climb into the Baptismal tub, and the pastor puts a hand on each of their shoulders. He wears a clip-on microphone, so his words are audible over the

loudspeakers when he asks each person if they have accepted Jesus. In each case, the new convert nods, and the pastor dips them backwards into the water until they are fully submerged, then pulls him back up. Dripping water and wide-eyed, the born-again Christian steps from the tub, is given a towel and disappears from view as the next person steps into the tub.

As a ritual, baptism has been thoroughly analyzed and interpreted (cf. Johnson 2007), and it would be outside the scope of this dissertation to delve into these meanings. What I want to highlight instead is the public nature of the rite. The necessary components of a Baptism include only water, two people—one who is being baptized and the other conducting the rite—and, conceivably, the Holy Spirit. A Baptism could occur after the service, in the basement of the church. For that matter, it could be conducted at home, in a bath tub or swimming pool. Yet, at great expense, this church has constructed a special room behind the altar and visible behind glass. Furthermore, it contracted the construction of a large baptismal tub that is transparent, so that the audience can see the full immersion of the initiates. Finally, the question from the pastor and the response of the new convert, ostensibly a contract between them and God, are made audible for everyone present. Again, a private relationship between the convert and God is made imminently public.

Rejecting Evolution

Finally, and most relevant to this discussion, people believe through confrontations with anti-evolution messages in church. I visited all varieties of what I have called Bible churches (mostly Baptist) in the area and found that their leaders were more adamant about a literal interpretation of Genesis and direct 6-day creation less than 6,000 years ago than any other church. In my experience, every larger Baptist church (and the Church of Christ) had a resident creation science expert, who subscribes to one or more young earth creation science publication and is asked occasionally to present the evidence for creationism to other members. Usually these presentations occur in the form of adult Sunday school classes.

Ever since the Fundamentalist movement allied itself with the anti-evolution movement in the 1920s, the authority of the Bible has been asserted to rest on the historical accuracy of the creation account (Numbers 2006). Because of this positioning, efforts to teach evolutionary accounts of human origins amount to an assault on the core identity of this group. Moreover, this authority is the basis for legitimizing a range of evangelical practices and beliefs (Malley 2004), including relations between men and women and between pastors and their “flocks.” Specifically, that authority includes the capacity to determine how scripture ought to be read and understood, constituting something known as “spiritual leadership.” A threat to this authority is thus understandably taken very seriously as a threat to a host of commitments.

Evolution is regularly mentioned during sermons and services at churches throughout the area. In addition to Baptist churches, I heard criticism of evolution during services in the Church of Christ, Seventh Day Adventist Churches and Jehovah’s Witnesses churches. For example, at a “Bible Study⁴⁰” in the Jehovah’s Witness church, I watched a series of skits performed next to the altar during service. The second of these skits was about the “dilemma of evolution.” Here, one of the women asked about evolution and the other explained that it was only a “theory,” in

⁴⁰ I have bracketed Bible Study with quotation marks because the event was identified as such by signs at the church despite having a format that resembled a worship service.

contrast to the incontrovertible word of God which very clearly does not say anything about any life evolving in Genesis. The only sure thing is Creation, so evolution is not worth the bother.⁴¹

At the “Patriotic Service” of one large Baptist church in the town⁴², a pastor gave a sermon on the need for a return to God in this country. Included in the sermon was a historical narrative wherein, prior to 1900, “the nation was based on the Word of God.” However, once evolution had become accepted, people reasoned that “if man evolved, then laws can evolve.” He claimed that in 1953 [1973?], a Supreme Court Justice said that the Constitution is what we say it is. They ruled that “life is insignificant. It’s perfectly ok to take that life and kill it.” He went on to claim that “now, when you’re 80 years of age, if you’re in a nursing home and can’t produce anything, we’re going to take away your food and let you die.” The ease with which the local cultural reasoning could derive the causes of social ills from “evolution” was staggering to me in the beginning. Darwin was linked with Social Darwinism and then Eugenics and then Hitler and the Holocaust in the course of a sermon or conversation. This was a line of logic echoed in countless media formats from tracts to videos stretching back to the beginnings of the anti-evolution movement prior even to the rise of Hitler (originally German militarism leading up through World War I was described as a result of German acceptance of evolution).

For many, a willingness to reject evolution is the mark of a true Christian, as opposed to a lukewarm Christian, who compromises between the Word and the world. I did not personally encounter any member of these churches who accepted any part of evolutionary theory, though it is possible there are those who do. I interviewed one woman who attends a Baptist church near Scotsboro. She was working as an administrator in a local hospital when I met with her. Clearly she was college educated, and during the interview she demonstrated a very good understanding of evolutionary theory and was well aware of the scientific evidence for it. Indeed, evolution made good sense to her and she had accepted it before she became a Christian and entered into a personal relationship with Jesus. Regardless of the scientific evidence, she believed being a good Christian required her to profess belief in the creation account given in Genesis. Listening to her, it was clear that it would be missing the point to treat her rejection of evolution merely as evidence of her religious belief and commitment. Rather, it is part of the act of believing.

This connection between commitment to faith and rejection of evolution was summarized well by the pastor at one missionary Baptist church, who exclaimed during a sermon, “As a Christian, I’m a creationist. I believe that God created the earth. There are some people who believe in evolution instead. They are accepting that on faith as well.” It is notable that his call to reject evolution was couched not merely as demanded by faith but also as consistent with sensibilities of evidence and reason. He went on to explain that we are justified in having faith in the Bible because it has been shown to be true so many times, especially through prophecies. For example, the Bible predicted that Israel would be a nation once more, and that is exactly what happened.⁴³ These kinds of appeals to evidence reflect wider cultural concerns with being modern and rational, and they were especially common in Bible churches. I met with, and befriended, several younger Baptist pastors. All had books on their shelves that disputed the science of evolution and/or presented the science of creationism. Some of the pastors

⁴¹ June 6, 2008. The service was in Spanish, so these are translations.

⁴² June 29, 2008. The “Patriotic Service” is given at many large churches in Scotsboro. It is generally held on the Sunday immediately before or after the 4th of July, U.S. Independence Day. At the service, most people wear patriotic clothes, including American Flag ties, shirts, hats and pins. The altar is decorated with red, white and blue streamers and American Flags. Patriotic hymns like “My country ‘tis of thee” are also sung during services.

⁴³ July 13, 2008.

recommended and even loaned me copies of such books, but they admitted to not having personally read them. Their primary resources for learning arguments against evolution appeared to come from conversations with other pastors and from reading online articles and blogs from experts.

While the leaders of both Spirit and Bible Churches are generally ill-disposed toward evolution, their respective approaches to it are quite different. The latter are far more openly hostile to evolution, and willing to dedicate time in Sunday school, Bible studies and sermons discussing it. The former seem mostly indifferent to it. Since the Baptists insisted on creationist positions and these Spirit churches were constantly being called upon to demonstrate that they are equally or more biblical than the Baptists, they seem to have simply taken the Baptist creationist position as a given. Whereas references to “evolution” were routinely encountered in Baptist churches, the topic was left unspoken in Pentecostal churches. Evolution was never a topic of any sermon in these churches, nor was it brought up spontaneously. It did not seem as though evolution was considered a relevant or important topic amongst those who attended Spirit churches, but they tended to default to a creationist position when I inquired about the topic. In contrast to the efforts I witnessed from Baptist pastors to explain to me the logical problems with evolutionary accounts, Pastor K at a Pentecostal church I frequently attended told me that he knew evolution was wrong because God had told him so during prayer.

Based on these observations, it is clear that most of the students in the area were immersed in antievolution from early in life, especially those raised in a Bible church. Baptist churches in particular regularly emphasize in Sunday schools and sermons that creation occurred exactly as described in the first few chapters of Genesis. The majority of students, who tend to go to all weekly services and church activities, would have been told, possibly by multiple respected adults, that evolution is a lie and that believing it means forsaking the Bible, Jesus, salvation and everything else that is really important in life. This message compels a response in those who choose to believe; it thus serves to illustrate the action inherent in belief.

This commitment to reject evolution stretches beyond church. Parents express concern over ideas, such as evolution, taught in schools. This sentiment is present in Scotsboro despite the apparent fact that treatment of evolution in public schools was handled in a manner that was sympathetic, if not entirely supportive, toward evangelical views on origins, it is ironic to note that I encountered many parents who elected not to send their children to public schools, citing religious reasons. Among these parents, there was concern that God had been excluded from schools, and that the curriculum was secular and thus atheistic. It was difficult to get specific numbers on what percentage of the student population was withheld from public schools due to such concerns, however, the town included several Christian private schools, with total enrollments at close to 1000 students. Many parents complained that these schools were prohibitively expensive. Those unwilling to send their children to public schools, and yet unable to afford private school, elected to homeschool them. Two large Baptist churches in town hosted homeschooling collectives once per week, where parents and children could meet to socialize. Some homeschooling parents constructed their curricula independently, but many purchase a curriculum. Among the more popular curricula were some published by Bob Jones University, a for-profit evangelical university. The high school level biology textbook and accompanying course “module,” was organized around creation science and a debunking of evolution.

In short, being a believer in Scotsboro equates to publicly denying evolution. One final manifestation of this equation is that heterodox assertions about evolution are actually not made public. I met many people there who wholeheartedly accept evolution, but who do not make their

acceptance known beyond trusted family and friends. Even at the more liberal mainline churches, pastors communicated to me in private that they did not think that evolution conflicts with Christian faith, and yet they were unwilling to come out publicly in support of teaching evolution. While many in their congregations accepted evolution, there were others who did not. Importantly, beliefs about origins among church attendees were not entirely predictable by the views of a pastor or denominational affiliation. This is especially the case at the United Methodist Churches, where I spoke to pastors who accepted evolution without reservations and to other pastors who argued for old earth creationist views. Though I did not encounter anyone in an evangelical church who confided in me that they accepted evolution, it would not astound me if such people existed. Nevertheless, I would predict that such a hypothetical person would be careful not to express their views within the church community.

This reluctance to express support for evolution has important consequences for how teachers approach evolution in their classrooms. As reports of teaching creationism accumulated, I grew curious about how non-evangelical parents responded to it. I was attending an adult discussion group at the Presbyterian (USA) church, wherein most other attendees were comfortable with evolutionary accounts of origins. One Sunday, I told them that I had been hearing from students and even teachers that creationist critiques of evolution were being included in science classrooms in Scotsboro. No one seemed to be surprised, including a vice principal at one of the middle schools. I asked them why no one complained about it (using third person, so as not to seem accusatory). The consensus was that it was not important enough to try to change. After all, it was always possible to talk to their children at home about it. Furthermore, it was agreed that fighting these practices would invite problems from others in the community.

Belief as Practice

While conducting ethnography on African Christian faith-healing services in Zambia, Thomas Kirsch noted that his informants spoke of consciously willing themselves to believe in the powers of particular churches to heal them. Failure to believe meant that healing would not work, suggesting that an individual's internal beliefs could be made apparent to oneself as well as the social group depending on health outcomes (Kirsch 2004). Based on the idea of a will to believe, Kirsch argues for a reconceptualization of belief as something one “does” rather than an internal, relatively stable state (2004). Such an approach sounds similar to the strategies discussed earlier that focus on practices rather than belief or to redefine belief as constituting its expression. However, Kirsch’s insight actually goes further in maintaining belief as a mental phenomenon while simultaneously recognizing as a kind of activity in the same way that thinking, imagining or dreaming are activities. Unfortunately, Kirsch does not develop this idea beyond the argument in his article, I will do so now.

When we imagine that beliefs are internal objects, then we have to admit that they are beyond our grasp, as noted by Needham, Rappaport and others. If we instead say that actions express underlying beliefs, and that by studying the actions we can unearth those beliefs, then we are substituting the evidence of our senses for a reified world of mental phenomena (Bell 1992). Both of these issues disappear, however, when belief is recognized not as mental states or propositions regarded as true, not as static mental objects, but instead as forms of practice, reiterated in the mind, spoken to others, and actively maintained.

The idea of believing as doing was foreshadowed by Geertz several decades ago. Calling for attention to the matter of belief, Geertz observed that it was not self-apparent why people believe in the worldviews suggested by their religious systems. Like many other anthropologists before him, he rejected Tylor's explanation that beliefs arise simply as answers to puzzling phenomena such as dreams or death. Even if religious ideas are used to answer such questions, he noted, this hardly explains why they would be believable in the beginning:

It seems to me that it is best to begin any approach to this issue with frank recognition that religious belief involves not a Baconian induction from everyday experience—for then we should all be agnostics—but rather a prior acceptance of authority *which transforms that experience*. (Geertz 1973: 109, italics mine)

Based on this passage alone, Geertz seems to give a straightforward account of the source of belief, as based ultimately in authority. If that were his point, then his argument would fall to circularity since he merely defers to “a prior acceptance,” which itself would need to be explained. In the context of the essay, however, it appears that his concern here is not the source of belief, but the consequences of belief—it transforms everyday experience. Beliefs do not just sit around in people's minds. Instead, to “believe” is synonymous with what Rosaldo called “the practical matter of how to live with ones beliefs.” (Rosaldo 1993). This notion of living with ones beliefs is what I mean by the act of believing, comprising perpetual efforts to reconcile the beliefs we profess/assert with the world as we see it.

When I began this research, I sought to document people's beliefs, as though they were objects in their minds that merely needed to be elicited. After listening to evangelicals for a while, I realized that the verb “to believe” was employed to the virtual exclusion of the noun “belief.” Sermons frequently call on listeners to believe in the power of Jesus, that through the *act* of believing, one is saved. If individuals must will themselves to believe, then in what does the act of believing consist? Clearly believing is more than thinking in one's mind that a proposition is true. After all, I can think things that I do not believe in. I can think to myself, “There are leprechauns in the world,” and yet I do not believe in leprechauns. The difference between believing and merely thinking or saying a propositional belief, is that believing transforms the way I respond to things in the world that bear upon that belief. Believing consists of responding to the evidence of the senses and to challenges from others in a way that confirms or justifies asserting the propositional belief.

Believing is a daily activity, requiring dedication and personal choice, and always subject to doubt. Several anthropologists of Christianity have noted that belief in the Christian tradition has long been characterized by and reflected in doubt (Elisha 2008; Luhrmann 2012a; Luhrmann 2012b; Saunders 1995; Shenoda 2012). In contrast to the popular tendency to cast doubt as the opposite of belief, Luhrmann posits doubt as a necessary component of belief. As Luhrmann points out, doubt can be a motivator for religious action such as prayer, church attendance or reading the Bible (Luhrmann 2012b). Indeed, people are always at risk of experiencing a “crisis of presence” (Saunders 1995) when trying to resolve the notion that God is all-powerful and ever-present while also invisible. As an example of efforts used to maintain belief in the face of doubt from the senses, Luhrmann notes that the act of belief for the Christians she studied involved *training themselves* to experience God through prayer, scripture reading and religious services (Luhrmann 2012b). In charismatic movements, like Christian mysticism before it, “believers” seek out direct experience of the divine in order to allay feelings of doubt and to verify that God is really there (Luhrmann 2012b). In this case, it is not certainty of a belief, but, on the contrary, doubt that leads to action.

Luhrmann notes that modern evangelicals, are maintaining their religious beliefs in the modern world in spite of ubiquitous skepticism, including by the believers themselves. Perhaps, as Toumey notes, it is because so much emphasis is placed on science in contemporary times that evangelicals seek out something empirical to demonstrate to themselves that their commitment to believe is reasonable. Luhrmann makes this argument to explain the rise of the *new paradigm* evangelical movement, which emphasizes having a personal relationship with God, which is ongoing, and which strengthens through practice. By training themselves to "hear God's voice" in their thoughts, Luhrmann's informants find a means of convincing themselves that God is real and active in their lives.

There is a sense, then, in which believing is a kind of cognitive practice, but lest we fall back into mentalism, cognition is not an activity contained within disembodied individual minds. The cognitive practice of believing takes place through dialogue with a social and material environment (cf. Bateson 1983; Hutchins 1995; Lave 1988). Based on Rappaport's insights regarding the social environment, when one asserts a belief, one socially obligates oneself to defend it. Displaying a particular belief could provoke challenge from other people. Under a rationalist discourse, the response is then to "defend" the belief, giving justification. Belief constitutes these responses, which are often equivalent to what is known among cognitive psychology as motivated reasoning (cf. Kahan 2013). As one example of a response, psychologists claim evidence of something they call confirmation bias, whereby people explain away contradictory evidence and selectively remember confirming evidence (Oswald and Grosjean 2004).

In dialogue with others, we encounter assertions that affirm or contradict a proposition to which we have socially aligned ourselves. Dialogue can also occur within one's mind, or in relation to writings, other symbolic communications, and other phenomena. Dialogue would certainly have to include God in some form. After all, if a person consciously interacts with something, then they believe in it. And if God is a psychic interactant, then there is no private belief. If God sees all, then there is no private act. A privately held belief is a social commitment with God. Worship, praise and prayer, whether voiced or merely thought, are forms of interaction with God. It is even possible to interact with God distally, as when actions or thoughts are taken or affirmed in consideration of God (e.g. in a final judgement).

Recognizing that beliefs cannot exist as purely internal phenomena does not suggest that individuals will always go out of their way to express their beliefs when challenged. A person may sit quietly in the pews, believing that God is a figment of other people's imaginations, and allow others to assume that she believes as they do. Atheist or agnostic students may not publicly identify themselves to other students in a school where evangelical Christianity is the norm. An agnostic secretary may go out of her way to keep her religious employer from knowing what she thinks about religion. A pastor may even continue to minister despite a loss of faith. These scenarios can and do happen all the time. I encountered each of these examples during my field work. Being selective about expressing beliefs is a necessary component of human interaction. What is not possible is for a person to "believe" something by simply sitting quietly with the proposition in mind, without thinking or doing anything with them. Beliefs can only exist in any relatively stable form if they are in some way enacted. So there are no beliefs without practice or activity, including cognitive activity.

This view of belief has implications for understanding the debate over evolution, particularly in an area where the dominant model is to equate evolution with disbelief or faithlessness. When creationists maintain their belief in a literally true Genesis origin account,

they typically do so by dismissing the consensus position among scientists from multiple disciplines on the age of the earth and earth's natural history. When a creationist responds skeptically to supposed evidence for evolution, or is compelled to seek out counterarguments, these are acts of belief, simultaneously social and cognitive.

An Illustration

As noted one way that a person believes is by interacting with outsiders, that is unbelievers, in a particular way. A Christian who holds to a particular interpretive tradition known as “literalism” (Malley 2004), is in the midst of a secular and skeptical culture that challenges the assertions that come from that tradition. My gateway into this aspect of believing came through the fact that I am very much a part of the secular and skeptical culture. As an ethnographer, I tried to gain an insider’s perspective on the faith of creationists, withholding judgment in the interest of facilitating understanding. Nevertheless, I did not (and still do not) share their beliefs. Thus, when I asked questions about their views on evolution, I found their answers unsatisfactory.

As noted in the Introduction to this dissertation, the differences between my position on evolution and those of my interlocutors were a challenge to be overcome. During discussions with creationists, it was not clear to me whether I ought to point out the problems that I saw with their arguments or claims in the interest of clarity, or whether I ought to minimize questions that challenged them. It was obvious, however, that pursuing either directly was an unworkable solution. If I were too lenient about challenging questions, then they would have no opportunity to convey the depth of their logic. However, if I were too engaged with challenging them, the dialogue would quickly come to obsess my thoughts in pursuit of a never-ending and extremely frustrating debate. While balancing these strategies was difficult, the outcome was ultimately productive in giving me an opportunity to reflect on the nature of our disagreement. And as should be obvious at this point, that nature goes well beyond the ideas themselves.

I had a number of personal conversations with pastors on the topic of evolution and creation. In person, these dialogues were always entirely genial with a limited number of challenges. I also had a few email exchanges with self-identified creationist. These dialogues were originally intended to gain a better understanding of creationist claims and arguments, and they did generally accomplish that goal. However, they were also carried out in a social context in which two people, myself and my interlocutor, disagreed fundamentally about reality. As an ethnographer, I wanted to plumb the depths of their arguments. As evangelicals, they wanted to convince me that I ought to accept the evidence for God and His role in Creation. As such, they serve as convenient, firsthand examples of what beliefs do in practice. Thankfully, these insights came to me only after I had spent a good amount of time exchanging with creationists.

Following two rounds of emails with a creationist I’ll call JR, both of which had devolved into an all-consuming exchange that left me emotionally and intellectually frustrated, I began to reflect on the reasons my efforts to simply better understand JR’s points of view were so unsuccessful. Thinking back through these exchanges, it occurred to me that they followed a basic script. First, they began always with a claim, typically with an argument attached to it, which threatened the integrity of the other person’s position. JR might send me an article claiming that carbon-dating methods were untrustworthy, and arguing therefore that fossils supposedly millions of years old could be only a few thousand, and thus consistent with a young-earth. Alternatively, I might send him a list of the lines of scientific evidence that support evolutionary accounts. Second, confronting this claim, I immediately began to find problems with it. I would investigate the publication to see if it was scholarly, the authors to see if they

were credible, and the links to see if the sources were trustworthy. In many cases I would receive a link to a web article making a host of claims, often without citations, and I would respond by Googling a few of the strongest claims and looking for existing rebuttals on websites such as talkorigins.org, rationalwiki.org and oldearth.org. Finally I would send back links to those rebuttals, usually with a summary of their points in the body of the email. Notably, JR seemed to do something analogous with the links that I sent him. He would send back links to additional arguments against claims that I had made. As each new claim required one or more counter claims, the lengths and density of content of these emails would quickly become unwieldy, such that reading and responding to all of it would become impossible. Ultimately, I would recognize that I would not be able to get the kind of personal views and reflections that I had sought, and that the conversation was going nowhere.

My goal was not to convince JR to accept evolution but to better understand JR's position. While I had hoped the exchange would give me a deeper knowledge of creationist thought, it actually seemed to merely reaffirm what I had already known based on reading creationist literature and visiting the Creation Museum. Because JR and other creationists have framed the argument as a choice between believing evolution and believing in the salvation of Jesus, they perceive only two options—Biblical creation and atheistic evolution. They are, naturally, aware of a supposedly middle path, where people who believe they are Christians claim to believe in both the Bible and evolution, but they tend to see this path as weak and compromising. For them, in many ways, these evolutionist Christians are worse than atheists, because they mislead the flock and confuse the debate. Not coincidentally, the "new atheists," like Dawkins and Sam Harris, also tend to sharply criticize these liberal Christians for confusing things. Because it has evolved in response to modernism and higher criticism, under fundamentalist-inspired apologetics (at least the apologetics I encountered through discussion with Baptist pastors during my research in Tennessee), if one part of the Bible were to be shown to be false, and particularly the very first book of the Bible, then the entire document would become suspect. By this logic, creationists like JR have constructed themselves into a room without exit. JR cannot come to accept that evolution happened without simultaneously, by implication, concluding that the Bible is not the Word of God. The stakes are therefore quite high in the effort to believe that evolution is not credible.

JR and I seemed inexorably fated to debate with one another, despite every conscious effort I could muster to maintain the position of ethnographer. In spite the friendly terms of our relationship, and of our mutual desire for understanding, we each failed at our goals. Just as I was unable to get JR to reveal his personal thought process when it came to evolution and creation, he was unable to get me to see his position as compelling. My questions aimed to prod JR into a deeper discussion and reflection on his ideas of evolution were interpreted by him as challenges that required rebuttals. My response to his efforts to convince me through appeals to scientific arguments was to find problems with those arguments, and to correct apparent misunderstandings of evolution and science. Why did we keep slipping into debate mode?

The insight came when I realized that I could use my own phenomenological experience of interacting with a creationist to understand JR's experience of interacting with an evolutionist. Both JR and I were interacting in a social context, locked into specific roles. We are prone to debate because we have few other options within our roles. JR's role is a kind of representative of the Baptist brand of evangelism, with its emphasis in the Bible as the ultimate empirical verification. In that role, he is motivated to project to me a kind of certainty. If JR has doubts, then he may choose not to reveal them to me, the researcher and disbeliever. If he revealed them,

then I would be able to report them to others. They could be made to serve as "evidence" that young earth creation science is not even fully convincing to young earth creationists. In short, it could be put to rhetorical purposes that would weaken his position. Early in our conversations, JL presented himself as logical to a fault. He said, for example, that he had to reject the position of theistic evolutionists because it involved too much mental gymnastics to reconcile with Genesis. He knows that the Bible is the Word of God, because scripture says that it is the Word of God. It is therefore most reasonable to conclude that whatever the Bible says about origins is what really happened. If most scientists believe a different account of origins, it must be because they are misled.

I, in turn, was acting out the role of a skeptic, ostensibly open to arguments and evidence for the creationists' claims, but ultimately motivated to dismantle those arguments and track down that evidence in the interest of analysis. This role was implied by my position as researcher. I had to consider how to frame JR's claims in a way that would be most acceptable to my community. This was made all the more difficult because he sought to claim scientific respectability for them. As a graduate student in anthropology, I am trained to see problems in argument and evidence, even among researchers who decline to claim the status of science. When I look at a creation-science article sent to me by JR, I am immediately struck by the differences between it and a peer-reviewed journal article. There is no presentation of data or analysis in the article, and the citations link to other creationist sources that have no data or that have been thoroughly rebutted elsewhere. They fail every test of a good source of information.

I noticed that JR was never convinced to abandon his sources, no matter how I criticized them. He was never persuaded by my sources, no matter how scholarly they were. We each imagined we were marshalling evidence to our positions, but the fact of the matter was that neither of us was able to produce something that was convincing to the other. In retrospect, our mutual ineffectiveness was practically assured. Given our roles, we could not, of course, have accepted one another's claims. But we were also ineffective because we were only able to offer mere text rather than actual evidence. I sent articles and university webpages that asserted specific facts about the world, but the evidence existed only insofar as authors of those texts could be trusted. I couldn't send him actual physical evidence because I didn't have access to it. Even if I were able to get JR into the presence of some fossil specimen, this would hardly have constituted evidence for evolution in itself, since it is the larger picture we get from a host of fossils from all over the world that is most compelling. Thus my challenge was to access and present to him a vast array of actual physical evidence along with the skills to understand that evidence and the reasons for understanding it that way. Not only would this be absurd, but it raises another issue: I have not myself seen physical evidence that proves in and of itself that evolution occurred. I am certainly aware of the evidence, as reported by the experts who discovered, analyzed and interpreted it. I am convinced that this evidence is compelling, partly because it makes sense as described to me, but mostly because I trust the scientific process by which scientific experts were all convinced that it was compelling in the first place.

Meanwhile, JR put his trust in the young-earth creationist organizations that produce documents meant to make creationism seem more scientific and reasonable than evolution. He was convinced of their reliability not based on the process that produced those documents, but instead on their consistency with his received understanding of scripture. JR is active in a Baptist church, and like all Bible churches, Baptists encourage constituents to lean heavily on the Bible as evidence for God's existence. Like many evangelicals, JR also tended to pursue alternative media sources—Christian radio, Christian television programming, Christian music, and

websites. Such media is significant not only for signaling commitment to others in the community, but also as a way of filtering and transforming events and cultural touchstones into something consistent with and capable of reinforcing a Christ-centered worldview. JR measures the sources he sends to me by the yardstick of conformity to these other materials. To the extent they are consistent with these various messages, they seem to him to be convincing.

It seemed to me at first that living in the modern world as a creationist and convincing oneself that the claims of creationism are true ought to demand excessive energy—constantly needing to revise mainstream scientific reports, to ignore new scientific discoveries consistent with evolution or an ancient earth. They would seem to be barraged by an evolutionary worldview in science museums, at the zoo, in the news, and on television. Surely, I imagined, they must be exhausted by constantly needing to deny consensual reality.

I eventually realized that such efforts would be necessary only in my own social world, not theirs. A creationist does not confront evidence for evolution on a daily basis because he is not surrounded by people and media that present this evidence. His social network regards such evidence with as much suspicion as he does. When confronted at all, any such examples of “evidence” are experienced as false or misrepresented claims. Instead the creationist finds himself surrounded by evidence for creation or divine design. He does not receive daily emails from scientific journals, the New York Times or NPR. He gets his messages from the Institute for Creation Research, Answers in Genesis, Apologetics Press or the Discovery Institute, which present scientific discoveries in a light favorable to an argument from design. A creationist is not buying and consuming books that assume or confirm an evolutionary worldview, but rather consuming books that deny it. Their worldview, which its inhabitants call the “Christ-centered Worldview,” is, in other words, made possible and believable by virtue of an epistemology situated within their social world.

When a creationist does encounter accounts favorable to evolution, he has tools at his disposal to act against them. These tools, in fact, are not especially different from those people well-disposed to evolution use when confronting creationist claims. The only real difference is their respective orientation to competing claims for truth. When I or any other “evolutionist” hears a creationist argument citing some supposed evidence that undermines evolution, I pursue a range of activities. I first tend to assume that the evidence is somehow problematic. I search for affiliations that impugn the source of the information or the author. I use what I “know” are facts to contradict the opposing claims. When the evidence or argument is unfamiliar to me, I go online to visit websites and experts that I believe are trustworthy, based on whether their claims are consistent with what I “know.” Through conversation and discussion with creationists, it became clear that they do exactly what I do when they hear an evolutionist argument citing some supposed evidence undermining creationism or supporting evolution. They consult different facts, different trusted websites and experts, but otherwise the response is the same. Verily, I regard my sources as superior to theirs, but so, in the end, do the creationists.

In short, JR and I were doing the same things in our debates. As noted, we each were compelled to defend our positions, even when it conflicted with our goals in the exchange. We followed a similar pattern of responding to the other. We each tried to appeal to trusted authorities and cited texts as evidence. Though I disagreed with JR over an account of origins, I agreed that the account was important. What we were each doing was engaging in the activity of believing. JR believed by defending his position, and I believed by defending mine. And if we were finding it impossible to break out of our doomed struggle, then why would anyone expect students and teachers to fare better?

Conclusion

Antievolutionists going back at least to William Jennings Bryan have worried about the possibility that teaching evolution to students destroys their faith (Lienesch 2007; Numbers 2006). One 8th grade science teacher told me that she did not think it was a good idea to teach evolution to 8th grade students since it could weaken their faith in the Bible, leaving them without moral foundation during adolescence when they need it most. Implicit in this concern about “teaching evolution” is that the act itself *causes* belief change. The act has agency that slips into student minds and changes them. When taught by a certified teacher in a public school, without any rival explanations of life, evolution is imbued with enough clear authority that students are compelled to accept it.

Many of the evangelical Christians with whom I spoke expressed to me the belief that if evolution is “balanced” with creation, and “creationism is taught right,” then students will choose to believe in creation instead of evolution. In other words, given the correct information, students will know that evolution is false. One Baptist pastor told me⁴⁴ that he doesn’t understand why evolutionists have a problem with teaching both sides because, if their theory has so much support, then they should be confident that children will choose it. Like most others I encountered who rejected evolution, this pastor accepted science as a form of legitimacy to the point that he would emphasize correspondence between scientific facts and the Bible in order to *prove* that the latter is accurate. Many people claimed that Creation has evidentiary support and/or that evolutionary theory is inconsistent with evidence and logic. Thus, being “taught right” would include presenting *scientific* evidence or argumentation for Creation or against evolution. The trouble, from the perspective of creationists, is that the public schools will not teach “both sides.” They believe that the institutions are biased in favor of evolution, and the law of the land is that creationism is not to be taught. Under this presumed scenario, creationist parents must fight an uphill battle against mainstream and public schools in order to be sure that their own children will believe as they do.

Recognizing that belief *is* an activity, and that stating beliefs constitutes both belief and practice, permits us to adapt Rappaport’s insights on ritual into an arena that may at first seem to be very different. As Rappaport argues, everyone who participates in the ritual (with apparent good faith) signals acceptance of the system on which it is based. The same acceptance obligates these participants according to their assumed roles in the system. The performance of beliefs could be considered analogous to Rappaport’s rituals, obligating the performers to their defense in the face of contradictory facts or challenges. For evangelicals, the importance would not actually be the *belief* in a six-day creation, but rather the *practice* of affirming it while denying evolution. Furthermore, a teacher’s coverage of evolution matters because it constitutes a public act in official buildings, implying that it is condoned by the Public. Being of the Public, teachers and students and parents and others in the community who recognize the significance of the Policy must respond by either accepting (explicitly or implicitly) or denying it. As we will see in chapter 5, anti-evolution activists may object to the teaching of evolution by writing letters to public servants and media outlets, politically supporting those who will also publicly oppose these ideas, and produce and circulate articles that claim to refute naturalistic accounts of evolution. Chapters 6 and 7 illustrate how teachers and students, respectfully, also confront evolution and feel compelled to signal their acceptance or rejection in classrooms. A signal could be a comment in class, an answer on a test, or even a response on a research instrument.

⁴⁴ July 22, 2008

Notably, a similar investment of special significance to what occurs in science classrooms also occurs among academics and other advocates of teaching evolution. I heard many reactions to the specter of teaching creation from people in my own social circles in Nashville, who are frequently situated in academia. Most of these people find the revelation that many people believe in creationism and a young-earth to be amusing but not necessarily unsettling. After all, it is generally acknowledged that people have the right to believe whatever they like as long as they are not hurting others. However, they are more unsettled, if not outright offended, by claims that creationism is scientifically credible. The apex of offense is when they learn that creationism is taught as being scientifically credible in science classrooms. This is an offense that animates people to express anger, ridicule and shock. In contrast to their counterparts in Scotsboro, my interlocutors insist that, were they to learn something like this were going on in their children's school, they would certainly contact the school and demand that it stop.

In many cases, people are willing to permit these ideas to be taught elsewhere in the school, such as in a social studies class (cf. Binder 2002). Clearly the concern is not that students will hear about the creationist claims. The concern is that they will hear it from an authority figure standing in a science classroom. This crosses a line which could be conceived as a boundary between the sacred and the profane. In the controversy over creationism in schools, *the* science classroom is considered to be hallowed ground. It may seem odd to talk about sacredness with regard to science. According to the "disenchantment" theory, the whole point of science is that it treats nothing as sacred. Indeed, this is one of the main differences between science and religion. However, Durkheim's thesis in *Elementary Forms* is that all social phenomena are based in religion (Durkheim 2001). For most educated secularists, the symbols of science are sacred, and any act of abusing those symbols, for example to legitimate a demonstrably nonscientific claim, is an act of sacrilege or profanity. It could be argued that certain spaces are sanctified as being for science only: science museums, journals, science classrooms, laboratories. The science classroom, in particular, is set apart in the discourse, even codified into civil court precedent, and maintained as a kind of sacred space where "religion and superstition," is not permitted because they are considered a profanity of the sanctity of science.

It is critical to keep in mind that the perceived and experienced conflict between evolution and creation in public schools is constructed on two sides. At the same time that people act to reject evolution, there are also teachers, academics, policy-makers, and engaged citizens who want evolution to be taught well. In the same way that asserting the historicity of the creation account in Genesis is an index of true Christian faith, displaying a commitment to teach evolution is an index of scientific literacy and modern-thinking. Chapter 4 will delve into these ideas in order to examine how Tennessee's science framework of 2009 came to include its evolution content.

Chapter 4: Biography of Standard 5, Part I

Background on Standard 5

When the Board of Education approved the Tennessee Science Framework in 2009, including Standard 5: Biodiversity and Change, which focuses on evolutionary concepts, they did it in spite of widespread sentiments critical of teaching evolution. As noted in Chapter 2, opposition to evolution began as early as the first quarter of the 20th Century in Tennessee. It would be a gross misrepresentation to say that all Tennesseans reject evolutionary theory, but the issue nevertheless remains highly controversial. By one estimate, less than 24% of Tennesseans support the idea of teaching evolution without also tempering it with alternative explanations like creationism or Intelligent Design Theory (Berkman and Plutzer 2010).

Though the Science Framework is written by experts in the Department of Education rather than elected officials, the process is overseen by political actors and its results approved democratically. Both the Education Commissioner and the Board of Education are appointed by the governor, and all are subject to laws and decrees of the General Assembly, a body of elected representatives that makes laws for the state. None of these actors has an interest in attracting the ire of that proportion of the public opposed to evolution. Consider that, in his study of evolution standards in every state across the nation, Gibson found a significant correlation between emphasis on evolution in the standards and public opposition to evolution, measured by affiliations with evangelical denominations with commitments to scriptural inerrancy (Gibson 2004). Given the political realities in Tennessee, the emergence and expansion of a state science education standard dedicated to biological evolution in middle school grades requires some explanation. This chapter aims to provide such an explanation, based on interviews with the authors and a content analysis of publications consulted by these authors. The subsequent chapter will complete this account, by examining how opposition to evolution eventually surfaced and affected the outcome.

The story of Tennessee’s evolution standards begins at the national level with “standards-based education reform,” an education reform movement that began in 1983, after the publication of *A Nation at Risk*, a research report by the National Commission on Excellence in Education that claimed that educational proficiency was falling for students across the United States (1983). Standards-based reform emphasizes education standards, to establish common expectations that all students should meet, and accountability, to ensure that students are actually meeting those expectations (Settlage and Meadows 2002). As part of standards-based reform, states adopted education standards and initiated standardized testing. When the No Child Left Behind Act was passed by U.S. Congress in 2001, nearly every state in the union, with the exception of Iowa, already had education standards for kindergarten through high school (Atkin and Black 2003). The Act not only required states to develop sets of education standards for the three main subject areas—math, language and science—and mandated testing, it also connected a school’s funding to test scores. If a school’s students test below proficiency on the standards for three consecutive years, they lose funding and may be taken over by the state.

In the state of Tennessee, the document that sets the standards for science education is called the Tennessee Science Framework. Tennessee’s State Board of Education, an executive body comprising governor-appointed board members that carry out policies authorized by the Tennessee General Assembly, adopts a new Science Framework every 6 years, corresponding with the schedule for schools to purchase new textbooks and other curriculum materials. The

science textbooks are developed by publishers based on the Science Framework, so the state tries to ensure that the Framework is up-to-date before the textbook adoption process begins.

The Tennessee Science Framework is a special type of document. Only the introduction to the Framework is presented as prose-style text. The bulk of it is presented in table form. The framework is divided into sections, based on grade levels in kindergarten through eighth grade, and based on courses in ninth through twelfth grade. Each section for a grade level comprises a set of Standards, denoted by numbers. For example, Standard 5 is Biodiversity and Change over Time. The set of Standards for the eighth grade includes Standard 5, as well as Standard 9 (Matter) and Standard 12 (Forces of Nature) as well as two sets of "Embedded Standards," on Inquiry and Technology and Engineering.

Though No Child Left Behind mandates that states set science standards, it does not specify the content of those standards. States are permitted to develop this content on their own, though this process takes place against the backdrop of the discourse on *scientific literacy*. Scientific literacy was introduced as a goal through two publications from the American Association for the Advancement of Science: *Science for All Americans* (1990) and *Benchmarks for Scientific Literacy* (1993). According to the first of these publications, being scientifically literate consists in having the "understandings and ways of thinking essential for all citizens in a world shaped by science and technology" (AAAS 1990). Evidence that American students were not sufficiently literate in science was provided in the form of low U.S. test scores in science compared to other developed nations (AAAS 1990; see also Claeson et al. 1996).

Science for All Americans and *Benchmarks for Scientific Literacy* lay out the scientific knowledge and understandings deemed by its authors as most important, based on criteria including utility, contributions to social responsibility, philosophical value and importance to human history or pervasiveness in modern culture (AAAS 1990). One such idea was the Evolution of Life, which was included in *Benchmarks* as one of six major ideas necessary to understand the living environment.

Despite the fact that understanding evolution is only one of many scientific ideas identified by *Benchmarks* as essential to participation in the modern world, it is often inflated to occupy a grander place in the measure of scientific literacy. To support this prominence, many scholars have invoked a quote from Theodore Dobzhansky that "nothing in biology makes sense except in light of evolution" (Dobzhansky 1973). This quote appears again and again in research articles on teaching evolution (Cummins, Demastes and Hafner 1994; Jackson et al. 1995; Moore 2007; Rudolph and Stewart 1998), not to mention editorials on the topic (Wiles 2010). It also was paraphrased by the authors of the science framework in interviews. The position is that, in order to properly teach biology without making it seem like a disconnected set of facts and concepts, it is necessary to teach evolution as an organizing principle that makes sense of everything else that is taught in biology.

While compelling as a quote, Dobzhansky's words really only go so far in explaining how teaching and understanding evolution have become synecdoche for scientific literacy more generally. A more likely explanation comes from the fact that, more than any other major idea in modern science, evolution is the target of attack. In other words, the need to defend evolutionary theory is incentive to emphasize its importance. For example, the President of the Thomas B. Fordham Foundation, an influential think tank in education policy, wrote in the foreword to a report published by the Foundation decrying opposition to the teaching of evolution:

Who cares? Everyone who is troubled by the weak scientific knowledge and skills with which most young Americans emerge from school should care. Everyone who is alarmed

by the performance of U.S. students on international comparisons of science achievement should care. Everyone who believes that our country's future vitality and prosperity depend to no small extent on our scientific leadership and our respect for science itself should care. As Paul Gross clearly explains, to the extent that science classes are consumed by matters other than science, our children will to that extent emerge from those classes without knowing science or respecting truth. (Gross 2000)

The implicit value in this passage is scientific literacy, once again measured in test scores and student knowledge of science, and it is undermined when evolution is not taught as truth. If it is the case that teaching evolution becomes most important when people oppose it, then educators have a special incentive to be sure it is taught in Tennessee, which has wrestled with the topic since before the infamous Scopes "Monkey" Trial of 1925 up to the present day.

The Development of Standard 5 in the 2009 Tennessee Science Framework

In 2007 a new Science Framework was developed in which coverage of evolution, previously reserved for high school Biology courses, was expanded into elementary and middle school grades based on the theory of "learning progressions."⁴⁵ The idea of learning progressions refers to a curriculum strategy whereby more complex concepts taught in later grades build upon simpler concepts introduced in earlier grades. The learning progression or "conceptual strand" that corresponds with evolution in the Framework is Standard 5: Biodiversity and Change. The guiding question for this strand is: "How does natural selection explain how organisms have changed over time?"

Standard 5 is present from the Kindergarten science standards through the high school biology standards, though in elementary school grades students are mostly learning to notice differences and similarities among species, including species present in the fossil record that are no longer extant today. The concepts for Standard 5 are not brought together in a way that resembles evolutionary theory until Grade 8, though the extent to which that occurs is debatable. To understand why, it is necessary to examine both how Standard 5 is written and how it is interpreted by teachers. The latter will be discussed in the Chapter 6. In this chapter and the next, we will consider the process of developing Standard 5.

I have attempted to reconstruct this process as completely as possible in order to demonstrate the fact that "what the standards say" is actually a very complicated question, considering notions of intent and agency. When processing the behavior of agents, we talk about intentions, stemming from beliefs and desires (Leslie 2000). Sperber's epidemiological approach to representations likewise presumes an agent who intends to transmit an idea to others. How can we conceive of agency and intent in the establishment of policy such as the Science Framework? Where do we locate the relevant beliefs and desires? In what way were the intentions of the individuals that work in the name of the state, such as the bureaucrats at the Tennessee Department of Education, relevant in this process? In order to answer these questions, I examined multiple drafts of the 8th grade science standards from 2007 and interviewed several of the people involved in the process of their development. This account is far from complete, due to the fact that the interviews took place nearly three years after the Standards were developed.

⁴⁵ According to the "User's Guide to the Tennessee Science Curriculum Framework" (accessed from http://www.tn.gov/education/standards/science/Users_guide.pdf on July 30, 2014) this was the first Framework based on the concept of learning progressions.

Multiple testimony and comparison to documents helps to ensure accuracy, but some details were simply unavailable.

According to Linda Jordan, science coordinator for the Tennessee Department of Education who oversaw most of the process, the Tennessee Science Framework approved in 2007 was precipitated by two situations. First, the science standards were due for their six year revision. Second, Tennessee had entered the American Diploma Project, which required a substantial overhaul of all of the state's education standards including the three major subject areas (Jordan, Aug 16, 2010).

The American Diploma Project is an initiative created by Achieve, Inc., a non-profit organization comprising governors and corporate leaders, dedicated to standards-based education reform⁴⁶. The American Diploma Project established recommended standards for Mathematics and Language Arts, though not for Science. The Achieve organization would later be responsible for developing the Common CORE standards in Math and Language Arts, and the Next Generation Science Standards, released in 2013. The American Diploma Project established minimum requirements for high school graduation that included three mathematics courses, four language arts courses, and three science courses, three and a half social-science courses and two years of a language other than English (ADP 2004).

The motivation for Tennessee officials to join the American Diploma Project was quite clearly economical. The guiding principle for the Project is to ensure that high school graduates have the skills needed by *employers*. This emphasis on employers is important because the educational overhaul that involved re-developing more "rigorous standards" in Math, Language Arts and Science was promoted publicly as a means of attracting jobs to the state. For example, articles in *the Tennessean*, the major newspaper in the capital, emphasized the importance of strong standards in order to attract hi-tech industries (e.g. Mielczarek 2008). At the Tennessee Science Teachers Association conference in 2010, a spokesperson from DuPont (a company with a presence in Middle Tennessee) endorsed the Diploma Project in his keynote address, emphasizing the importance of rigorous standards for making Tennessee attractive to industry⁴⁷. Similarly, a Powerpoint presentation available through the Department of Tennessee's website described the American Diploma Project by emphasizing the role of corporate leaders in the Project and the aim of ensuring that graduating students are viable employees, which makes the state more competitive in terms of attracting jobs⁴⁸. A portion of this Powerpoint was shown at a Rotary Club meeting at my East Tennessee field site, delivered by the Assistant Director of Schools in Fall of 2008,⁴⁹ and it is likely that the same Powerpoint was shown in many more places throughout Tennessee.

The Yates Committees

Once the governor and his education commissioner initiated the education overhaul entailed by the Diploma Project, the task of revising the Framework was assigned to Dr. Sharon Yates, a special assistant to Keith Brewer, who was the Deputy Commissioner of the Tennessee Department of Education at the time. I interviewed Dr. Yates in 2010 in her office on Peabody campus at Vanderbilt University, where she was serving as a literacy specialist and lecturer. Before working at the Tennessee Department of Education, she worked for the US Department

⁴⁶ <http://www.achieve.org/our-board-directors>

⁴⁷ Field notes.

⁴⁸ Accessed from <http://www.tn.gov/sbe/TDP%201-23-08.pdf> on July 29, 2013.

⁴⁹ Field notes.

of Education and the Ohio Department of Education. When she left the TDoE, she lectured at Lipscomb University briefly, and then assumed a lecturer post at Peabody Teacher's College.

Yates' role in developing the new standards was that of facilitator. She organized committees and persuaded the TDoE to provide funds for lunches and to offset costs to participating teachers. To organize the committees, she solicited resumes from teachers, principals, directors and higher education faculty, and selected them based on specialty in a subject area, experience writing standards, and ability to work with others. She also admitted a political element to the selection, stemming from pressure to follow the recommendations of certain school directors. She then created "teams" of teachers and specialists for each grade level. These teams were created according to a process she described as "democratic," whereby members were meant to represent various regions of the state and diversity in gender, race and ethnicity.

After producing drafts of the new standards, the committees were disbanded, and the drafts were turned over to the curriculum specialists at the Tennessee Department of Education, of which there are three, each corresponding to a subject area. The mathematics and language arts standards were discarded when they returned to the Department, but the science coordinator Linda Jordan claimed to have used most of the science standards developed by the Yates committees. This decision by Jordan was described by Yates as "honorable," considering the work that had been accomplished by so many teachers around the state. Jordan explained her adoption of this early draft in similar terms:

We wanted to honor everything we could that the teachers had done on those writing committees so we kept what we thought was congruent and comprehensive and made sense, and then added in the technology and engineering embedded standards as well as the inquiry embedded standards. (Jordan interview, August 17, 2010)

Given that Jordan described the initial draft from the Yates committees as an important base on which to build, it makes sense to examine that draft in as much detail as is available. Through sheer luck, I managed eventually to secure a copy of the draft for the 8th Grade standards.⁵⁰ Before then, I was also able to interview Virginia Cooter, the chair of the committee in charge of middle school science for the Yates draft, in order to record her account of the process.

At the time I interviewed Cooter, she was a middle school science teacher in Greene County, Tennessee. She was active in several professional organizations, including the Tennessee Science Teachers Association (TSTA) and National Science Teachers Association (NSTA). She was effectively a local expert on earth science education, having served as President of Tennessee Earth Science Teachers (TEST) in the past. She had participated actively in the Tennessee framework for several iterations, working with Jordan during the development of the 2001 Tennessee Science Framework, which was being replaced by the 2007 Framework.

According to Cooter, the older 2001 Framework was used as the starting point for the 2007 Framework. The committee chaired by Cooter started with the former Science Framework and sought to address specific problems, some of which were perceived by members of the committee, and others were identified by third parties. One problem, identified by a report on the National Assessment of Educational Progress (NAEP) conducted by the National Center of Education Statistics (NCES), part of the U.S. Department of Education, was that the Tennessee Framework did not explicitly emphasize "inquiry" and did not include embedded technology and

⁵⁰ Neither Linda Jordan, Sharon Yates, nor Virginia Cooter saved the initial drafts from the Yates committees, which is not surprising given the passage of time (nearly 3 years at that point). By apparent coincidence, more than a month after our interview, Linda Jordan found a copy attached to an old email and sent it to me.

engineering standards. Another issue from that same NAEP report was that the Framework had been criticized as not being sufficiently rigorous, so the committee endeavored to improve the rigor by adjusting expectations from students to include more higher-order thinking. Finally, from Cooter’s perspective, certain grades, like Grade 8, had a disproportionate number of science standards, compared to other grades. These standards included two major topics in physical science (11. Forces and Motion, and 13. Interactions of Matter), one in earth science (9. Earth Features) and three in life science (2. Interactions between Living Things and Their Environment, 4. Heredity and Reproduction, and 5. Diversity and Adaptations Among Living Things). She sought to reduce that number in order to make it more manageable for teachers, and to allow them to spend more time on particular topics.

The counterpart of the evolution standard in the 2001 Framework, was Standard 5: Diversity and Adaptations Among Living Things, governed by the central theme “that living things have characteristics that enable them to survive in their environment.” While adaptations were clearly the focus in this standard, classification and relatedness among species were also included. For Grade 8, the Learning Expectation for this Standard 5 was that students should be able to “identify characteristics used by scientists to classify organisms into different categories.”

The draft of Grade 8 Standards produced by the middle school science team retained several of the Standards from the 2001 Framework, including the earth science standard and the two physical science standards. Reflecting the intention to address the problems mentioned above, the middle school science team deleted two of the life science standards: Heredity and Reproduction, and Diversity and Adaptations. They also added a standard for Inquiry.

The surviving life science standard on this early draft was focused on ecology and titled “Interactions between Living Things and their Environment.” It comprised five components, each of which also had 1-3 State Performance Indicators (guidelines used to formulate test questions for each component on state standardized tests). I have included all five components below:

- 8.5.1 Predict organisms with similar needs may compete with one another for resources including food, space, water, air, and shelter.
- 8.5.2 Evaluate how organisms may interact with each other in several ways such as producer/consumer, predator/prey, or parasite/host relationships.
- 8.5.3 Verify that food provides fuel and building material for all organisms, which can be stored or consumed by another organism.
- 8.5.4 Analyze the eight major biomes of the world (fresh water, ocean, tundra, coniferous forest, deciduous forest, tropical rainforest, grassland, and desert).
- 8.5.5 Categorize the biotic and abiotic factors in the environment.

Based on these components, it is clear that evolution was absent from this early draft. In order to understand why, it is possible to scrutinize the draft alongside what is known about the committee. The committee itself comprised two higher education faculty and four middle school science teachers. We unfortunately have information only on Virginia Cooter. However, given her position as chair of the committee, along with her substantial experience with writing standards, it reasonable to expect that her influence was substantial. During the interview, she indicated specific interest in each of the themes represented in the standards that were retained. First, Cooter demonstrated considerable interest in the earth sciences, reflected in sustained activity with the Tennessee Earth Science Teachers and substantial experience consulting on earth science education. In this light, retention of the earth science standard makes sense.

She also indicated a great deal of interest in ecology. For example, most of the examples she mentioned from the life sciences concerned biodiversity and its importance to the survival of a given species. When I asked her what she hoped her students leave her classroom knowing after she covers Standard 5 from the 2009 Framework, she took a minute to think and formulate her words before she answered: “That all living things are impacted by changes in the environment. And so we need to protect our environment and our resources. In other words, why it's important to maintain it.” She gave the example of the promise of gaining medicines from the rainforests. She then summarized her point: “we need to protect as much as we can for future generations. I guess I’m going more for the environmentalist view of it” (Cooter interview, September 13, 2010).

Furthermore, Ms. Cooter thought of “change over time” as being a much more general topic than biological evolution, expanding it to include many aspects of ecology. During our interview, she characterized the coverage of habitat succession in the sixth grade as an example of change over time. For eighth grade, she mentioned covering natural selection, and how it operates, but then focused her recall on examples of endangered populations with “small gene pools,” such as cheetahs, South American sea lions, and Florida panthers, suffering genetic diseases. She claimed that these problems were “due to a change over time” (Cooter 2010).

Finally, Cooter specifically mentioned that the physical science standards were included out of consideration for an advanced 8th Grade science course offered in Metro Nashville Public Schools that focuses entirely on physical science. By concentrating Grade 8 standards in the physical sciences, students who take this course would still be able to cover most of the Grade 8 standards, which is important since such students are nevertheless still required to take the state standardized test for Grade 8.

It is tempting to hypothesize that the near absence of evolution from this early draft resulted from concerns or prejudice about evolution among the members of the middle school science committee. The fact that Cooter attends a Baptist church and speaks openly about her faith, for example, seems at first to support such a hypothesis. However, throughout the interview, she gave no indication that her religious beliefs could have played a role in avoiding evolution coverage in eighth grade. She reported teaching evolution as a high school earth science teacher in the past. Asked whether she sees any conflict between her faith and science, she was unequivocal: “No, I don't. Because I feel like as a science teacher I probably appreciate more of what God has created because I see all of the diversity, and it just amazes me, totally amazes me, that he would give us so much variation.” In fact, she reported telling incredulous students that she is comfortable with what science tells us about the past because she thinks that God created the world in *His own way* and *His own time*. The implication is that evolutionary processes were God’s chosen means of creation. She says that “science is about figuring out what God did” (Cooter 2010).

There is also some evidence from the draft itself that undermines the idea that evolution could have been excluded based on prejudice. Specifically, one of the two State Performance Indicators for Standard 8.5.2 on the draft requires students to “Distinguish among co-evolutionary processes such as commensalism, parasitism, mutualism.” Obviously, this Performance Indicator is built on the assumption that species do not merely evolve, but actually co-evolve, in relation to one another. At the most basic level, the very use of the term “co-evolutionary” indicates that the authors of the draft were not averse to referring to evolutionary processes.

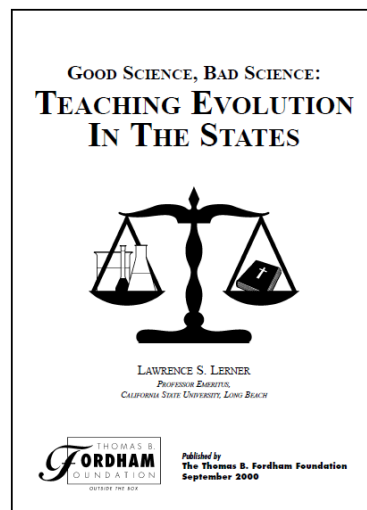
In the end, there is a much simpler explanation of how the initial draft of the Grade 8 Standards ended up with less coverage of evolutionary concepts than the preceding Framework. In the older Framework, the Diversity and Adaptations standard was possibly the least coherent item among all those specified for Grade 8. It would have required substantial additions to develop into something that could be conceived as a foundation to build upon in Biology I. By contrast, most of the pieces for Interactions between Living Things and their Environment were already present, albeit poorly organized in the old Framework. The committee saw its task as editing down the Grade 8 standards in order to make it possible for teachers to go into more depth. In that situation, they chose to use their time efficiently. They kept what was strongest and pruned away the loose strands.

Regardless of the reasons for it, it is the case that evolutionary concepts were missing in the Yates draft for Grade 8 science. If we want to explain how the evolution standard was developed in Grade 8, it is clearly untenable to suggest it was simply carried over, through mostly bureaucratic inertia from the 2001 Framework into the 2007 Framework. On the contrary, Linda Jordan and her unnamed editors must have themselves introduced a version of the standard that was focused on evolutionary change. Through interviews and analysis, I was able to identify two outside sources of influence for including evolution. The first source of influence came from the national attention given to evolution standards in each state, which included severe criticism of states that treated evolution lightly. The second came from sets of recommended science standards produced by scientific organizations. Understanding these motivations requires some background, and I will discuss each in turn.

National Attention

Reflecting the overall tendency to emphasize evolution as a window into scientific literacy more generally, in 2000, the Thomas F. Fordham Institute, a think tank that advocates for standards-based education reform, published “Good Science, Bad Science: Teaching Evolution in the States” (Lerner 2000). Lerner, the author of the report, examined science standards in every state except Iowa (which had no standards at the time), and evaluated their coverage of evolution based on a set of eight criteria including the explicit mention of the term “evolution,” treatment of biological evolution, deep geological time and cosmic origins, and a lack of “creationist jargon.” Lerner did not select these particular criteria based on recommendations from education researchers. Nowhere did he mention trying to ensure that the evolution standards would be effective in guiding teachers toward instruction that would address student misconceptions, for example. Instead, he selected criteria based on what they suggested to him regarding the activity of antievolutionists.

Based on how its standards scored on this rubric, each state received a letter grade modeled after traditional U.S. grading systems (A: “Excellent,” B: “Good,” C: “Satisfactory,” D: “Unsatisfactory,” F: “Useless or Absent,” and F-: “Appalling.”). A dozen states received a grade of F, including Tennessee. In fact, Tennessee’s overall score was 2%, lower than every state except Kansas, which received a negative score and an F-. Excerpts from Tennessee’s standards were even spotlighted as particularly egregious examples of poor standards with the caption: “Tennessee’s nontreatment of evolution is an embarrassing display of ignorance.” The



incoherence of the excerpts are clear even without Lerner's patronizing addition of "sic" to point out errors:

Small changes in an ecosystem can potentially effect [sic] the entire biosphere. develop a natural, uninhibited, rate of change. [sic] Some changes in organisms may be predicted using genetic inheritance and other theories of system change. (quoted from Lerner 2000)

"Good science, bad science" was not intended to be merely informative; it was a normative document. The title alone makes it clear that there is a right and wrong way to treat evolution, and the grading system reiterates the point. Beyond that, morally loaded language is used to both praise and deride various states for their coverage. Kansas received the brunt of moral judgment, its standards summarized as "A disgraceful paean to antiscience."

Moreover, "weak" standards are directly linked in the report to the presence and activity of a maligned "antievolutionism," glossed by terms such as "creationists" and "ignorance." In fact, the cover of the report prominently features an image of a simple scale with test tubes on one side (representing science) and a Bible on the other. The report card system was explicitly conceived as identifying the presence of political opposition to evolution: "The grades given in this report for the treatment of evolution in state science standards reflect the extent to which states have resorted to the anti-evolution tactics sketched above" (Lerner 2000).

The assumption that creationists were behind every problem with the standards was further manifested in the way these problems were described. For example, Nebraska's standards are characterized as: "A decent treatment of evolution marred by the incursion of creationist notions." North Dakota's coverage is described as: "A minimal treatment of evolution rendered useless by the insinuation of creationist views." Elsewhere, Lerner suggests poor treatment of evolution is the intention of the state itself: "It appears that young Kentuckians are to be sheltered from any exposure to evolution and other dangerous words and theories." "Mississippi appears determined to keep evolution outside its borders." "We don't use that word in Oklahoma!" Lerner's working assumption is so entrenched that he retains it even when particular state standards seem to contradict it. Discussing Arkansas and Wisconsin, he notes:

These standards mention evolution in the context of biology but treat it so skimpily that the coverage is useless or nearly so. [...] It is hard to know the reason for this stratagem. Possibly, the standards writers hope to achieve a degree of scientific respectability while not ruffling creationist feathers.

Lerner simply assumed a connection between the presence of antievolutionism and weak evolution standards. The possibility that other factors could be relevant for poor standards was not considered, though some anomalies seem to suggest it. Specifically, Lerner's claims that weak evolution standards are a result of antievolutionism would predict a situation in which states have good overall science standards by default, and poorer standards concerning evolution.

His report conveniently includes results from another study he authored for the Fordham Foundation that graded each state for their science standards as a whole (Lerner 2000). Comparing the two grades, we see that nine of the states received an F for evolution standards also received an F for their overall science standards, suggesting that their poor evolution standards could be a symptom of a more fundamental problem with developing good standards. Curiously, ten of the states actually had grades for evolution standards that were *higher* than the grades for their overall science standards.

Tennessee's evolution standards similarly defy Lerner's assumptions. While the evolution standards were paltry, the rest of the science standards received an F as well. In the excerpts of the standards presented in the report, the problems clearly went beyond censorship,

involving sentence fragments and disconnected concepts. Nevertheless, Lerner summarized the standards thus: “It seems the Scopes trial is still underway in Tennessee. None of the sketchy biology coverage makes sense—but the rest of the standards are nearly useless, too.” In light of the overall problems with Tennessee’s science standards, it seems odd to have led by referencing the Scopes trial. Perhaps he could not resist reminding his readers of Tennessee’s past experience with antievolutionism, or maybe “an embarrassing display of ignorance” was precisely what he expected to see coming from the creationists that must be so active in the Scopes Monkey Trial state.

The special attention that Tennessee received in the report, along with the insinuations that states with poor grades are under the control of creationists, translated into political pressure to include evolution in future drafts of the Science Framework. In an interview, Linda Jordan referred with embarrassment to “The Fordham Report.” I asked her whether she takes these kinds of things into account when she writes the standards, and she replied, “If the Commissioner's office takes it serious, we take it serious. [...] If they get any bad reports anywhere on anything then they’re on you and they want you to respond to it.” In the case of “Good Science, Bad Science,” it was picked up by newspapers across the country, including USA Today (Marklein 2000). It clearly drew the attention of officials in Tennessee because a year later Tennessee approved new science standards that prominently featured evolution in high school biology. The next report from the Fordham Foundation, “The State of State Science Standards,” gave Tennessee a grade of B (Gross 2005). While this later report evaluated the entire science framework, rather than only evolution coverage, it reported an abbreviated evaluation of evolution specifically as well, and Tennessee’s evolution coverage earned it full marks (Gross 2005).

The science coordinator Linda Jordan, as well as many of her superiors in the Department of Education, would have been aware of this history with the Fordham Report. Indeed, Jordan pointed out to me that the bad grade Tennessee received in the Fordham Report continued to plague the Department well after its publication. She said that every few years, someone rediscovers the Report and it again catches the attention of education commissioner in office at the time, and she is made to “address” the problem all over again. Considering this situation, it is not surprising that a person in the position of Jordan would have immediately noticed that the draft of the Grade 8 science standards produced by the Yates committee was missing evolutionary theory and sought to correct this absence in order to avoid more potential negative press in the future.

Guidelines from Authorities

As a second external motivating factor, both Linda Jordan and Virginia Cooter made frequent reference to guidelines coming from nation-wide authorities on science. According to Jordan:

You have a set of standards that has been updated or revised according to generally what is happening on the national front. So we look at other state curriculum frameworks. We look at national standards. Those are pretty much the Bible that we go by. (Jordan interview, August 17, 2010)

Jordan and Yates contrasted two sources of recommendations for changes to standards: from teachers and from “experts.” When Sharon Yates established her committees for drafting the education standards, she was making an explicitly “democratic” effort to collect and empower recommendations from teachers. However, though Yates championed the idea of getting teacher input, she also recognized the limitations of relying on that alone: “You have to

know when their approaches are not appropriate or too old-fashioned, or represent a more traditional way of doing things that just is not supported in the research literature” (Aug. 30, 2010). This sense of balancing between the on-the-ground experience of teachers and the knowledge established through research was a frequent theme in these interviews with policy makers. It came up again later in the interview with Jordan, when she criticized the overzealousness of some advocates for teaching evolution by stating that they have “absolutely no understanding of the pressure that teachers can be under in small school systems,” followed by a reference to her own classroom experience teaching evolution in eastern Tennessee.

While many education policy-makers clearly recognize the importance of listening to teachers, they tend to regard this teacher input as less valid than input from larger, national institutions. Jordan mentioned several such institutional sources of input during our interview, including the NAEP science framework, the *National Science Education Standards*, produced by the National Research Council (NRC 1996), and *Benchmarks for all Americans*, produced by the American Association for Advancing the Sciences (AAAS 1993). While only NAEP actually assesses student achievement, all three documents establish science standards, and all were reportedly read closely by Jordan and her editors. Obviously then, in order to learn their relevance to the development of Standard 5 in the 2007 Tennessee Framework, it is important to examine what each includes on evolutionary concepts as part of the Grade 8 standards.

The National Assessment of Educational Progress (NAEP) would seem to be particularly relevant to the 8th grade standards because it is a national test that specifically assesses students in the 4th, 8th and 12th grades. Because it assesses students in every state in the U.S. using the same scale, it is the principle means of comparing the effectiveness of education for each of the states. The same NAEP science framework was in effect from 1996 through 2005. It was updated in 2009, well after the 2007 Tennessee Science Framework was written. Looking back at the 1996-2005 NAEP science framework, three subject areas were addressed: earth and space sciences (geology and astronomy), physical science (physics and chemistry) and life science (biology). The NAEP framework lacks much detail, but “change and evolution” was included among four “major concepts” in life science⁵¹. The concept of “change and evolution” included the following points:

- Diversity of life on Earth;
- Genetic variation within a species
- Theories of adaptation and natural selection;
- Changes in diversity over time.

These points are unfortunately quite vague regarding the precise ideas they mean to capture. For example, it is not clear what is meant by “changes in diversity over time.” Is this referring to the notion that evolutionary processes produce diversity of species? Is it meant to draw attention to mass extinction events, during which diversity decreased? Equally problematic, there is no clear link among the different points. Are students merely supposed to be aware of genetic variation, or should they know that genetic variation is crucial for natural selection to work? Are they merely supposed to know that Earth is biological diverse, or should they know that this diversity was produced by evolutionary processes? Notably, ideas of relatedness and even large-scale evolutionary change are not mentioned⁵².

⁵¹ <http://nces.ed.gov/nationsreportcard/science/lifescience.aspx>

⁵² NAEP provides sample questions on their website going back to 2000. Looking at the life science questions in Grade 8, it is notable that 20 of the 36 provided were primarily concerned with ecology. Fourteen were concerned with organisms and their cells. Only 2 questions provided were about evolution.

Like the NAEP, the *National Science Education Standards* (NSES) likewise groups concepts across multiple grades, giving recommended standards not for Grade 8 alone, but Grades 5-8. The NSES also divides science into three major content areas (earth, physical and life science). Within life science, five “underlying concepts or principles” are included: structure and function in living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, and diversity and adaptations of organisms. The NSES provides more detailed explanations than the NAEP in terms of what should be included under diversity and adaptations:

- Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.
- Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
- Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the earth no longer exist. (NRC 1996)

The last document, *Benchmarks for scientific literacy*, was often referred to simply as *Benchmarks* in interviews with Jordan and Cooter. Like the NAEP science framework and *NSES*, *Benchmarks* provides recommended standards for groups of grade levels rather than a set of standards for each grade. In *Benchmarks*, grades 6-8 are treated as a single group. By the end of 8th grade, students should have learned the following concepts:

- Small differences between parents and offspring can accumulate (through selective breeding) in successive generations so that descendants are very different from their ancestors.
- Individual organisms with certain traits are more likely than others to survive and have offspring. Changes in environmental conditions can affect the survival of individual organisms and entire species.
- Many thousands of layers of sedimentary rock provide evidence for the long history of the earth and for the long history of changing life forms whose remains are found in the rocks. More recently deposited rock layers are more likely to contain fossils resembling existing species. (AAAS 1993)

In *Benchmarks*, the authors paid careful attention to the order in which particular concepts should be taught. For example, after noting the difference between evolution, as the observable fact of historical changes in life forms, and natural selection, as the proposed explanation for how that change occurred, they state:

Students should first be familiar with the evidence of evolution so that they will have an informed basis for judging different explanations [such as natural selection]. This familiarity depends on knowledge from the life and physical sciences: knowledge of phenomena occurring at several different levels of biological organization and over very long time spans, and of how fossils form and how their ages are determined. (AAAS 1993)

On the same point, they continue:

Before natural selection is proposed as a mechanism for evolution, students must recognize the diversity and apparent relatedness of species. Students take years to acquire sufficient knowledge of living organisms and the fossil record. Natural selection should be offered as an explanation for familiar phenomena and then revisited as new phenomena are explored. (AAAS 1993)

It is notable that *Benchmarks* recommends focusing on evidence for evolution, specifically what creationists call “macroevolution” involving large-scale changes in life forms—which involves teaching the *most socially controversial* aspects of evolution in earlier grades, while saving the less controversial aspect—i.e. small-scale changes within a species, driven by natural selection—for later grades. To follow this recommendation would be much more likely to provoke opposition from antievolutionists, and thus would be politically unwise. Oddly and in spite of the authors’ own assertions, the actual benchmarks they recommend do not follow this pattern. Instead, concepts relevant to both evolutionary change and natural selection are introduced concurrently, beginning in the earliest grades and continuing through high school.

Table 1, on page 123, summarizes the concepts and principles recommended according to each of these documents (NAEP Science Framework, *NSES* and *Benchmarks*), and organizes them in a way that makes it possible to compare the degree of overlap and consensus among them. As can be seen, some concepts, such as extinction, natural selection and adaptation, appear consistently across all three documents. Other concepts can be found in only one of the documents. For example, only the NAEP Framework seems to note the importance of genetic variation for evolutionary processes to occur, albeit without any explication. Only *Benchmarks* notes that the fossil record provides evidence for changing life forms over time. And only *NSES* refers to the principle of common ancestry and uses it to explain similarities among living things. It is not, in other words, immediately clear how a synthesis of these disparate documents would even look. To find out, we turn to the draft that resulted.

Grade 8: Standard 5 — Biodiversity and Change (1st Draft, Aug. 2007)

We can augment the account of the process of standards development from key actors through examination of the documents produced through that process. The Tennessee Board of Education keeps archives of drafts submitted, allowing snapshots of the process. The first official draft to be submitted to the Board was not the draft from the Yates committees. In Linda Jordan’s account, most of the draft she received from the Yates science committee was retained, but they did make some changes. In her own words, “The biggest factor that my k-8 editors brought to the table was the addition of the embedded standards, because the content had pretty much already been established by the Yates committee” (Jordan interview).

By examining the document itself, the differences between the Yates draft and the draft that would be presented to the State Board of Education on August 10, 2007 can be precisely noted, and the content *did* change substantially, particularly regarding biology. While the portions of the 8th grade standards that focused on physical science, specifically Forces and Matter, were mostly kept as they were, the standard on earth science was removed, and the standard for life science was changed entirely from one that emphasized ecology to one that

Table 1: Comparison of Standards Documents

	NAEP	Benchmarks	NSES	TN Framework Draft 2 (GLEs)	TN Framework Draft 2 (SPIs)
Biodiversity	Diversity of life on Earth;		Millions of species of animals, plants, and microorganisms are alive today.	GLE 0807.5.5 Describe the importance of maintaining the Earth's biodiversity.	SPI 0807.5.4 Identify several reasons for the importance of maintaining the Earth's biodiversity.
Species can be organized into groups				GLE 0807.5.2 Identify various criteria used to classify organisms into groups. GLE 0807.5.3 Use a simple classification key to identify a specific organism.	SPI 0807.5.2 Use a simple classification key to identify an unknown organism
Evidence for common ancestry (homology and DNA)			Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.	GLE 0807.5.6. Cite various types of evidence that support changes in life forms over time.	SPI 0807.5.5 Analyze DNA information to make inferences about common ancestry. SPI 0807.5.6 Compare and contrast internal and external structures of a variety of organisms for evidence of common ancestry.
Fossil evidence for evolution		Many thousands of layers of sedimentary rock provide evidence for the long history of the earth and for the long history of changing life forms whose remains are found in the rocks. More recently deposited rock layers are more likely to contain fossils resembling existing species.		GLE 0807.5.7 Investigate fossils and sedimentary rock layers to gather evidence for changing life forms.	SPI 0807.5.7 Compare fossils found in sedimentary rock to determine their relative age.
Extinction	Changes in diversity over time.	Changes in environmental conditions can affect the survival of individual organisms and entire species.	Fossils indicate that many organisms that lived long ago are extinct. Extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.		
Genetic Variation	Genetic variation within a species			GLE 0807.5.4 Explain how genetic variation is associated with evolution and natural selection.	SPI 0807.5.3 Analyze data on genetic variation to associate biodiversity, natural selection, and evolution.
Natural Selection and Adaptation	Theories of adaptation and natural selection	Individual organisms with certain traits are more likely than others to survive and have offspring.	Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations.	GLE 0807.5.1 Analyze how structural, behavioral and physiological adaptations affect an organism's ability to survive in a particular environment.	SPI 0807.5.1 Analyze structural, behavioral, and physiological adaptations to predict which organisms are likely to survive in a particular environment.
Small changes lead to big changes		Small differences between parents and offspring can accumulate (through selective breeding) in successive generations so that descendants are very different from their ancestors.	Biological evolution accounts for the diversity of species developed through gradual processes over many generations.		

emphasized biological evolution. The overall format was also changed. The following discussion will focus directly on this new draft, identified in the Board archives as *1st Draft, Aug. 2007*.

Within the Science Framework, the standards for each grade level are demarcated. Each standard, including “Standard 5—Biodiversity and Change,” has five components. The first two are the “Conceptual Strand” and a “Guiding Question,” both of which appear in identical form throughout the K-12 Science Framework, for every grade level. According to the *User’s Guide to the 2009 Tennessee Science Framework*⁵³, the Conceptual Strands are “statements that express the unifying, ‘big ideas of science’ that all students should grasp after completing their K-12 science program.” For Standard 5, the Conceptual Strand is “A rich variety of complex organisms have developed in response to a continually changing environment.” Guiding Questions are intended “to give teachers and administrators clearly defined targets that they can use to sharpen and inform instructional articulation across the K-12 science curriculum sequence.” For Standard 5, the Guiding Question is “How does natural selection explain *how* organisms have changed over *time*?” (italics in original).

The next three components are “Grade Level Expectations,” “Checks for Understanding,” and “State Performance Indicators.” Each of these comprises a list of statements that refer to skills, abilities or activities that students ought to be able to complete. The statements each begin with a verb, and are implicitly preceded by a phrase such as “Students should be able to...” According to the User’s Guide, the authors intended all three of these components to be linked, albeit without a one-to-one correspondence. Grade Level Expectations, or GLEs, are “clearly defined statements of what all students should know and be able to do upon completing a particular grade level or course” (*ibid.*). Checks for Understanding are “suggestions” for assessing student learning in the classroom, such as “Create and use a simple classification key to identify an organism.” Finally, State Performance Indicators, or SPIs, are used by the state as a basis for state standardized tests. Key actors in the Department of Education emphasized during teacher training workshops, in interviews, and in the *User’s Guide* that they regarded the GLEs as the most important components in the standards, and repeatedly told teachers not to focus only on the SPIs, despite the fact that the latter would be the most important for state assessment. Because the Checks for Understanding were described specifically as “suggestions,” I will be ignoring them in the analysis of the Standard that follows.

In the first draft produced by Linda Jordan and submitted to the State Board, there are 7 GLEs and 7 SPIs for Grade 8 (TDOE 2008):

GLE 0807.5.1 Analyze how structural, behavioral and physiological adaptations affect an organism’s ability to survive in a particular environment.

GLE 0807.5.2 Identify various criteria used to classify organisms into groups.

GLE 0807.5.3 Use a simple classification key to identify a specific organism.

GLE 0807.5.4 Explain how genetic variation is associated with evolution and natural selection.

GLE 0807.5.5 Describe the importance of maintaining the Earth's biodiversity.

GLE 0807.5.6. Cite various types of evidence that support changes in life forms over time.

GLE 0807.5.7 Investigate fossils and sedimentary rock layers to gather evidence for changing life forms.

SPI 0807.5.1 Analyze structural, behavioral, and physiological adaptations to predict which organisms are likely to survive in a particular environment.

⁵³ http://tn.gov/education/standards/science/Users_guide.pdf

- SPI 0807.5.2 Use a simple classification key to identify an unknown organism
- SPI 0807.5.3 Analyze data on genetic variation to associate biodiversity, natural selection, and evolution.
- SPI 0807.5.4 Identify several reasons for the importance of maintaining the Earth's biodiversity.
- SPI 0807.5.5 Analyze DNA information to make inferences about common ancestry.
- SPI 0807.5.6 Compare and contrast internal and external structures of a variety of organisms for evidence of common ancestry.
- SPI 0807.5.7 Compare fossils found in sedimentary rock to determine their relative age.

Comparing the GLEs and SPIs on the Tennessee Science Framework draft to recommended guidelines from the NAEP Framework, *Benchmarks* or *NSES* is complicated by the fact that the latter are phrased in terms of *concepts* or principles that students are supposed to *understand*, whereas the former are phrased as *skills* that students should be able to *do*. It is nevertheless possible to identify common themes contained in the documents. The themes I identified were: 1. biodiversity, 2. classification, 3. evidence for common ancestry, 4. fossil evidence for evolution, 5. extinction, 6. genetic variation, 7. natural selection and adaptation, and 8. the idea that small-scale changes can accumulate and lead to large-scale changes. None of the documents included all eight themes, and only one of the themes is present in all four documents—natural selection and adaptation. A comparison of the documents along these eight themes is presented Table 1, on page 123.

By directly comparing across themes, it becomes clear that Standard 5 in this draft of the Tennessee Framework was not simply a blind aggregation of the recommended standards from NAEP, AAAS and the NRC. First, there are two themes featured in the recommended standards that are not present in Standard 5. Second, Standard 5 emphasizes classification, dedicating two GLEs to it, and yet none of the recommendations mention it. Third, despite the possibility of identifying common themes, the Tennessee Framework does not appear to use any of the same language as the recommendations, with the possible exception of a couple of terms—e.g. “genetic variation” and “common ancestry”—for which there are no obvious substitutions anyway.

The authors of the Tennessee Science Framework—Linda Jordan and her editors—thus appear to have used ideas presented in the recommended standards filtered through their own sets of sensibilities. They may, for example, have decided that extinctions were simply not all that relevant to conveying the concepts of evolutionary change. The idea that small changes lead to big changes, itself a direct contradiction of the creationist separation of microevolution and macroevolution, may have been deemed too confrontational. Classification may have seemed like an obvious link with earlier grades, which nicely leads into a discussion of common ancestry. There is, of course, no way to really know at this point. However, these discrepancies accentuate the importance of a third factor, in addition to expert recommendations and national attention.

Personal Agency of the Science Coordinator

We have already seen factors in play that would have likely motivated any bureaucrat charged with writing science standards to have included coverage of evolution and addressed particular themes. However, these structural factors only get us so far toward the resulting draft produced by Jordan and her editors. Based on the interview and supplemental information, it is clear that Jordan was motivated by personal factors, as part of her own professional identity, to ensure that evolution would receive coverage.

Earlier in her career, Linda Jordan was a high school biology teacher in Lenoir City, in eastern Tennessee and a middle school science teacher before that. Dr. Jordan drew on that experience in the classroom during our interview as a way of positioning herself to talk about strategies for teaching evolution. For example, she related the following in the context of discussing how some advocates for teaching evolution are unfamiliar with the context in which many teachers work:

The interesting thing about it was that I usually did all of the Biology I and the Biology II, and my counterpart picked up any extra sections we had. And if we were getting get in trouble, it was going to be one of her kids, and it was because she just matter-of-factly said, “This is the way it is, and I can't help it that you come from a background where your parents believe something different.” But I didn't present it that same way so that if anyone was going to get upset it was going to be one of her students. (Jordan interview, August 2010)

These statements by Jordan reveal several important things. First, she very easily can move from a position of speaking as state science coordinator to speaking as a biology teacher, suggesting the experience of teaching biology in eastern Tennessee is still relevant for her, and is part of her identity. Second, she believes that evolution can be successfully taught, as long as it is approached in a way that is sensitive to student backgrounds. Elsewhere, during the interview, she had elaborated on her own approach to teaching the topic:

But I know that if you teach biology and present it in the right way, you will introduce evolutionary theory or the ideas that support evolution all the way through, but you won't name it until you get to the end. Then you bring it back in and say evolution is what that's called, and by that point, if you've done your job right, the kid should say, “Oh, is that all this is?” Because they will understand it, they will have a sense of how important it is in the understanding of biological concepts. And so there's no question about why we're going into this. But if you just hit them with evolution right off the bat, and just say, “You're going to learn this because you have to, because it's on the test...” Unfortunately, a lot of our teachers do this: they get combative with students and it turns them off. They're not listening. I mean there they are; their eyes are open, but they're not tuned into what you're saying. (Jordan interview, August 17, 2010)

Third, she regards evolution as essential to teaching biology “the right way.” Evolutionary theory is not merely important, but an integral part of biology, effectively impossible to avoid:

If they are teaching genetics the way they're supposed to, then they're covering evolution. If they're studying interdependence the way they're supposed to, they're covering evolution. It's the thread throughout all the contents, so they're just fooling themselves if they think they can never touch it, because at the end of the day... if they're teaching it the way they're supposed to, all of that should be running through it. (Jordan interview, August 17, 2007)

Dr. Jordan drew on this belief in the centrality of evolution within biology to emphasize that it *should* be taught:

...because you at least want the ideas presented so that when they *do* get to biology, and if they go on into college biology or zoology—that's where I was really exposed to it—then they are already exposed to most of those ideas, and you can...they can build on that. They have some understanding of it, whether they want to embrace it or not. I would say to my students, “We're not here to try to change your value system or your moral compass. This is the idea that underlies biological concepts, and if you go to any college,

more than likely the professor is going to start from that standpoint and assume that you are familiar with these ideas. And if you don't have this background or this understanding, you're going to get lost." Especially in zoology, because it's all about evolution. (Jordan interview)

In the above excerpt of our interview, Dr. Jordan communicates the reasons she has for wanting evolution to be taught in high schools. To summarize her argument, understanding evolution is important for understanding biology, particularly for students who plan to go to college. She also mentions the idea that introducing evolutionary concepts in earlier grades gives students (or teachers) something to "build on" in later grades. Elsewhere, she used the term "learning progression" to denote this same concept, which she noted was a "buzzword" in education circles at the time. Dr. Jordan used learning progressions to defend teaching evolutionary concepts in middle school:

You have similar ideas being built up through the grade levels, and they just become more sophisticated each time they are taught. [...] It isn't any different than talking about cells and first starting off with parts of the whole and that you can take things apart and you can put them back together, but usually they don't function as well unless all the parts are together. You talk about that with kids in order to have some kind of understanding of what a cell is further down the road. In the same way, you have to introduce these concepts [about evolution] in early grades in order for them to have a foundation to build on, because if they have nothing to hook it to, then they're more prone to resist ideas that they've heard about at home shouldn't be embraced.

Notably, the theory of learning progressions is typically phrased in terms of teaching foundational concepts, and then elaborating and building upon those concepts as a student continues along a curriculum (Catley, Lehrer and Reiser 2005). The logic behind it is that students always enter the classroom with understandings and concepts. Teachers should be aware of student conceptions, so that they may reinforce the accurate conceptions while eliminating misconceptions (Carey 2000). Since students go to school year after year, it makes sense to begin this process of eliminating inaccurate conceptions and reinforcing accurate conceptions in earlier grades, so that students will, it is to be hoped, enter upper level classrooms with mostly accurate conceptions.

I pointed out to Dr. Jordan that many science teachers in middle school had poor understandings of evolutionary theory themselves. She agreed with me, citing the fact that the teaching licensure that most middle school science teachers have is a K-8 licensure, which does not require any special coursework in science or science education. However, as the following exchange shows, she did not think that teaching evolution with misconceptions was more harmful than not teaching it at all:

Jordan: Kids come to school with a wide variety of misconceptions and certainly misinformed teachers are one source of those misconceptions. There are teachers that don't really understand concepts themselves, but we're always going to have that. Physical science is probably the worst. I would bet you that most K-8 teachers don't understand physics concepts either. So, should we not teach it? I don't think so. We've got to have them *exposed* to the ideas anyway. We have probably a lot of misinformed teachers in all of the subjects, not just science, but I think it predominates in science because they don't understand underlying concepts behind the scientific ideas.

Me: And hopefully by high school or at least by college they will have figured those out?

Jordan: We just hope that we've given them *some kind of foundation* to build on. But if we stop teaching everything we think is not taught well in earlier grades there wouldn't be a whole lot left.

As noted above, the theory of learning progressions is normally concerned with making sure that students have *accurate* conceptions on which to build, in order to help students better understand difficult concepts. In this case, Dr. Jordan seems to be indicating that students merely need to have “some kind of foundation,” or be simply “exposed to the ideas.” Under a learning progression paradigm, where the goal is accurate student understanding, her argument does not really make sense. If students are given misconceptions in lower grades, then later instructors will only need to work even harder to correct them.

However, she does not actually say anything about ensuring that students correctly understand evolution. She instead points out that they need to understand that *evolution is important*. In the excerpt above, she states that the reason for introducing evolutionary concepts in early grades is “because if [students] have nothing to hook it to, then they're more prone to resist ideas that they've heard about at home shouldn't be embraced” (Jordan, pers. interview, 2010). Her focus is not on student understanding of evolution, but on student acceptance. Whereas theories of learning progressions are typically couched within “cold” conceptual change theory, Dr. Jordan is thinking about students as existing in a social milieu. Students may well get misconceptions from misinformed teachers, but they also see that ideas associated with evolution are important, at least within an academic context. By discussing the same ideas year after year, each time with more details and by a teacher with more knowledge, students are less likely to “resist” these ideas.

Thus, the science coordinator of Tennessee indicated in our interview that she was convinced that evolution is an important topic that ought to be covered, even in early grades where it cannot be covered sufficiently. She also explained to me specifically why the Science Framework itself ought to include explicit references to evolution and natural selection when these terms can cause so many problems. She spoke of the standards as a means of supporting science teachers who face local challenges to covering evolution:

My response to teachers has always been it's in the standards. It's going to stay in the standards; I'm not taking it out. No amount of pressure is going to make me take that out. That's content that needs to be taught. However, we all know that there are these little games that get played within districts but your best argument and best line of defense is the standards. (Jordan interview, August 17, 2010)

Here she recognizes the challenges teachers can face in some districts as well as a sense of duty she owes to support these teachers. The insinuation seems to be that she sees herself, in her position as lead author of the Science Framework, as a guardian defending the teaching of evolution in Tennessee.

This aspect of her identity is further demonstrated through relationships she has with a nation-wide network of evolution advocates. She served on a task force for the National Academy of Sciences in their 1998 publication *Teaching about evolution and the nature of science* (NAS 1998). She was in regular contact with Eugenie Scott, director of the National Center for Science Education, a watchdog group concerned with monitoring and opposing antievolutionist activities. In the past, she had participated in a yearly event at the University of Tennessee in Knoxville. The event is known as Darwin Day, and was founded by Maximo Pigliucci a former UT professor of biology and outspoken advocate for teaching evolution. This network would have given her a personal and professional incentive to work to ensure that

evolution was included and featured as prominently as possible in the Science Framework. In this light, the Fordham report and national standards may have served primarily to convince her immediate superiors and state officials to support her efforts, but her own motivation was rooted in a sense of professional identity and responsibility to others.

Finally, this discussion of Dr. Jordan's personal motivations illustrates how the idea of teaching evolution has come to supplant the original goals of scientific literacy: to understand important scientific concepts and theories. Just as the new, more rigorous Framework was conceived to project an image of Tennessee as a good location for companies with hi-tech jobs, the presence of evolution in that Framework shields the state from criticism on its dedication to promotion scientific literacy.

Conclusion

To summarize, this chapter has presented an account of the development of Standard 5 in the Tennessee Science Framework of 2007. By interviewing key players and analyzing the various drafts they produced, I have established that the inclusion of evolution was anything but accidental. Though the previous Framework had already contained some concepts from evolutionary theory in earlier grades, the first draft of the new standards had removed most of those elements in an effort to reduce the breadth of the standards and allow science teachers to provide more depth. Nevertheless, when the task of writing the Framework was passed to a new author, substantial changes ensured that evolutionary concepts would have a prominent place even in earlier grades than previously. The reasons for the inclusion of evolution involved national discourses about scientific literacy, with evolution as its primary emblem, all made more salient due to professional concerns of their lead author to represent herself and the state well.

The biography of Standard 5 is not yet complete, however. While apparently no actors at the state education policy level were opposed to the presence of evolution in the Framework, this attitude did not prevail elsewhere in the state. In a democratic system, we would expect public institutions like the State Board and Department of Education to act in accordance with the interests and desires of the people. In this case, the outcome was a struggle between those who believed it was in the people's interest to create strong science standards, which had to include biological evolution, and those who believed it was in the people's interest to prevent the next generation from being presented evolution as Reality or Truth. This is not a mere difference in priority between economic interests (attracting hi-tech jobs) and spiritual interests (preventing demoralization). Rather, it is a disagreement over what evolution education means for society. In Chapter 5, we will see the outcome of this struggle, focusing on what happened when this second draft was posted for public comments.

Chapter 5: Biography of Standard 5, Part II

Best Laid Plans...

When policy-makers and education experts devise standards or make recommendations, they too forget local contingencies relevant to implementation. Focus is given to children's developmental capabilities as they relate to the conceptual building blocks of important ideas. For example, Catley and his colleagues recommend a learning progression for teaching biological concepts, where basic ideas are learned in earlier grades and later concepts are built on top of those (Catley, Lehrer and Reiser 2005). Though theoretically such plans rest on sound logic and good research, they necessarily leave out important considerations. Local situations are not only relevant for the implementation of standards; they are also relevant when standards are actually being produced. In Tennessee, teachers are involved in the standards development process, and they have their own concerns.

Considerations based on practices in larger districts, such as Metropolitan Nashville Public Schools, can have impacts on the process as well. For example, MNPS includes a course for eighth grade students who test above average for their grade level, which is called Physical Concepts. Students in this course do not take eighth grade science, and their curriculum is not based on the 8th grade science framework. In order to ensure that these students can perform adequately on the standardized test, the teachers of Physical Concepts teach an abbreviated version of the standard 8th grade curriculum. In light of this situation, many of the 8th grade science teachers who weighed in on the Science Framework advocated for more physical science topics to be included for the grade, so that they would have less additional material to cover for the test. Mostly for this reason, the Science Framework implemented in 2009 included 3 standards for 8th grade science, two of which were physical science related, and only one of which related to the life sciences.

If the draft discussed in the last chapter had been approved as written, eighth grade science teachers would presumably dedicate one third of class time throughout the year to covering evolutionary theory. However, that draft was based mostly on expert recommendations. When the draft was submitted to the Tennessee Board of Education on August 10, 2007, the Board requested that it be posted to allow for public feedback. The Department of Education posted the draft on the state's web site to give the public an opportunity to review the Framework over a three month period before a revised draft would be due to the Board.

During that public review period, Linda Jordan and her editors received emailed comments from sixty people regarding the draft of the Framework⁵⁴. Slightly over half (32) were basically positive. Five of the comments, including two from higher education faculty in Tennessee, complimented Dr. Jordan on the changes to the Framework. Another 8 reported errors, ranging from typos and duplications to technical inaccuracies. Nineteen of the comments asked for clarifications of specific standards or asked questions about when the new Framework would take effect. One question concerned one of the Course Level Expectations in Standard 5 of high school Biology I. The teacher was uncertain how to interpret a phrase—"Associate structural, functional, and behavioral adaptations with the ability of organisms to survive under various environmental conditions"—and requested clarification.

⁵⁴ Dr. Jordan gave me records of all of the emails she received during this period of public review. My discussion in this section is based on these records.

The other 28 emails registered complaints about the new standards. Nearly all of these came from teachers and district curriculum specialists. The most frequent kind of complaint criticized the new Framework for giving teachers too much to cover or for requiring students to learn concepts that were too advanced for their age, based on ideas about mental development. A few were more general complaints about the fact that teachers had purchased course materials and invested time learning to teach concepts from the old standards. By shifting content from one grade level to another, these efforts are wasted, forcing teachers to “start all over” with new content. In one case, a school district had formed a committee made up of teachers and administrators, who conducted a review of the draft that resulted in several pages of recommendations. While the Grade 8 standards were referenced, there was no indication that teaching evolutionary concepts in middle school was a problem they perceived.

Only four of the sixty people who commented were critical of the inclusion of evolution in the draft of the Framework. These were the only messages from parents and others outside of systems of education. The first message was sent on August 27, 2007 from an anonymous citizen using an email server that could be traced to Morristown, in eastern Tennessee. The message follows:

As a Christian parent, I am curious about whether evolution will be taught my daughter and when? Also, from the information I have read, the unit on Earth sounds like the Big Bang theory. Will this theory be taught as well? Is this being taught from K-12, in bits and pieces along the life of their school years, so they too will never acknowledge that God is the creator of all life? If this is so, count my girl absent for those days because we believe in Jesus!! Also, why confuse a child anymore than they already are. (I recall being confused and did not “sort” this stuff out until my early 30s. I could not understand why God created us from monkeys.) I loudly applaud those teachers who will not teach this in their classrooms. Concerned TN parent

Several observations can be made. First, the message from Concerned TN Parent communicates several ideas about evolution education that have historically concerned fundamentalist Christians in the U.S. The letter-writer expresses concern about “the Big Bang theory” along with evolution. Though the scientific community regards the two theories as completely distinct, concerning entirely different phenomena, time periods and matters, in the minds of many evangelicals, these the Big Bang is closely associated with evolution because both theories posit naturalistic accounts of origins, of the universe and of human beings, respectively, which contradict a literal interpretation of the creation account in the first chapter of the *Book of Genesis*.

The effects of teaching these ideas are imagined to be twofold. On one hand, they are confusing for Christians who are taught that God created humans and the world. Concerned TN Parent recalls “being confused” about “why God created us from monkeys.” On the other hand, they are naturalistic explanations of origins, and thus do not “acknowledge that God is the creator of all life.” Both of these issues stem from a belief that such ideas are intrinsically incompatible with Christian faith. After all, the letter-writer indicates that “we believe in Jesus” is sufficient explanation for opposition to withholding a child from school when they are taught.

Second, the letter-writer gives no indication that s/he has actually seen the draft of the Framework. The comments are phrased as questions about “whether evolution will be taught and when.” S/he alludes at one point to “the unit on Earth,” but does not identify anything in particular from the draft. Instead, she says that her impressions come “from the information I have read.” Because the writer gives no indication of grade level or specific standards, it is

impossible to determine which of the units “sounds like the Big Bang theory.” In the Science Framework, Standard 6, grouped under “Earth and Space science,” concerns the Universe and has the following guiding question: “What big ideas guide human understanding about the origin and structure of the universe, Earth’s place in the cosmos, and observable motions and patterns in the sky?” No specific theories are ever mentioned under Standard 6 for any grade level so it does not appear that she was basing her impression on the draft itself. In noting the unlikelihood that the letter writer read the draft of the Framework, it is not my purpose to detract from the comments. Instead, it reveals something about the manner in which s/he was motivated to publicly comment on the Science Framework.

Finally, the writer expresses disapproval without ever requesting the Department of Education to change the standards in the draft. Certainly it is clear that the writer does *not* believe that evolution and the big bang should be “taught from K-12, in bits and pieces along the life of their school years.” Instead of suggesting changes, Concerned TN Parent alludes to two forms of action available to resist the standards. One form of resistance is that parents may withhold their children from school during the days such ideas are taught. The other form of resistance noted is that teachers may elect to simply not cover these topics in their classrooms. This approach is perhaps surprising. Concerned TN parent is writing the state of Tennessee on a forum designated for comments on the Science Framework, but uses the opportunity not to request the state to modify policy, but instead to remind state actors that the citizens of Tennessee have tools at their disposal to invalidate those policies that do not conform to community sensibilities.

The second letter-writer was Mitch Carter, a 7th grade science teacher in Williamson County, though he did not mention his profession or position in his letter⁵⁵. His entire message follows:

Dear Dr. Jordan,

Thank you for allowing public review and comment on the revisions to the state K-8 science curriculum standards. It is this step in public policy changes that achieves the very best for all concerns and groups of people. Also, thank you for the thoughtful approach that is evident in the revised curriculum standards.

I am a taxpayer and voter in the fifth Congressional District. I am interested in what is being promoted taught in Tennessee public school with my tax money.

I must take exception to the revisions to Standard 5: Diversity and Change. The revisions, as written, are an obvious explanation of only one view of the natural world – an evolutionary worldview. The curriculum is missing a balanced viewpoint. The evolutionary viewpoint is not the only explanation concerning this benchmark. Tennessee students are not being taught the whole story.

The problem with teaching a single viewpoint is that it begins to give the impression that it is the only viewpoint. No matter the intentions of the teacher, without a balanced approach, it comes across that the evolutionary explanation is fact. The fact is that genetic variability is a result of the recombination of the encoded information that existed the beginning of the population. Organisms adapt and respond to their environment in the way in which they were designed to respond.

I am also very interested in the report Commissioner Dr. Lana Seivers will give to the General Assembly in response to S.R. 17 by Senator Finney: A resolution to request the

⁵⁵ I recognized his name and email address, having already been in contact with him regarding a related incident.

Commissioner of education to provide answers to questions concerning creationism in public school curriculum's in Tennessee.

I propose that the revised K-8 state science standards reflect a balanced worldview in regards to Standard 5: Diversity and Change. A revision of this sort will give Tennessee students a more complete understanding of this curriculum standard.

Sincerely,

Mitch Carter⁵⁶

(Email sent 9/5/2007)

It is important to note that his message was sent not only to Dr. Jordan, but also copied to Gary Nixon, the chair of the Tennessee Board of Education.

Another letter was sent by a woman affiliated with the Tennessee Baptist Foundation, an investment institution for the Tennessee Baptist Convention. Her letter was noticeably similar in format to the last letter:

Ms. Jordan,

I am a parent of two elementary age children. My children attend Shayne elementary in South Nashville. I have been very pleased with Shayne, the administration and especially the teachers. My boys have had a positive experience thus far and hope to continue thriving in Metro schools.

It has come to my attention that the state is revising the science curriculum. As I read the standards. I was glad to see that the state has been very thorough in the review. I am very concerned, however, about standard five: diversity and change. This revision overlooks facts that disprove evolutionary theory. Please reconsider this standard.

I am very interested in the report Commissioner Seivers will give to the General Assembly in response to S. R. 17 by Senator Finney: A resolution to request the commissioner of education to provide answers to questions concerning creationism in public schools, curriculums in Tennessee.

Thank you for your time.

Bonnie Sneed

(email sent 9/14/2007)

It is difficult to miss the fact that both messages have similar organization and wording in certain places. Both begin with a general compliment about the standards, and a personal introduction that identifies the message writer as affected by them. Both then explain why they are opposed to the treatment of evolution in the standards. Most strikingly, both include nearly identical statements regarding interest in "S. R. 17."

Senate Resolution 0017 was a bill proposed in February of 2007 by Tennessee Senator Raymond Finney. At the time, Sen. Finney represented the 8th District, comprising Blount and Sevier counties in the northeastern part of the state. His resolution was "to request the commissioner of education to provide answers to questions concerning creationism and public school curriculums in Tennessee."⁵⁷ Had it passed, it would have requested the education commissioner Dr. Lana Seivers to submit, in writing, responses to a series of questions. Because any summary of this resolution would fail to capture appropriately its tone, rhetoric and logic, the entire resolution is quoted here:

(1) Is the Universe and all that is within it, including human beings, created through purposeful, intelligent design by a Supreme Being, that is a Creator?

⁵⁶ "Mitch Carter" is a pseudonym. When I interviewed this teacher, I promised not to identify him by name.

⁵⁷ <http://www.capitol.tn.gov/Bills/105/Bill/SR0017.pdf>

Understand that this question does not ask that the Creator be given a name. To name the Creator is a matter of faith. The question simply asks whether the Universe has been created or has merely happened by random, unplanned, and purposeless occurrences. Further understand that this question asks that the latest advances in multiple scientific disciplines –such as physics, astronomy, molecular biology, DNA studies, physiology, paleontology, mathematics, and statistics – be considered, rather than relying solely on descriptive and hypothetical suppositions.

If the answer to Question 1 is “Yes,” please answer Question 2:

(2) *Since the Universe, including human beings, is created by a Supreme Being (a Creator), why is creationism not taught in Tennessee public schools?*

If the answer to Question 1 is “This question cannot be proved or disproved,” please answer Question 3:

(3) *Since it cannot be determined whether the Universe, including human beings, is created by a Supreme Being (a Creator), why is creationism not taught as an alternative concept, explanation, or theory, along with the theory of evolution in Tennessee public schools?*

If the answer to Question 1 is “No” please accept the General Assembly’s admiration for being able to decide conclusively a question that has long perplexed and occupied the attention of scientists, philosophers, theologians, educators, and others.

According to the Tennessee government’s records online, the proposed resolution did not even make it through the Senate Education Committee, and so was never voted on by the General Assembly.⁵⁸ It was pronounced dead before June of 2007 following considerable negative press and a lack of support even within the Republican-controlled Tennessee Senate.⁵⁹

Given its moribund status, it is odd that both letter-writers seemed to believe that it had or would be adopted when they wrote their letters in September of that year. However, the fact that they mentioned it suggests two things. First, their nearly identical phrasing along with the overall similarity of their letters suggests the two letter-writers were somehow in contact, or part of a larger campaign intended to affect the standards. As will be noted below, there seems to have been such a campaign among citizens in Williamson County at the time, though it is puzzling that the campaign would have resulted in only two emails sent to Linda Jordan. Second, it suggests that S.R. 17, and its rhetoric, was an important motivating factor for the writers. The logic it presents—that any uncertainty over the ultimate origins of the universe ought to necessitate teaching creationism in science classrooms—must have seemed compelling to them.

Reference to Senator Finney’s proposed resolution is interesting as a window into the logic behind opposition to Standard 5. The resolution represents what its authors and supporters must have believed to be an airtight case. This case rested on two logical steps. First, that there is a *possibility* that a supreme being created the universe and everything in it. This step follows from any of the three possible responses anticipated for the first question. If the commissioner had responded that the universe was not created by a supreme being, her certainty about the answer to a question that is arguably impossible to determine would have been regarded as hubris and arrogance. Any naturalistic account of origins was thus destined to be impugned and doubted. Had she responded that the universe *was* created by a supreme being, the resolution’s response would not have been to highlight the uncertainty intrinsic to such a question. Indeed, if she had answered that it was created *or* if she had answered that it was impossible to know, the

⁵⁸ <http://wapp.capitol.tn.gov/apps/Billinfo/default.aspx?BillNumber=SR0017&ga=105>

⁵⁹ <http://ncse.com/news/2007/06/tennessee-creationist-measure-is-dead-now-001112>

next logical step was basically the same. The commissioner's answer would have been followed by what the authors must have intended as a rhetorical question: "Since it cannot be determined whether the Universe, including human beings, is created by a Supreme Being (a Creator), why is creationism not taught as an alternative concept, explanation, or theory, along with the theory of evolution in Tennessee public schools?" Whether there was a creator, or there simply *might have been* a creator, the implication seems to be that creationism ought to be taught in Tennessee public schools, at the very least, as an alternative to evolution. In other words, *any doubt* about naturalistic explanations automatically implies that a supernatural explanation ought to be included as well.

It hardly needs to be pointed out that, had the resolution passed, the Education Commissioner would have had a number of options for handling it other than to agree to the allow creationism to be taught. Since it was merely a request, the Commissioner may have chosen not to comply. The Commissioner may have answered the first question in some way other than "Yes" or "No" or "The question cannot be proved or disproved," and then would have answered the question to the full extent that was requested (since no follow-up questions are indicated for any other response). A different response is not difficult to imagine, especially since the third option does not make any sense: How could a question be proved or disproved?

Had the Commissioner chosen to answer the second or third question, she may have pointed out that creationism actually *may* be taught in Tennessee public schools, in a social studies course or a Bible literacy course. She may have pointed out that teaching creationism in science classrooms has been determined by courts to violate the Tennessee Constitution and U.S. Constitution. She may have stated that creationism is a religious rather than scientific account of origins and thus is not appropriate for science classrooms. She may have noted that time in classrooms is limited, and it is not practical to give time to every possible explanation for the origin of the universe, particularly since the possibilities are far more than those mentioned in the resolution. Regardless of the possibilities (and the reader may wish to add to this brief list), the point is that the author of the resolution and its supporters, including these two letter-writers, must have imagined that the only logical conclusion based on the premises—either there is a creator, or we do not know with certainty that there is not a creator—is that creationism ought to be taught in public schools.

The science coordinator Dr. Linda Jordan responded to each of these three messages without referring to Senator Finney's resolution. Because the responses were extremely similar, it serves to treat all three simultaneously. First, she expressed gratitude for the comments, but then points out that the standards are aligned with national standards developed by the American Association for the Advancement of Science and the National Resource Council. All of these authorities establish evolution as a topic that ought to be included in K-12 standards. She emphasizes, by invoking specific publications and authoritative bodies, that the Framework ought to be accepted. She then writes:

The national standards document takes the position that science is taught in science class, therefore, the state science standards only reflect *science* concepts. If the student desires to study religious thought, there may be other courses available within a school district that can serve this purpose. Most science teachers do not receive any religious training in their teaching preparation courses. Because religious *beliefs* vary greatly from one religion to the next, religious viewpoints are best taught in the home or in the respective churches where highly trained, educated professionals are able to answer all of the

questions students may have concerning certain religious teachings. (Jordan, email sent 9/18/2007, italics in original)

There is no record of responses from any of these letter-writers to Dr. Jordan's replies.

A fourth message was emailed to the science coordinator on September 20th from a man who used his full name and provided a phone number. The message was brief:

Linda,

I am a parent of a Williamson County public school student. I was just reading through the state's Revised Science Curriculum standards and had a few questions pertaining to some of the learning objectives. Who may I contact to address my concerns?

Thank you,

Warren Harris⁶⁰

Brentwood, TN

615-XXX-XXXX

Dr. Jordan replied 9 minutes later: "Please address concerns about the science learning objectives to me." An hour later, she received the following message:

Linda,

OK, you asked for it. It is my intention to investigate the current TN BOE policies as they pertain to the teaching of evolution. I am working with the Discovery Institute, and we are seeking ways to enhance how evolution is being taught around the country and in TN. Here are my questions:

1. How is evolution taught currently in TN?
2. What Biology textbooks are being used? What publisher, date, edition?
3. When are Biology books up for adoption?
4. What is the process by which textbooks are adopted?
5. What policies does the state have for teaching evolution? I need copies of policy
6. What policies does the state have for teaching controversial issues? I need copies of policy
7. Do the state [sic] have policies protecting teacher academic freedom? I need copies
8. Do they have policies for teacher's use of supplemental materials? Need copies.

Thank you,

[Name, mailing address, phone number in email]

The Discovery Institute is a think tank based in Seattle that has historically advocated for teaching "alternatives" to evolutionary theory, such as Intelligent Design Theory. The Institute will be discussed in much more detail in a later chapter, but it is relevant to note that it is behind media savvy efforts to influence popular opinion on the topic of evolution. The Discovery Institute has been accused of peddling creationism, but repackaging it in order to obscure its religious nature (Forrest and Gross 2004).

The list of questions seems unlikely to have been authored solely by Harris. It uses the phrase "the state" in a generic manner that suggests a lack of familiarity with the local situation. Furthermore, the questions seem out of place directed at the state science coordinator. Questions about textbooks are far more appropriate in the context of a specific district, where textbooks are actually adopted. Whereas, in original message, Harris had mentioned having questions about the "learning objectives" in the Revised Science Curriculum standards, this message does not even mention the standards. It is as though someone else, perhaps at the Discovery Institute, requested some basic information in order to get a sense of available options for affecting local shifts in

⁶⁰ "Warren Harris" is a pseudonym. When I interviewed him, I promised him anonymity.

policy, and then Harris basically forwarded the list of questions to the state science coordinator without considering the most productive or effective course of action for finding the information.

The message is notably confrontational, beginning with, “OK, you asked for it,” and continuing by announcing his intention to “investigate” and find ways to “enhance how evolution is being taught.” Her reply was quite formal:

Mr. Harris

I do not recall “asking” for anything in my response to your initial email, Mr. Harris. I simply replied to your question concerning to whom questions concerning the *science learning objectives* should be addressed. Since I am the State Science Coordinator and responsible for the development and revision of the science standards, I informed you that I would be the person to address specific queries about the science curriculum.

She responded to each of the questions by referring him to a more appropriate source. Regarding the first question, she referred him to the science content standards on the state’s website. Questions about textbooks were referred to the State Textbook Coordinator, and questions about policies were referred to the State Board of Education’s website. She closed the message with her full name, title and full contact information. She also copied the message to the textbook coordinator and the chair of the Board of Education.

Dr. Jordan was unfamiliar with the Discovery Institute at the time, but the tone and nature of the message seems to have worried her. She immediately forwarded the email to Eugenie Scott, the executive director of the National Center for Science Education (NCSE), whom she addressed by first name. NCSE is a national watchdog organization that monitors the activity of antievolutionists, like the Discovery Institute and many creationist groups, and provides data and expert consultation for advocates of evolution education to draw upon when facing threats from such groups. In the message, Dr. Jordan asked, “Let me know your thinking.”

In her reply, Dr. Scott told her that the man was using rhetoric, such as “academic freedom,” which she associated with the Discovery Institute (DI). That fact, in conjunction with his claim to be working with the Institute, confirmed for her that DI was involved. She also provided the science coordinator with background information on the Discovery Institute’s “teach the controversy” strategy, which she claimed was behind antievolution efforts in many other states. Finally, she noted the possibility that, based on questions about textbooks, DI would try to get a book called *Explore Evolution*, which she described as “DI’s latest anti-evolution book,” onto the state’s approved textbook list.

In the email exchange that followed, Dr. Jordan sent the other emails she had received that related to evolution. Scott replied:

It looks like you may have something of a campaign on your hands. Perhaps someone at the church made an announcement and these three individuals are the ones who are most concerned about the issue perhaps or perhaps there will be more. (email 9/24/2007)

She based this hypothesized campaign on the similarities between the two messages that mentioned Senator Finney’s resolution. She did not include any additional advice for Dr. Jordan about how to proceed.

Dr. Jordan told me in our interview that she had come to expect the topic of evolution to raise concerns among some Tennesseans:

We have this come up every time we revise the standards [...] A lot of times they’ll come to the final adoption meeting, and raise sand. And we always say to them, well I don’t say to them usually because it’s the publisher’s meeting, but the publishers respond that they bid books that match the standards, and so they’ve begun to realize that if they’re going to

make changes, then they have to make it when the standards are made. They're getting kind of savvy about it now. (Jordan interview, August 16, 2007)

The science coordinator did not receive any more correspondence from any of these four letter-writers. However, she received a fifth message five days later from the elementary curriculum specialist for Williamson County schools:

Hi Linda,

I just wanted to share with you that we have had several parent and teacher concerns about the words “natural selection” in the proposed science curriculum. I did not keep count, but I would say at least twenty. I personally do not have an issue with it, but several of the callers were quite emotional. I directed them to respond directly to you. I am not aware of whether they did or not.

I just wanted to share this information!

Best wishes!

Jackie

Dr. Jordan’s response to her message offers a window into the course of action she planned to pursue at the time:

Jackie

Thanks for sharing this information. Actually I would be willing to bet that I have already encountered at least some of your concerned parents in emails they have recently sent expressing these concerns. I think most of the unrest is coming from a particular religious group associated with a “Discovery Center.”

Natural selection is in the national science standards and shall remain in the state science standards. In years past I have worried about the support I might have at this level if someone questioned this particular content in the science standards. I am happy to report that if we are challenged on these issues I feel very confident that I will be fully supported by the department on the retention of this content. Natural selection is just good science teaching and shall remain part of the TN science curriculum.

Have a nice weekend!

Linda

It should be noted that she makes an immediate connection between the parents to which Jackie is referring and the campaign hypothesized by Eugenie Scott at NCSE. The report she has received from this curriculum specialist fits within that narrative. The fact that she misremembers the name of the Discovery Institute is consistent with the lack of familiarity alluded to earlier. Faced with the prospect of a public campaign, Dr. Jordan nevertheless indicates a commitment to resisting these efforts. Similar to when responding to the previous emails, she emphasizes to the Williamson County curriculum specialist that evolutionary concepts are in the national standards. She further demonstrates her commitment by noting her belief that her decision to retain evolution in the Framework would be supported by her institutional superiors. She concludes with the victorious assertion that it “shall remain part of the science curriculum.”

Despite her confidence at the time she sent that reply, she would soon reconsider. A few of the parents from Williamson County apparently contacted members of the State Board of Education directly. Dr. Jordan recalls being contacted by Gary Nixon, the Chair of the Board, regarding the phone and email campaign. He was “not happy” about the attention and suggested changes be made to the Framework. Pressure from the Board was significant because ultimately the Tennessee Science Curriculum Framework would have to be approved by that Board. Dr.

Jordan also contacted the Williamson County curriculum specialist directly to gauge the threat. According to the specialist, she asked Dr. Jordan why the state could not simply remove the offending words, including both “natural selection” and “evolution,” while keeping the rest⁶¹. As we will see in the concluding section, this is precisely the strategy the authors of the Framework would pursue. First, however, I will discuss what I have learned regarding the phone and email campaign from parents regarding the standards.

An analysis of the Parent Campaign

The epicenter of the campaign was Williamson County, which borders Nashville’s Davidson County to the south. Williamson County is among the top 20 wealthiest counties in the US, with a median household income of \$69,546 (the state median income was \$44,140), according to the 2010 U.S. Census.⁶² The county’s population is relatively highly educated; more than half the population (51%) over the age of 25 has at least a Bachelor’s Degree, compared to 23.5% for Tennessee as a whole.⁶³ It is also heavily Republican, with 69.1% voting for McCain in the 2008 presidential election, as opposed to 29.1% for Obama⁶⁴.

I later contacted several people involved in the phone and email campaign, for additional details. The curriculum specialist in Williamson County used the term “furor” to describe the slurry of phone calls, but noted that it was short-lived. Parents were directed to contact the state, since it was the state that set policy on academic standards. As we have seen, three of them seem to have followed through with the campaign beyond the local level, by emailing the state science coordinator. Other parents reportedly contacted members of the State Board of Education, though specific numbers and records on that correspondence were not available to me.

As noted above, one of the earlier letter writers was a 7th grade science teacher in Williamson County named Mitch Carter. I had met this teacher in 2009, when he lead a session at the TSTA conference called “Icons of Evolution,” which involved showing excerpts from the DVD by the same name, followed by a discussion. He opened that discussion by relating his perspective on the issue:

I’m a middle school teacher and I teach 7th grade science in the old curriculum, so with the new recent change in the standards I can no longer teach evolution, this is just a passion of mine. And, I don’t know, but I could just imagine a high school teacher teaching this unit and they tell the students one day, “OK students, if you’ll turn to chapter 11, our next unit of study is on evolution.” I can just imagine students raising their hand and saying, “Do I have to believe this?” And I think, what are they asking? Do I have to believe this? I mean who am I? I’m a science teacher! I mean if anybody is going to tell you the truth, you would think that the science teacher would tell you the truth...”

When I spoke to him in 2010, it had been more than a year since the conference and three years since he had written to the science coordinator. During the interview, he explained to me that his motivations for getting involved in the policy-making process stemmed from this conflict that he had felt at the time. He believed that he had been called into teaching by God, and did not want to use his position to undermine God’s word by teaching contrary to the Bible. He thought

⁶¹ Personal communication on August 12, 2014.

⁶² http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml

⁶³ Ibid.

⁶⁴ <http://uselectionatlas.org/RESULTS/datagraph.php?fips=47&year=2008&off=0&elect=0&f=0>

that teaching students what evolution is and how it works, without the mention of alternatives, was the same as telling them to believe in it.

He rethought his position in 2009 after the “Icons of Evolution” discussion. In that discussion, many of the teachers had weighed in on their approaches to teaching evolution. One shared an approach that involved emphasizing to students that they did not have to believe in what was being taught:

Yeah, I just tell them, “It's not about belief, it's about you gotta get these answers right for the state test.” Because I am required to teach it. That is...[chuckles from other teachers] I am THAT honest. That's exactly what I tell them. I say, “Whether you believe it or not is a personal choice, but this is what you're expected to know about.”

This strategy was compelling for Mr. Carter. He had not previously considered that students could learn about something without learning to believe it. This realization apparently convinced him that there was no reason to be concerned about evolution in the standards.

Indeed, his thinking had changed even more substantially. Around a decade beforehand, he gotten a number of curriculum materials, including the “Icons of Evolution” DVD he had shown at the conference, from Answers in Genesis, a creation science organization founded and led by Ken Hamm, which is responsible for the Creation Museum in Kentucky. These materials were designed for use in the classroom, in order to assert inconsistencies in evolutionary theory and evidence for creation. He was not willing to actually use them, however, as doing so would be an illegal violation of his contract with the state. Even more, he was no long in support of the kind of policy suggested by Senator Finney’s Resolution, to require teachers to teach about creation. He had realized that teachers who believed in evolution would be able to use that opportunity to mock and undermine the creation account.

When I asked another letter-writer, Henry Warren (pseudonym), for details about the campaign to change the standards, he told me that they had gotten help from the Discovery Institute, specifically in the form of establishing networks that allowed participants to communicate. His own role in the process was apparently brief, however. He claimed that the Discovery Institute had tried to recruit him to act as a lobbyist in Williamson County. According to him, the Discovery Institute wanted to introduce “creation science” in science classrooms. I asked him whether they had actually called the alternative theory “creation science,” since I knew that the Discovery Institute generally distances itself from anything overtly religious when dealing with the public, but he insisted that this was the term they had used. He was supposed to contact members of the district school board to see who could be an ally. His attempts to contact school board members cost him too much time and money. He quickly lost interest and decided his time would be better spent with his family and “being a light to the world.”

While Warren’s account of working with the Discovery Institute is interesting, it is possible that he was exaggerating certain points. During our conversation, he gave me reason to doubt his reliability, relating to me a conspiracy theory involving unions, Planned Parenthood, the ACLU and public schools to “destroy America.” He told me that he was writing a book to expose the conspiracy. While other points certainly give the impression that Discovery Institute was involved in some way with the campaign, the actual involvement from them may have been minimal. In any event, his loss of interest explains why Dr. Jordan never heard anything else from him, and also why the campaign in Williamson County seems to have died off so quickly. It is easy to forget that people who participate in these campaigns are not fanatics. They are usually people with jobs, families and other concerns that compete with their activism. It is possible that the campaign would have simply evaporated on its own without any response by

the State of Tennessee. Neither Nelson nor Warren seemed to be aware of what their efforts had managed to accomplish in the end.

The Monkey in the Bathwater

The Department of Education and Board of Education were, of course, not aware of the extent or depth of the political organizing related to this campaign. They interpreted it as evidence that the Standard 5 would continue to spark controversy and have potential political ramifications. Knowing what we know now, it is tempting to think that they overreacted. It is impossible to know what may have happened, had they reacted otherwise. Those involved in the campaign may have lost interest specifically because of the response from the Department, and more opposition may have resulted had the original version of Grade 8 Standard 5 been implemented in public school throughout the state. Leaving aside hypotheticals, this section concerns the editorial response of Linda Jordan and her team at the Department of Education to the specter of greater public opposition.

The changes that would come to Standard 5 were concentrated on Grade 8 and did not impact the high school Biology I standards, which had included explicit and extensive coverage of evolution and related ideas for more than a decade. The focus on middle school is puzzling if too much attention is accorded to the emailed complaints Dr. Jordan received. None of them specified a particular grade level that was an issue, though the message from Morristown expressed concern about evolution and Big Bang theory being taught “from K-12, in bit and pieces along the life of their school years.” The other messages from Williamson County took issue specifically with evolution being taught without a “balanced viewpoint” (Carter) or “facts that disprove evolutionary theory” (Sneed), without regard for grade level. The science coordinator may have been predisposed to expect middle school to be the primary concern, especially given that the biggest changes were in those grades. In our interview, Linda Jordan told me that most concerns relate to evolution being taught in middle school:

LJ: But it's always in K-8. I really don't have any trouble in Biology. Now I've had a teacher or two every once in a while that will say, “To be fair, if you're going to present evolutionary theory, you should present the other side of it.” A couple of teachers have done that, but other than that the public usually doesn't get with me on the 9 to 12. It's the K-8 that they get upset about.

M: Why do you think that is?

LJ: They still consider those students children, and they don't think that they should be exposed to those ideas at that age. (Jordan interview, August 17, 2007)

The focus of edits in the Grade 8 standard was removal of the terms “evolution” and “natural selection,” which were specifically noted as offensive to many of the parents who complained. Dr. Jordan expressed to me the desire to retain the underlying content in spite of a change in specific terms. Specifically she said that they “didn't want to throw out the baby with the bathwater.” Given the amount of time and effort spent in developing standards that would receive national approval, it is no wonder that Dr. Jordan did not wish for evolution content, judged to be so crucial to rigorous science standards, to be removed. Unfortunately though, it was precisely this “baby” that critics opposed, and it would prove to be difficult to keep it.

In all, three of Grade Level Expectations and three of the State Performance Indicators were changed. Below, I will analyze line edits, but first, the following were deleted entirely:

GLE 0807.5.6 Cite various types of evidence that support changes in life forms over time.

SPI 0807.5.5 Analyze DNA information to make inferences about common ancestry.
SPI 0807.5.6 Compare and contrast internal and external structures of a variety of organisms for evidence of common ancestry.

Whereas the focus of the changes to Standard 5 were supposed to be the terms “evolution” and “natural selection,” none of these deleted sections contain those terms. The deleted GLE used the definition of evolution—changes in life forms over time—rather than the term itself. The SPIs, by contrast concerned “common ancestry,” an idea that was not mentioned specifically as offensive, but nevertheless insinuates something that has fueled antievolutionist sentiment since its inception: that humans are related to apes, monkeys and other animals. These deletions suggest that the nature of the edits were different from Dr. Jordan’s characterizations of them.

The line edits also were more substantial than merely replacing offensive terms with euphemisms. The first line edit concerned GLE 0807.5.3, which was originally:

Analyze how structural, behavioral, and physiological adaptations affect an organism’s ability to survive in a particular environment.

Again, neither term “evolution” nor “natural selection” was present in the original. Following the edit, the GLE read:

Analyze how structural, behavioral, and physiological adaptations within a population of organisms enable it to survive in a particular environment.

The change seems at first glance to be a minor rearrangement of sentence structure. However, the substance of the GLE is shifted considerably. The first version is focused on how specific adaptations affect the ability of *an* organism to survive. The implication would be that some traits enhance an organism’s chances of survival, which is basically natural selection. By contrast, the second is focused on how adaptations enable a population to survive. Rather than focus on the individual organism, it concerns the survival of the population (as opposed to extinction). This GLE has ceased to be about the principle of natural selection, and is instead about species survival and the maintenance of biodiversity.

Due to an apparent error, the SPI that corresponds to this GLE was not changed during this first round of editing. In both drafts, SPI 0807.5.2 reads as follows:

Analyze structural, behavioral, and physiological adaptations to predict which *organisms* are likely to survive in a particular environment. (my emphasis)

The inconsistency was caught in the second round of editing, however, so that the final draft is written:

Analyze structural, behavioral, and physiological adaptations to predict which *populations* are likely to survive in a particular environment. (my emphasis)

Clearly, then, the shift in meaning for the GLE was not an accidental byproduct of a shift in sentence structure. The corresponding SPI was changed to reflect the new meaning, and the change comprised nothing more than a shift from “organisms,” with a focus on differential survival and thus natural selection, to “populations,” with a focus on the extinction or survival of a species. The second edit was made to GLE 0807.5.4. It originally stated:

Explain how genetic variation is associated with evolution and natural selection.

After being edited, the GLE read:

Explain why variation within a population of living things can enhance the chances for group survival.

In this case, the original GLE contained both “offending” terms, and they were predictably removed. Furthermore, the original version was admittedly vague in its use of the term

“associated with” to link genetic variation, evolution and natural selection. Nevertheless, the “association” among these terms is extremely important for evolutionary theory. Without genetic variation in a population, the population cannot evolve because there is no variation to be “naturally selected.” The edited version removes not only “evolution” and “natural selection,” but also, inexplicably, “genetic.” Like the GLE discussed above, it is explicitly about “group survival.” However, in this case, it could actually be made to suggest the same idea as the original, though it is ambiguous enough that it could be interpreted in other ways as well.

One reason that genetic variation within a population can enhance the chance that the population will not go extinct is that this variation makes it possible for the species to *evolve*. When a population has many individuals that have many different traits, each of those differences represents another opportunity for the individuals that possess it to survive and reproduce despite some major environmental change. In other words, genetic diversity in a population makes it more likely that at least some of the organisms in the population will adapt to the change, and leave descendants with those adaptations; i.e. the population will evolve. If the population does not have this variation, then a major environmental change may wipe the population out. None of the individuals will survive. The edit would seem to be a more-or-less ingenious way to ensure that teachers cover the relevance of genetic variation for natural selection and evolution, though the next chapter will note that this GLE can be interpreted differently.

The corresponding SPI was also the target of line edits. Both the original and revised version of this SPI are presented below, respectively:

Analyze data on genetic variation to associate biodiversity, natural selection, and evolution. (August 10, 2007)

Analyze data on levels of variation within a population to make predictions about survival under particular environmental conditions. (November 2, 2007)

Again the term “genetic” is deleted, suggesting that the editors identified it as either potentially offensive or merely redundant. However, the second possibility is impugned by the fact that *non-genetic* variation (e.g. cultural variation and variation attributed to developmental irregularities) is both possible *and* generally regarded as irrelevant to evolutionary theory (Dawkins 1989; Ridley 2004; Zimmer 2006). Its deletion therefore signals a move away from the concept of evolution.

Elsewhere, the offending terms “evolution” and “natural selection” were deleted, along with “biodiversity,” and replaced by a phrase that shifts the meaning to align with the corresponding GLE discussed previously. Like GLE 0807.5.4, the revised focus of this SPI is the survival of species, apparently as related to environmental issues such as disappearing habitat and possibly climate change.

In summary, the edits included deleting entire GLEs and SPIs as well as line item edits that targeted “evolution” (including euphemisms), “natural selection,” “genetic” and “common ancestry.” As a result of these edits, the overall emphasis of Standard 5 in Grade 8 shifted from evolutionary theory to environmental issues connected with biodiversity. In my reading, the changes are substantive.

However, Dr. Jordan disagreed with me during our interview. The result of these edits was described by Dr. Jordan at first as making Standard 5 in Grade 8 “more or less benign,” in regards to their capacity to offend. Dr. Jordan contested a characterization I used during the interview that they had opted to “take out evolution and natural selection.” She distinguished between the terms and the ideas they represented. In her perspective, while the terms were

removed, the ideas themselves were merely “tempered.” She characterized it thus: “I mean, we knew there were some terms that were causing concerns and so we just tempered it, filtered it, I guess, which is not unusual” (Jordan, interview, 2007).

I pushed back against her characterization by telling her about a critique I had heard from Dr. Mary Ball, biology professor at Carson-Newman, with whom I had recently spoken. I mentioned that Dr. Ball had argued that the new Tennessee Science Curriculum Framework was weaker regarding evolution than the previous Framework. In that Framework, Standard 5 in Grade 8 was centered on a single Learning Expectation having to do with classification, which was elaborated through two “Accomplishments”:

- 8.5.2 Identify characteristics used by scientists to classify organisms into different categories.
 - a. Infer the relatedness of different organisms using a system of classification.
 - b. Compare different organisms according to similarities and differences in their structures and function.

Dr. Ball drew my attention to the first of those “Accomplishments,” which explicitly mentions the connection between classification systems and relatedness among organisms, implicating common ancestry. The new framework, following the edits, contained no mention of relatedness or common ancestry whatsoever. As we have just seen, those references were deleted in the final draft.

When I brought up this critique to Dr. Jordan, she was surprised, and denied it at first. She had recently been working on the state standardized tests, and reported that the test for grade 8 included cladograms, where students were expected to infer relatedness. She reasoned that there must be an SPI that mentioned relatedness since the tests are based on the SPIs. After looking through the document, she eventually relented, speculating that possibly “the editors thought that this was too close to natural selection,” but ultimately admitted, “I don’t know. I don’t know.” The editing was not done by her, but was instead left to the middle school committee chair. Despite these edits, Dr. Jordan believed that the essence of Standard 5 in Grade 8 remained the same: “I think that anybody that really understands that content realizes that that’s what they’re supposed to teach...” (Jordan, interview, 2007).

The question of whether Standard 5 tells teachers to cover evolution without specifically saying it involves several complicating factors. Dr. Jordan insisted at other times during our interview that she wanted the term “evolution” to be in the Standard, noting that it provides a tool for teachers to convince parents and administrators that they should teach it. However, she had personal experience to expect that the word itself was not necessary. She noted that she had taught evolution in high school biology when she was a science teacher in the early 1990s. At that time, the word “evolution” was missing from the Science Framework. When Lerner graded Tennessee’s standards in 2001, he gave them the second lowest score in the country based on the failure to include any clear reference to evolution. Still, it appears that Dr. Jordan was not the only teacher to cover it. Several veteran teachers mentioned issues with teaching evolution going back to the 1990s. The key to successful coverage, according to all of them, was that it was not mentioned by name—a red flag for students and parents—but was instead introduced and developed with sensitivity to local concerns. Given this history, it is more than reasonable to say, as Dr. Jordan does, that teachers will be able to read between the lines and figure out what is intended under Standard 5. Indeed, when I first read the Grade 8 science standards, they appeared to me to be clearly about evolution.

Nevertheless, the “correct” interpretation depends on a certain level of understanding of and knowledge about evolution. Without familiarity with evolutionary theory, a reader would be expected to come to a different conclusion. Dr. Jordan herself even recognized in her statement that many Grade 8 science teachers do not understand the content and therefore may not realize that evolution is what they are supposed to teach:

...but I don't know if we have a lot of eighth-grade teachers that are that savvy because we have licenses that are K-8 and 1-8, and they may not have enough background to understand that it is the same thing. They probably don't understand it that thoroughly. We also have 7-12 licensure and those teachers probably have more background in the sciences and do see that... (Jordan interview, August 17, 2007)

In the next chapter we will see that background in the sciences is not the only factor that determines how the Standard is read. Many teachers are also motivated to *not see* evolution, specifically when they are themselves conflicted about teaching the topic.

Conclusion

In order to comprehend the State, as an entity, it is necessary to see how it acts and reacts in the real world. Looking at the level of state government, the process by which the Tennessee Science Framework, specifically Standard 5, was developed, edited and approved, illustrates the importance of timing and organization in influencing official policy. In the case of the Science Framework of 2008, we saw that the people most responsible for developing the science framework were interested in giving a central place to evolutionary theory in the biology curriculum, and yet their efforts were ultimately thwarted by public pressure on the State Board of Education.

Unlike with human entities, the State’s decisions are not the product of thought, but rather of politics. The end result—the Science Framework—bears little correspondence to what science education scholars and professional scientific organizations recommend regarding evolution education. The campaign by parents in Williamson County, Tennessee to pressure the State Board of Education to pullback on expanded coverage of evolution resulted in the substitution of “change over time” for “evolution” in the 8th grade standards as well as other small changes in wording, which sacrificed clarity for confusion. Members of the State, judged by the State as qualified and empowered to produce education policy, attempted to put out a set of standards that would make NAS and AAAS proud. Their attempt ended up garbled. Particularly by removing the word “evolution,” connections among concepts related to evolutionary theory are never implicated. As we will see in Chapter 6, the ambiguity of Standard 5 in eighth grade permits teachers a way to avoid the topic of evolution altogether. It also means that no 8th grade science teacher is going to have much luck convincing an administrator or parent that “evolution” is part of the Science Framework. In this case, the State proves itself to be so sensitive and responsive to well-placed public pressure that a relatively small number of residents were able to render evolution standards, which were developed through months of consultation with science educators, basically incoherent.

In 2013, several national organizations, including Achieve, Inc., the National Science Teachers Association, the American Association for the Advancement of Science, and the National Research Council, released a final draft for the Next Generation Science Standards (NGSS), a set of recommended standards designed to be adopted wholesale by states. When an earlier draft of NGSS went up for public review and feedback, it attracted the attention of creationist groups. For example, Apologetics Press, a creation science organization affiliated

with Churches of Christ, sent a newsletter to its subscribers⁶⁵ alerting them to the public review process for the NGSS and encouraging them to make their opinions known. The newsletter included a link to a website set up by Villa Rica Church of Christ designed to facilitate giving feedback on the evolution content of the Core Standards. The website presented reasons for opposing evolution standards and instructions for giving feedback. Despite the efforts of Apologetics Press and others, evolution is prominently featured in NGSS, beginning as early as 3rd grade⁶⁶. It would seem that such efforts exercise less influence on national, non-governmental bodies as they have on state, governmental bodies.

At the same time, however, following the release of the final draft of NGSS, only 8 of 29 lead states involved in their development actually adopted them⁶⁷. Though Tennessee was one of these lead states, having promised to adopt them, along with other Common Core Standards as a precondition for applying to Race to the Top funds, the state has been slow to follow through. As of this writing in 2016, the Science Framework approved in 2008 remains in effect for Tennessee. The reasons for the slow uptake have not been made public. While some of the reluctance may stem from the evolution content, the bulk of it seems to be related to widespread antagonism over Common Core Standards in Math and Reading. Regardless of the pains taken by the developers of Common Core to insist that they are a “state-led effort,”⁶⁸ many conservative opponents have identified it as a federal takeover of state education⁶⁹. As such, it fits well within the overall account presented in Chapter 2, wherein people are concerned about outsiders wresting control of schools away from local communities. While it may not allay their concerns, the next chapter will explain why it is that documents like NGSS or even the Tennessee Science Framework are nevertheless subject to local control in U.S. schools regardless of how they were produced.

⁶⁵ <<https://apologeticspress.org/apcontent.aspx?category=9&article=1614>>

⁶⁶ <<http://www.nextgenscience.org/pe/3-ls4-1-biological-evolution-unity-and-diversity>>

⁶⁷ <http://www.edweek.org/ew/articles/2014/01/29/19science_ep.h33.html>

⁶⁸ The subtitle for the Next Generation Science Standards is in fact “By the states, for the states.”

⁶⁹ <http://www.tfpstudentaction.org/politically-incorrect/common-core/the-federal-takeover-of-education-from-lbj-to-common-core.html>; <http://www.usnews.com/news/articles/2014/08/06/jindal-common-core-tests-are-federal-scheme-to-control-curriculum>; <http://www.freedomworks.org/content/top-10-reasons-oppose-common-core>

Chapter 6: The Local World of the Teacher

Introduction

Chapter 6 is about teachers and their interpretations of Standard 5 and implementation in their classrooms. Recall that the thesis of this dissertation is that we cannot understand the reality of the conflict over evolution education if we focus only on ideas, but instead we need to look at the contexts in which the conflict plays out. In this chapter, we begin with a document or text, which is Standard 5 in the Tennessee Science Framework. Like any text, it is tempting to assume it has an intrinsic meaning, as an encoded message, or a public representation of its authors' intended meaning. When I first began my project, I read Standard 5 in Grade 8 as a clear call to teach evolution, despite the fact that the term "evolution" was technically absent, having been replaced by the euphemism "change over time" after members of the public complained about an earlier draft. Interviews with state actors at the Tennessee Department of Education seemed to confirm my own interpretation, as they all emphasized the importance of teaching evolution. When I asked the lead author of the framework whether she thought the edit had changed the meaning behind Standard 5, she said, "I think that anybody that really understands that content realizes that that's what they're supposed to teach..." (Jordan, interview, 2007). In short, for policy-makers, the intended meaning behind Standard 5 was teaching evolution.

If we employ Sperber's epidemiological approach to understand this effort to teach evolution, then Standard 5 should be treated as a public representation, serving as a link between the authors and the teachers who will enact the effort. However, the account presented in this chapter complicates this link. If Standard 5 is a public representation, then what is it actually representing? Does it represent the ideas intended by its authors? And if so what would it mean for a single public representation to be produced by a collective, with different mental representations? Or does it represent the ideas of its readers, of the teachers, scholars, policy-makers and parents who try to understand it? In each case, those who encounter the public representation understand it not merely according to their own understandings, but also according to their own interests. Examining the statements of 8th grade science teachers regarding Standard 5, we will see how they are able to exploit the ambiguity built into the Standard to ensure that they are able to both *not* teach evolution and at the same time teach the entire Standard without leaving anything out.

The Tennessee Science Framework is, to paraphrase Annelise Riles (2006), an artifact of modern bureaucracy. As we saw in chapter 5, it is a negotiated document, and as a result it can be fairly ambiguous. Indeed, the ambiguity was intentional. Linda Jordan explicitly tried to please critics of teaching evolution by removing overt references to "evolution," while simultaneously keeping the evolution content in the text. Crucially, once the artifact was produced and made official, it acquired its own agency, quite separate from the intentions of its creators. In this chapter, we will see that merely reading the evolution standard in the document gives you part of the picture (cf. Lerner 2000; Mead and Mates 2009a), but it cannot tell you how the text will be read, understood and used in practice. In her work on education reform policies in eastern Kentucky, Maureen Porter points out:

While policies may be written at a state level, actual reform is radically local. Negotiations about proposed changes are enmeshed in local webs of personalized relationships, power hierarchies, and long-standing paradoxes about the very meaning of education itself. (Porter 2001: 265)

While teachers generally take their roles as educators seriously, their vision of the curriculum is often different from that of state educators. Administrators and teachers are locally present where pedagogical acts are carried out. The individuals at each level make decisions based on their own education, positions, personal beliefs, understandings, motivations and social influences. While they are constrained somewhat by considerations of district-level curriculum maps, state standards (especially that which is likely to be on the state standardized tests), and the actions of administrators, it is the teachers who make the day-to-day decisions about not merely what to include in the curriculum, but also how to present them. And these teachers, who almost always live in the communities where they teach, are subject to all kinds of social pressures, which are felt at home, at school and at the grocery store. Furthermore, most of Tennessee's teachers are also the products of the schools where they grew up. Their values, beliefs and knowledge reflect their backgrounds in regions where evolution has been historically treated as anathema. At the classroom level, teachers face challenges to teaching evolution that include inadequate knowledge about the topic, personal religious beliefs that conflict with the theory, and uncertainties about reactions from students and parents. These factors are all relevant in how they approach Standard 5 in the Framework, including the ways that they read and *interpreted* it.

“Unpacking the Standards”

As it turned out, themes over the ways the 2009 Tennessee Science Framework would be read and understood were a central aspect of efforts by the Tennessee Department of Education to implement the new standards. The most obvious attempt by actors at the Department to transmit ideas about the standards to teachers across Tennessee came in the form of Standards Awareness Workshops, developed precisely to help teachers and schools adjust to the new standards in Language Arts, Mathematics and Science. This section looks at these workshops, including how they were designed, executed and perceived by the teachers who participated in them. This account is based on interviews with organizers and presenters, as well as notes from participant observations at three of the workshops. Studying this transmission revealed unanticipated complexity regarding how the authors intended to implement the Science Framework. Specifically, different participants had different ideas about *what* the workshops were intended to accomplish.

Workshops were held in the spring of 2009, and again in the early summer. I attended three such workshops in June of 2009, including one in Nashville (June 16-18), another in Knoxville (June 1-3) and one in Grainger County, in northeastern Tennessee. The workshop leaders in the sessions I attended regularly taught science in middle school. The presenters at the workshops were mostly teachers who had worked with TDoE in the past, including involvement in developing the standards. Many teachers worked in multiple workshops, presenting the same material in each new location. The workshops were hosted at ten schools throughout the state, spatially distributed in a way that would allow local teachers from anywhere in the state to attend one without the need to travel great distances. School districts sent teacher representatives for specific grade levels and subjects to attend the workshops and bring back information for other teachers in the district. Poorer districts were sometimes unable to send a teacher for each grade level and subject, and so I met many teachers who were supposed to be bringing back information for more than one grade level.

Throughout these workshops, I was able to interact with teachers directly and listen to their impressions of the standards and the workshop itself. Through these conversations, I

learned that the reality of how teachers interpret and implement the Standards is not nearly as straightforward as may be implied by the content of the Workshops. Teachers are not blank slates onto which policy-makers can paint curricula. Even within their classroom alone, they are motivated by the inertia of the past. They have lesson plans, posters and books focused around the *old* standards, and so they are immediately interested in which standards have changed in order to determine what they can still use.

The workshops were also useful in revealing what state actors wanted teachers to know about the Framework. In order for teaching to occur as hoped, teachers needed to have a clear idea of what specific topics to cover, ideas about how to teach those concepts, and an understanding of those concepts. All three sorts of information are essential to the successful implementation of the standards. When I attended them, early in the project, I was working within an epidemiological framework with a focus on cognition, and I expected at the time that the workshops would attempt to impart *conceptual content* from the standards, in the form of knowledge that students needed to learn. As it turned out, I was possibly the only participant who had expected this. The authors of the standards, who also organized the science workshops, were mostly interested in passing along information on how to *read* the standards, since they were written in a way that was both different from the previous standards and not necessarily intuitive. By contrast, the teachers who attended the workshops were interested in learning classroom *activities* (teaching methods) that would help them to teach the standards. Thus contrary to my expectations that the workshops would help to ensure that the teachers had an accurate understanding of the concepts they were supposed to teach, they were actually focused primarily on explaining how the Framework is meant to be read and understood, and secondarily on providing ideas about how to teach the concepts.

In an interview with Richard Audet, one of the lead authors on the Science Framework, I was later told that the workshops were mandated by Dr. Connie Smith, supervisor of the state coordinators for science, math and language. Dr. Smith emphasized that the goal of the workshops was “unpacking the standards.” Among the ideas that needed to be unpacked was the organization and logic underlying the Framework. Accordingly, information on how to read the standards documents, including the codes and concepts that run prominently through them, was among the most prevalent in the workshops. The infographic on page 150 was often presented and discussed during the workshops in order to clarify how the Framework was intended to be read.

For each grade level, each Standard in the Framework is represented in a table that contains propositions, separated into cells on the table according to a particular organizational logic. Once a teacher has learned to read the framework as a document, he can interpret what he needs to teach. The Guiding Question, at the top, is supposed to be a meta-question that guides all lessons on a specific Standard, which is maintained from one grade level to the next. For Standard 5, the Guiding Question is "How does natural selection explain how organisms have changed over time?" Whereas the Guiding Questions stays the same across grade levels, the three columns under the Guiding Question contain, from left to right, lists of Grade-Level Expectations (GLEs), Checks for Understanding (✓), and State Performance Indicators (SPIs) change from one grade to the next. The workshop presenters told the teachers that they should use Grade-level Expectations to plan lessons. They should think of the Checks for understanding as suggestions for formative assessments of the GLEs. Finally, the State Performance Indicators are the basis for the questions on the state standardized tests, and so should be kept “at the back of the mind” when planning instruction.



General Organizational Format of the Tennessee Science Curriculum Framework

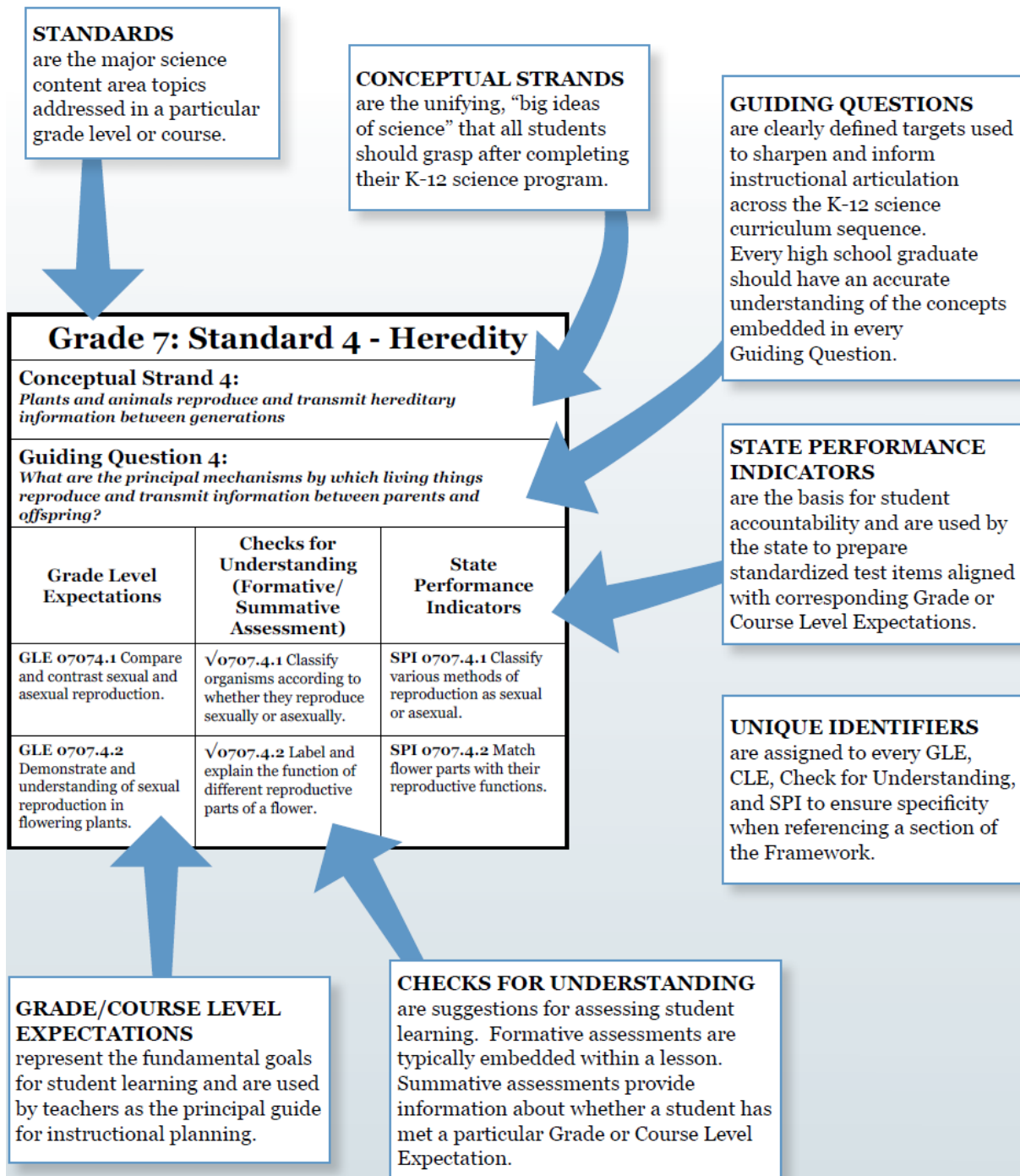


Figure 1: Tennessee Department of Education infographic to demonstrate how standards should be read

In the interview, Richard Audet explained that, in the past, teachers rigidly focused on ensuring students got the basic knowledge needed to ensure they could correctly answer state standardized test questions. Now, because teachers see this learning progression, they understand the importance of students understanding content from the standards. Instead of emphasizing test-taking skills, teachers will emphasize student understandings. As a result, students will do better on tests since they understand the material so well. He sums up his assessment, “The populace has advanced to a level that we [education experts] can really do with standards what we’ve been wanting to do: get beyond ‘teach to the test,’” and thereby maximize the impact of the standards.

The authors designed the GLEs for a given Standard to fit together from one grade to the next as a “learning progression.” For example, on Standard 5, the GLEs for eighth grade build upon GLEs learned earlier in 3rd and 5th grade. In turn, the 8th grade GLEs are prerequisites for learning expectations in Biology I, a high school course. Each year builds on the knowledge taught in the preceding years. The importance of the standards and the way that standards for each grade level comprise a learning progression was emphasized across multiple activities and presentations. For example, in one activity, science teachers from different grade levels worked in groups to organize GLEs from a single standard but different grade levels into a logical progression so that concepts were built upon over time.

Teachers were also repeatedly told to focus on Grade Level Expectations (GLEs) when thinking about what to teach rather than the corresponding State-performance Indicators (SPIs), on which standardized tests are based. Notably, the teachers attending the Workshops did not, by and large, accept this supposed primacy of GLEs over SPIs. I noted many bemused grins, eye rolls and, in one case, an outright challenge to the suggestion that teachers should ignore the SPIs and focus on GLEs. Snorting loudly, one teacher asked the presenter if the state honestly expected teachers to do this, given the pressure they were under to bring up test scores. Despite assurances from the presenter that teaching the GLEs *would* improve test scores, by giving students a better understanding of the principles being tested, the grins in the room did not disappear.

This kind of pushback from teachers was fairly common during the Workshops. Most of the teachers indicated through speech and behavior that they would rather be enjoying their summer vacation than be stuck in a school listening to presentations. I attended a workshop in Grainger County, in eastern Tennessee, in which teachers dressed as though they couldn’t wait to get back their vacation. They made jokes to one another during lectures, miming hanging themselves or shooting themselves in the head with imaginary guns. Even among teachers who made efforts to appear professional, I heard comments that were critical, and often cynical, of what they called “buzzwords,” including “inquiry-based learning,” “learning progressions,” and “standards-based reform.” One veteran teacher told that these state workshops always say the same things; they simply change the buzzwords every now and then.

Since participating teachers were expected to return to their respective districts and pass along this information to their colleagues, most teachers in the state were only ever exposed to a filtered presentation focused on what the participating teachers found most relevant. As noted above, teachers attended with hopes that they would get some very practical ideas for how to teach the new Standards. During presentations on the structure of the Standards, I watched many teachers’ eyes glaze over. They only really engaged when classroom activities were being presented, which could be employed in some form to their own classrooms. As a consequence of

their expectations, teachers were selective about which ideas presented at the Workshops would be adopted.

The Standards Awareness Workshops I attended took place during the summer of 2010. That Fall, I had the opportunity to follow up with one of the teachers who attended one of the workshops. John was a 30-something-year-old teacher, with a stocky, yet athletic frame, short brown hair, and an olive tan. He taught 7th and 8th grade science in the district in east Tennessee where I conducted long-term fieldwork. During the Workshop, he had acted as a sort of “class clown,” often joking with the other teachers about wanting to leave. Like the other teachers, he treated the summer workshop as a waste of time, and he wore shorts, flip-flops and a t-shirt to index his attitude.

When I met John in his classroom, he was dressed more professionally with slacks and a collared shirt. He told that he had relayed what he learned at the Workshop to other science teachers in his district in a day-long workshop at the beginning of the semester. Surprisingly, he said that he had found the State Workshop to be helpful for him. Like the other teachers I had encountered, he was most interested in the activities and ideas for teaching offered at the Workshop. He particularly like one idea, demonstrated at the Workshop, of having students keep scientific journals. He had adapted this idea directly into his course, and he showed me examples from students. However, he also had misunderstood aspects of the Science Framework. For example, the Workshop presenters had emphasized that “Embedded Standards” having to do with inquiry were to be embedded within other curriculum content rather than be treated separately. When John shared with me the curriculum map for 8th grade science, which tells teachers at each grade level what they need to teach for each subject during the course of the year, it began with a separate unit on Inquiry. Rather than reflect the standards, it seemed to be based closely on the organization of the textbook. Indeed, John admitted to me that he was very familiar with some of the content, but that he was able to rely on the science textbook to fill in gaps in his understanding.

Teachers’ Understandings

Throughout all three workshops I attended, I noted that the topic of evolution was never discussed among entire classrooms, and the workshop leaders did not bring it up. Standard 5 was actually included as an example in one activity that aimed to explain how the standards were to be read. While this may sound like an opportunity for the state to inform teachers about precisely what ought to be taught about evolution, the presentation and discussion was focused very specifically on the numerical and formatting system used for the new framework. The specific content was never discussed.

When I later interviewed Audet, I asked him about the possibility that many teachers do not understand the science content that they are asked to teach, specifically noting the likelihood with regard to evolution theory. I knew that such gaps existed, and the authors of the framework and even the chair of the board of education all agreed on where those gaps were likely to be: middle school science teachers, who teach grades 6, 7 and 8. Most such teachers have a K-8 Certification, which qualifies a teacher to teach elementary school grades, but it does not involve special coursework in the discipline being taught, which means that many 8th grade science teachers have only basic understandings of biology.

His response suggested that he did not think of this content as essential to the process of standards implementation. Audet explained to me that teachers were expected to master the content on their own. The necessary knowledge ought to have been learned in postsecondary education. He said that, through the Workshops, the Tennessee Department of Education could

“teach them to fish,” but could not “give them a fish.” Gaps in a teacher’s knowledge should be addressed by the teacher through independent research or professional development. In fact, the state was attempting to facilitate professional development in particular content areas through a new STEM website. Audet was closely involved in the development of the website, speaking about it like his personal project. He pointed out that GLEs would be tagged to link to web resources for content and for classroom activities. Eventually he wanted to tag them to keywords, enabling teachers to easily find the resources they needed. The website even included resources on misconceptions, so that teachers would learn to watch out for them.

Later in the project, when I began to interview 8th grade science teachers, I noted substantial gaps in their knowledge about content in Standard 5, as I had predicted based on a host of previous studies (Aleixandre Jiménez 1994; Nadelson 2009; Nehm, Kim and Sheppard 2009; Rice and Kaya 2012; Rutledge and Mitchell 2002; Trani 2004; Wiles and Branch 2008). Of the eight teachers I interviewed, only two had an accurate understanding of the content. Though virtually all of the teachers were able to explain how natural selection works, they were hazy on certain details such as the source of variation through genetic mutations, and they defaulted to more Lamarckian mechanisms to explain specific examples of evolution in the interview.

The most glaring gaps were related to knowledge about the evidence for evolution and how phylogenetic relationships work. For example, several of the teachers told me that they could not understand how apes could still exist if humans evolved from them, a problem they interpreted as a weakness in the theory. One teacher misinterpreted a *National Geographic* article on *Ardipithecus ramidus*, with the subtitle: “Move over Lucy, and kiss the missing link goodbye,” as evidence that humans are not actually related to chimps, and then taught this new “finding” to her students. Looking at the article itself, it is easy to see how she may have been misled. The third paragraph reads:

The fossil puts to rest the notion, popular since Darwin's time, that a chimpanzee-like missing link—resembling something between humans and today's apes—would eventually be found at the root of the human family tree. Indeed, the new evidence suggests that the study of chimpanzee anatomy and behavior—long used to infer the nature of the earliest human ancestors—is largely irrelevant to understanding our beginnings. (Shreeve 2009)

The teacher’s misunderstanding seems reasonable until you read the rest of the article, which describes how *Ardi* retains ancestral traits from earlier common ape ancestors, indicating that chimps derived those traits after splitting with the hominin line. That she would have missed the main idea of the article suggests either that she read it carelessly, possibly only up through the first paragraph, or that she wanted to see something that was not there.

Though these misunderstandings cannot be entirely ignored, I do not want to over-emphasize them. As Chapter 7 will make clear, the relationship between understandings of evolution and people’s beliefs and attitudes about it is complicated. The examples above can be viewed as misunderstandings, but they were actually presented to me as reasons to reject evolutionary theory. In other words, these examples are better seen as evidence that these teachers were opposed to teaching evolution than as evidence that they required more coursework in the topic. Rather than discuss them further, it is useful to consider the local environment of teachers, so that we can discover what motivates teachers to focus on these kinds of supposed “weaknesses.”

The Local Situation of the Teacher

Tennessee's Department of Education does not govern education in the state, but rather sets guidelines. The task of governance falls on what the Tennessee Constitution calls "Local Education Agencies" (LEAs) which are more commonly known as school districts. Tennessee has nearly a 100 such districts, most conforming to county boundaries, though some counties have districts divided between an urban center and a rural periphery. LEAs do not receive oversight from the state, except when test scores for a school are low and do not show adequately yearly progress for three years, as dictated by No Child Left Behind. In this case the state then has authority to take over or shut down the offending school.

Districts are headed by a Director of Schools, who is appointed by an elected school board for contracts of 2-6 years, depending on the district. Directors have the authority to hire and fire school personnel, both principals and teachers. Theoretically, their directive is to carry out the will of the school board, though in practice, a school board may defer to the Director for most practical matters. The activities of teachers are overseen by principals. Activities of principals and teachers are overseen by the director, and activities by the director and his or her assistant directors are overseen by the school board. Of course, the school board's activities are theoretically overseen by the public, though board meetings are rarely attended, in my experience.

While state standards for each subject and grade level are set by the State Board of Education, LEAs have a great deal of flexibility in how subjects are covered. Most produce a curriculum pacing guide for teachers, stating which topics will be covered, in what order, and for how long. Teachers, in turn, have some flexibility with these pacing guides, extending a unit if students are having difficulties, being the most typical teacher-led alteration. These curriculum maps seem to be one means by which districts are able to limit coverage of evolution. The common practice seems to be placing evolution at the end of the year in high school. Multiple biology teachers, in different districts, complained to me that when the class lags behind the schedule, the first topic to go is evolution.

Education policy is ultimately enacted in the "everyday classroom" (Rockwell 1995), where teachers act based on situational factors. Science teachers are individuals and community members, in addition to being employees of the school district. Sometimes they act according to interests that fall outside the intention of policy-makers. Teachers in rural Tennessee face not only shortages of time and teaching materials, but also concerns about their own employment. With threats of loss of funding and administrative control on schools, teachers feel great pressure to ensure that students have high test scores. In many districts teachers' salaries are even tied to test performance.

At the same time, administrators may give weight to sentiments against evolution and thus discourage teachers from covering the topic. In many areas of rural Tennessee, the public school system is the largest employer of the county. This means that directors of schools hold considerable local power, and few teachers are willing to risk losing their job by acting contrary to the director's wishes. Consider, for example an interview I had with a district-level science coordinator in a rural county not far from the capitol. She explained to me with surprising candor the consequences for any teacher stupid enough to teach evolution, "That's a good way to get yourself fired around here." In the east Tennessee district where I conducted long-term ethnographic fieldwork, the director and assistant director of curriculum both taught Sunday School, though the director taught adults in a Baptist Church, while the assistant director taught children in a Church of Christ.

A teacher has a life history, a family, an identity, particular interests, and sets of knowledge. They typically live day to day within the same community that is served by the school. The teacher sees the parents of students at the grocery store, at a restaurant, or at church. Moreover, teachers tend to work in or near to the district where they attended school. Having been raised in this environment, it should not be surprising that many administrators and teachers do not merely listen to community concerns, they may also share them. Half of the 8th grade science teachers of every participating middle school in the study believed that evolution was antithetical to Christian faith and is dangerous to teach.

Even if teachers do not agree that evolution ought to be a concern, they recognize the reality that evolution is a concern for their students, administrators and others. Disgruntled members of the public are not simply phone calls, emails or even visits to the office. They are neighbors and fellow shoppers, gas-pumpers, and fans at the game. Their students, of course, also exist among these attitudes and tend to be a part of it. I met many teachers who disagreed with religious reasons for rejecting evolution and yet accepted the argument that creationism could be taught out of fairness. At a Tennessee Science Teacher Association conference, teachers attending a session titled "Icons of Evolution," which involved watching and discussing the DVD "Icons of Evolution," based on the book of the same name, connected with the Discovery Institute, were ready to agree that *if* there is evidence against evolution, students ought to know about it. At the same time, they were completely unwilling to discuss it as a religious matter, despite efforts by the session organizer to steer the conversation in that direction.

All of this is brought to bear on how Tennessee science teachers interpreted the Framework to determine what exactly they were supposed to teach. I spent six months within the jurisdiction of one LEA in eastern Tennessee, conducting ethnographic fieldwork. I was able to learn firsthand how the LEA was governed and how unofficial policies of tolerating the teaching of creationism were able to escape outside notice. The implications of the balance of power in Local Education Agencies are that, as long as the Director is supportive of creationism in the science classroom, a teacher could introduce it with impunity. Indeed, even in Nashville I witnessed a principal and teacher chatting about the fact that evolution had no scientific support. The teachers in the district in East Tennessee were in a context where avoidance and even subversion of evolution were encouraged, a situation that allowed a great deal more flexibility in discussion evolution that in the districts that allowed me access.

Though I was not able to meet with most teachers in the district, owing to opposition to the project by the district administration, I was able to approximate their approaches to evolution through interviews with students in the district. Out of 6 high school teachers who taught biology, the students of at least 3 different teachers told me that they had been taught that evolution is "only a theory" and that the science behind it has problems. One of the teachers explicitly taught Intelligent Design as an alternative theory to explain the diversity of life. Another teacher taught creation science and evolution science side by side and encouraged the students to decide for themselves. The third teacher simply cautioned students that evolution was not settled science, explaining that they were learning it only to pass the state tests. Regardless of a teacher's specific approach to disparaging evolution, the students with whom I spoke were convinced that evolution was not scientifically sound. To my surprise, this included a student whose parents were agnostic and who told me that he too was agnostic. Despite any religious-based objections to evolution, he had been convinced by his teacher that evolution had serious problems, including a lack of supporting evidence.

In spite of public and administrative support in the district for subverting evolution, teachers were still able to exercise some agency. Of the three remaining high school teachers, one simply avoided the topic altogether, covering it cursorily immediately before the state test. The other two taught it, but were careful to avoid offending students. I spoke to one of them, who explained his strategy as teaching all the components of the theory, without mentioning the word “evolution.” Only near the end of the course, when students have come to understand and accept all the components, does he bring all the concepts together and call it by its name. He claimed that this strategy has been effective, and that thus far no students or parents had complained. The reader may recall that his strategy closely mirrors that described earlier by Linda Jordan.

I was only able to talk to two of the middle school science teachers, out of as many as a dozen who teach 8th grade science across the 8 middle schools in the district. Both of these teachers told me that they tempered the evolution lessons. One teacher told me that she encourages students to do an extra-credit research project on creation science during the unit on evolution. She told me that she directs them to any of several “good resources” on the internet, including “answersingenesis.org,” which she characterized as being “excellent” and “very accurate.” The other teacher taught mostly from the textbook. He simply assigned the material on evolutionary theory, but if questioned by students told them that he did not believe in it, and that they could decide whether to believe in it themselves. I interviewed only 4 students in 8th grade, and none of these students remembered learning anything about evolution or “change over time.” This is despite the fact that the curriculum map for the district had located the unit on evolution at the beginning of the year, and the other 8th science teachers had told me that they had already covered it. It is likely that the students had learned about related concepts without ever being explicitly told that they relate to evolutionary theory such that they were simply not aware that evolutionary material had been covered.

I am often asked how the teachers at my east Tennessee field site could get away with what appear to be blatant violations of constitutional law, as determined by multiple court cases. Much of the above can be linked directly to the practical aspects of small town politics, where most community members know one another: they see each other at the grocery store, greet one another in restaurants and pay close attention to church attendance. Everyone with whom I talked knew who the Director was. They had gone to school with the Assistant Director of Curriculum. Even the media in the town were unwilling to press the issue. I spoke with a reporter for the town’s only newspaper, who was in charge of covering education topics. While she admitted to hearing rumors about creationism being taught, she had never written anything on it (nor had anyone else at the paper) and did not want to share specifics with me, especially after learning that the Director was against the project. Her ability to get access to information and events required good relations with him.

In this town, the community members who believe in evolution are a very quiet minority. They tended to work in nearby colleges and universities, and most of them attended the Presbyterian (USA) and Episcopal churches, though I met a few through the several United Methodist Churches. They were willing to talk and participate in the research anonymously, and generally supported evolution education, but none openly opposed reports of creationism being taught in the public schools. Most people with whom I spoke about the issue were resigned, explaining that it was easier to talk to their kids after school than to fight against it. A representative of the Tennessee Chapter of Americans United for the Separation of Church and State, a watchdog group that monitors and provides legal aid for violations of church-state

separation, told me that the group knew there were violations throughout the state, but that very few people come forward, not merely on the subject of creationism, but also prayer in schools, religious displays by on-duty teachers, and displays of Ten Commandments in public spaces. In these cases, those who “blow the whistle” on violators often face public sanctions, including ostracism, threats and vandalism, as occurred for the plaintiffs in Dover, Pennsylvania who brought suit against a public school for introducing Intelligent Design materials (Humes 2007).

In summary, there exist communities in Tennessee where teachers handle the unpopular task of teaching evolution by subverting it. As long as administrators can maintain official distance from these acts, and as long as parents and students do not complain, these teachers are able to carry them out with impunity. At the same time that it is apparent such practices occur, it is impossible to document how widespread they may be. By necessity, these teachers act outside of the purview of the state, and by extension, they are unwilling to cooperate with a project that scrutinized their approach to this topic.

Teacher Interpretations

Though I was unable to learn much about the perspectives of science teachers in this district, I was able to eventually interview their peers in other districts, in order to gain more insight. The districts that participated in this project were biased in favor of supporting evolution education. After all, administrators would not have opted to participate had they been worried that I would uncover efforts to subvert the standards. Indeed, most of the districts declined to participate after learning that the research concerned evolution specifically. This was especially the case in the eastern part of the state, where 80% of districts initially interested in participating ultimately decided against it. While it would be presumptive to conclude that any districts unwilling to participate must allow teachers to cover creationism (after all, the district may wish to avoid parental attention on the topic of evolution precisely because they do teach it and it is controversial), the pattern of refusals demonstrates how unlikely it would be for a district to choose to participate in the presence of known violations.

In all, I conducted in-depth interviews with eight middle school science teachers in three school districts, along with most of their students at the time of the interview, in order to learn their perspectives on Standard 5. These teachers are probably not representative of the views and approaches of the majority of their peers, as they were willing to talk to me, an outsider anthropologist from a major university in Nashville. It is likely that there are many more 8th grade science teachers in Tennessee who go to less trouble to reconcile their curricula with official state policy. Nevertheless, the teachers who spoke with me illustrate the transformations that policies undergo when they enter the everyday classroom of situated teachers.

The heart of the issue is that all the teachers I met believed that they *must* teach the standards. Given the high stakes associated with student test scores, impacting their incomes, relations with administrators and even their jobs, no teacher considered simply not teaching a standard. Equally crucial, however, was that they did not see “teaching evolution,” as a viable option, owing to a variety of concerns, many of which are pragmatic. Thus, teachers were compelled to reach the conclusion that covering Standard 5 does *not* require teaching evolution. Teachers employed two main semantic readings in order to resolve their conundrum. First, they read Standard 5 as not being about evolution at all. Second, they distanced themselves from the act of “teaching evolution,” by defining “teaching” as something like indoctrination wherein students are compelled to accept knowledge as truth.

Only two of the eight 8th grade science teachers indicated support for teaching evolution. One of them, whom I will call Chris, is the primary science teacher at a middle school in a town in eastern Tennessee on the outskirts of Knoxville. The district where he works has seen controversy over teaching evolution in the past, though the administration was nevertheless fully amenable to my project, suggesting that these conflicts were only peripherally felt by administrators. Though he avoids the word “evolution,” Chris says that he teaches “change over time” in a way that his students know he is actually talking about evolution. On whether Standard 5 requires teachers to cover the topic of evolution, he says: “Yeah that's what it is. I mean you can call it something else but that's what it is.” Both he and the other teacher believe that evolution is supported by scientific evidence, and they teach that evidence to their students. Furthermore, neither of these two teachers reported any personal conflict between their own faith and evolution:

Me: Do you think that a Christian can believe that humans evolved from other animals?

Chris: Yeah. I really think the two can coexist. I think it's all a matter of time tables.

Me: So, do you feel any conflict between your religious beliefs and evolution?

Chris: Nope. There's no people here at this time, but let's look at the seven-day story. What's a day to an omnipotent being?

The other teachers, by contrast, indicated to me reluctance to teach evolution, based on a variety of reasons. They all agreed that “teaching evolution” in middle school would cause conflict. This was not merely the case for those who taught in rural Tennessee. Diane, a teacher in her mid-thirties, with curly chestnut hair, teaches at a school that serves a mostly white, middle and working class community in Nashville. During the interview, Diane told me:

...I didn't want to step on people's toes because it's a big religious area. You know, we're in the Bible belt. So I didn't want phone calls like that.

Notably, the teachers seemed most sensitive not to complaints from parents, but from the students themselves. At some point in the interview, each of them expressed the idea that eighth grade students are still too young to be confronted with evolution. Kelly, a young teacher only a few years out of college, with shoulder-length, frizzy blonde hair and a nose stuffed with allergies, expressed this idea most clearly, using a moralistic argument:

I don't think they're ready for it at this age. I just don't think that they can have a civilized debate on the concept without screaming or yelling or people crying and breaking down. They're just so...so young. And that's why I have to teach it as change over time. Because they are like that. They're so, “This is what I was taught in church, don't throw that away from me.” And at this age, I can't take that away from them. Because they're going to have a rough 4 years ahead of them. Where you don't want to take away what they were taught in church, because they're going to be tested. Because high school sucks. They look back at it, I looked back at it, and you think about all those experiences you had and think, “Thank God I had *something* to help me get through that.” I wouldn't have wanted to be questioning.

Implicit in her concern, of course, was an idea that she shared with Diane—that evolution is incompatible with Christianity. As Diane told me, “It says in the Bible that God created man, so as a Christian, I don't see how you could [believe that humans evolved from non-human animals].”

Tom, is in his mid-fifties, tall and slim, with thinning gray hair. He speaks slowly, with a kind smile and a friendly demeanor. He taught 8th grade science in Nashville, in a middle school serving a community with a high immigrant population. Most of his students are minorities and

English language learners, and his school, like several others in Nashville, has been under pressure from low test scores. Though he did not indicate that evolution posed any conflict for his personal religious beliefs, Tom recognized that many of his students believe there is a conflict, and he does not want to invite this kind of discussion in his classroom, leading him to avoid the topic of "evolution" as much as possible.

Tom: I don't think it's covered very well in the book. They present it in an evolution chapter. They really ought to split it out, because then you're having to deal with that evolution card.

Me: So do kids notice that it says evolution in the title?

Tom: Yes, I believe so.

Me: So then do you have to say, "Hey, we're not covering evolution. We're just covering adaptation"?

Tom: I didn't bring it up. I just talked about adaptations. And I could tell, they were like, "Well, see"?

Faced with the conundrum of teaching a subject that is so controversial, many teachers find ways to temper it. The most common strategy was simply to avoid the term "evolution." According to Jill, who taught middle school students in a rural district in Middle Tennessee:

But, at this age the students are at a point where if you say the word evolution, they have been taught at home to shut down. And so we know that evolution happens, a form of evolution happens all the time. And so in order for the students to continue to keep their mind open and accept what is actually happening and not just say evolution is not happening because "I've been told that evolution is horribly bad and wrong and awful." So she [another teacher] did not use that term [evolution].

While a few of the teachers simply substituted "change over time" as a euphemism for evolution, others took advantage of the difference in terms to refocus the content away from evolution altogether:

Me: Do you think the standards require you to teach evolution?

Kelly: Does it require it?

Me: Well, I mean, if you are teaching the standards, then would you need to teach evolution?

Kelly: I think it requires us to, but there's a way you can teach around it, to teach change over time versus the whole theory of evolution. I think you can teach change over time and not get into the controversy of evolution. There's a way to do it tactfully, and I haven't had a parent complain at all. If I taught evolution, parents would complain.

Elsewhere in the interview, Kelly made it clear that she did not mean simply to avoid using the word "change over time." She distinguishes between the concepts clearly:

Me: Do you think that evolution is supported by evidence?

Kelly: If we're talking change over time, yes, if we use that definition. But I don't know about evolution.

Me: OK, so what...what specifically do you think is supported by evidence?

Kelly: Well, changes. Like the appendix going away. Kids lose their wisdom teeth. I use the example of students changing, like how they're taller at the end of the year than at the beginning. If you go to a historic home, all the doors are smaller because people were shorter back then. We use more of our brain power now than we used to.

Me: Alright then, what's not supported?

Kelly: If we evolved from apes then we wouldn't have any apes left. If everything evolved for something else then we wouldn't have the other animal because nature would deselect for that animal. So doesn't make any sense to me.

Me: What are some common misunderstandings you've noticed in your students?

Kelly: That we evolved from apes. That's the biggest one because that's the one they've been hand-fed in church, what they've been told, seen in cartoons, what the media has shown.

Kelly's discussion reveals the fuzziness of "change over time" for describing a process. For the teacher, it can include the normal development of the organism, variation resulting from environmental factors, as well as changes within a species. By contrast, "evolution" refers specifically to the idea that humans come from apes. This particular definition of "evolution," has the discursive advantage of encapsulating the most saliently offensive claims of modern evolutionary theory and thereby leaving the rest to be taught without issue.

While many of the teachers were content to find various means to soften the offense of evolution through careful use of terms, others sought ways to conclude that Standard 5 does not cover evolution content at all. The clearest example of this was Tom, who simply pointed out that Standard 5 in 8th grade never mentions the word "evolution" and maintains that he teaches exactly what he has to:

Tom: Evolutionary theory? No, it's not a part of the content

Me: Do you think it's a part of the standards for 8th grade?

Tom: Adaptation isn't necessarily evolution.

Me: OK. So it's just adaptation?

Tom: That's what I interpret the standards to say

Me: Do you remember what else you cover from Standard 5 besides adaptation?

Tom: Everything I'm asked to do. All of it.

During the interview, we looked at Standard 5 for 8th grade together, and he read each GLE out loud, pointing out that the word "evolution" appeared nowhere in the 8th grade standards.

I noted two major interpretive strategies these teachers used to sidestep the intent of the authors of the Framework with regard to Standard 5. The first method was to teach the standard as a set of disjointed concepts. For example, Tom covered each of the major topics of Standard 5—fossils, adaptations, taxonomy and biodiversity—separately, without connecting any of them together. And, to be clear, I cite the fact that he also complained to me that the textbook is too explicit about its use of the word "evolution," to support my claim that he was using a legalistic interpretation of the standards merely to avoid teaching evolution and not because he had no idea what the state had meant. He eventually explained:

Tom: It's just that I take this very seriously, and I've given it considerate thought. I'm teaching what I'm told. And just because I don't expand on adaptation to lay out the whole gamut of scientific thought, there is enough there already to do, and they know where it's going.

Tom's minimization of requirements of the standard was aided by the Framework and the importance of standardized testing. Students are not tested on whether they understand how the taxonomic organization of species reflects phylogeny, but instead on whether they can use a dichotomous key to classify a species. They are not tested on whether they understand that faunal succession in the fossil record is evidence for large-scale changes in organisms over time, but instead on whether they could apply the law of superposition (that fossils found further down are older than those closer to the surface).

The other interpretive strategy was for teachers to adopt interpretations that focused on biodiversity issues rather than evolutionary issues. When the creationist teacher Mitch Carter (pseudonym), discussed in the last chapter, asked his fellow middle school science teacher how he approached the standard on evolution, the teacher replied with what Carter described as “a twinkle in his eye,” that the standards for Grade 8 are not about evolution; they are about biodiversity. This particular interpretation was, of course, encouraged by the title of Standard 5: “Biodiversity and Change over Time.” Due to the ambiguity in the text, resulting from the negotiation that occurred during editing, many of the GLEs in Standard 5 could be read in terms of biodiversity *instead of* evolutionary theory.

For example, I noted that GLE 0807.5.4 appeared to be a clever means of getting teachers to cover the importance of genetic diversity in allowing evolution to occur. During interviews, however, it became apparent that there is another way to interpret the reason that variation is important to a species’ survival: inbreeding among endangered species. Virtually all organisms have at least some alleles for particular genes that are harmful, but also recessive, which means that they are not expressed when a better functioning version of the gene also exists. These harmful alleles are only really a problem if an organism has two copies of the same bad allele, which obviously could only happen if both parents had the same harmful allele. Such a situation is likely to occur when the parents are closely related, which is why inbreeding is associated with genetic abnormalities (Charlesworth and Charlesworth 1999). And inbreeding is more likely to occur when other viable mates are difficult to find. The term for this phenomenon among biologists is inbreeding depression (Hedrick and Kalinowski 2000). This inbreeding can result in offspring that are less likely to survive themselves (Keller and Waller). Thus low populations may have low genetic diversity, leading to inbreeding and genetic diseases, which in turn makes offspring even less likely to survive.

If this alternative interpretation seems to be far-fetched, considered the following passage excerpted from one of the textbooks in use in Grade 8 in Tennessee:

However, if a population decreases rapidly, many characteristics may be lost entirely from a population because all of the individuals with those characteristics died. This reduced number of characteristics within a population is called a *genetic bottleneck*, as shown in **Figure 7**. If the population is able to increase again, inbreeding will cause the individuals to be genetically similar. These genetic similarities may make the population more susceptible to birth defects and genetic diseases. And many individuals would likely be affected by the same disease. (*Holt Science and Technology, Tennessee Grade 8*. 2010, italics in original)

This excerpt comes from a section within a chapter that covers natural selection, so it is not the case that this particular interpretation of the GLE is presented to the exclusion of the primary interpretation. However, it is not a passing comment either. The passage is followed by an example of the Florida panther population, which is endangered and suffers from inbreeding depression. The “Reading Check” at the bottom of the section asks, “How can a decrease in genetic variation within a population affect the population,” which sounds very similar to GLE 0807.5.4. For a teacher who prefers not to emphasize evolution, this is a salient and tempting reading of the GLE. One middle school science teacher I interviewed in eastern Tennessee focused on this when asked about the coverage of natural selection in Grade 8:

In the eighth grade we do natural selection. We do the giraffes, and next go through a lot more with natural selection. We talk about the variations in the South American sea lions and the cheetahs and about how because of their habitat being encroached upon, it's much

smaller and the genetic pool is so much smaller. They have so many more genetic diseases and this is due to a change over time. Those are some topics that I will discuss. The Florida Panthers are in the textbook and in the cheetahs and the sea lions are ones that I have.

While these interpretive strategies appear to be purely utilitarian, teachers recognized the stakes involved in getting it wrong. The dilemma these teachers face, between concerns over evolution and getting it right for testing is palpable. Even with these options for interpreting Standard 5, some teachers had difficulty deciding what to do. For example, Jill equivocated throughout an attempt to answer this question:

Me: Looking at the eighth-grade science standards do you think that requires you to teach about evolution?

Jill: I don't think it requires, which I really don't. I know it's expected and I know that's how it's really interpreted and I know that we're supposed to use the textbook first of all rather than going off in another direction that it goes but, no, when I read the standards, it looks optional, but I know that there are going to be questions on the TCAP and that's what drives it and I would be remiss to skip over it because if the students see it on the TCAP, then they need to be prepared, so I need it covered even though the standards look like I don't have to. It's very important and I know that the test scores are very important, and so I would be remiss not to cover it.

Given the difficulties involved in interpreting Standard 5, and the risks engendered by those interpretive choices, nearly every teacher engaged in another semantic shift. To ensure that "teaching evolution" as an act is something that these teachers *do not do*, they adopt a very specific idea of what it means to "teach evolution." In addition to the word "evolution" itself, the word "teach" also has a special meaning in the context of opposition to evolution. To "teach" evolution is equated to telling kids that evolution is true. Many teachers I talked to expressed this kind of concern, which stems doubtlessly from the fact that teachers generally imagine themselves to be imparting knowledge, which is, by definition true.

The best example of this notion was expressed by Mitch, a teacher who organized a session at the 2009 Tennessee Science Teachers Association conference to discuss his conflict with teaching evolution. He began the discussion with the following statement:

I'm a middle school teacher and I teach 7th grade science in the old curriculum, so with the new recent change in the standards I can no longer teach evolution, this is just a passion of mine. And I don't know but I could just imagine a high school teacher teaching this unit and they also took the students one day, ok students if you'll turn to chapter 11, our next unit of study is on evolution. I can just imagine students raising their hand and saying, "Do I have to believe this?" and I think, "What are they asking? What are they asking? Do I have to believe this? I mean who am I, do you know who I am? I'm a science teacher! I mean if anybody is going to tell you the truth, you would think that science teacher would tell you the truth..."

Notably, the teacher facing this professional crisis was being hypothetical. Teachers who have actually dealt with it have found the solution, as the immediate response to his expressed concern demonstrates. A woman in the room explained to Mitch:

I just tell them it's not about belief. It's about you got to get these answers right for the state test. Because I am required to teach it. That is... [chuckles from other teachers and from Mitch] I am THAT honest. That's exactly what I tell them. I say, "whether you believe it or not is a personal choice, but this what you're expected to know about."

I interviewed Mitch a year later and he told me that he hadn't thought of it that way before and was no longer concerned.

In other words, to teach implies endorsement, and, in the context of a subject like evolution with claims that undermine biblical authority, it is seen as indoctrination. To combat the sense that they are "teaching" evolution, teachers adopted the language of critical thinking:

You know I just want them to be able to think for themselves. I don't want to sway their opinion to whatever I think. I want them to understand that it's open-ended.

In our interview, I asked Tom what he teaches the class regarding "classification," and his response was "critical thinking," which makes no sense except as a way of completing his point from earlier. This attitude is best understood through the contrast between "teaching evolution" with "teaching both sides." To teach evolution only implies that there is no choice but to accept it, whereas to teach both sides makes clear that students are free to make a choice between atheistic evolution, on one side, and biblical creation, on the other.

"Teaching both sides" was nearly always brought up in interviews with parents, pastors, teachers and other community members as the most acceptable solution to the debate over evolution. Reflecting this, Diane explained:

So I wanted to reassure kids that were believers that you have a right to believe what you believe and those of you who don't, you know, I'm just presenting both sides. Here's what they say. Here's what they're thinking. I didn't want to get phone calls or anything like that.

It is notable that "teaching both sides" needn't imply formally covering creationism alongside evolution. In the case of Diane, it mostly consisted in reminding students that they had a choice. She paraphrased for me what she told her class when they asked her about evolution:

For those of you who are believers, you know where you came from. And for those of you who don't know or aren't sure or are not a believer, then you believe in the scientific explanation of the big bang theory, and then from there we evolved. And that's your right.

In short, Diane and other teachers were able to teach Standard 5 without violating community sentiments against "teaching evolution." They were able to do this by exploiting the ambiguity in the text of the Tennessee Science Framework. They negotiated the content in Standard 5 through their interpretations of it. First, by employing the term "change over time," rather than "evolution," they could avoid controversy surrounding the latter term. In some cases, they also adopted a hyper-specific definition of "evolution" limited to human evolution, and an overly general definition of "change over time," referring to anything from development to environmental change. Second, they used the absence of "evolution" in the text to argue that Standard 5 was either a collection of disjointed biological concepts or actually about biodiversity and ecological concerns. Finally, they contrasted their own coverage of evolution with efforts to "teach" it. Whereas the latter was a kind of indoctrination aimed at changing students' beliefs, the former was situated in the rhetoric of "balance."

Conclusion

The primary argument throughout this chapter is that Standard 5 in the Tennessee Science Framework cannot be understood simply as a text with intrinsic meaning. Instead, the Standard is interpreted by teachers, administrators and other actors. Furthermore, it is through this process of interpretation that teachers are able to negotiate between the demands of the state and the concerns of community members.

Though the authors of the Framework contributed to the ambiguity teachers exploit, they made no effort in standards training workshops hosted throughout the state to inform teachers what they intended by Standard 5 or how to teach it. Ironically, these workshops emphasized how to “read” the standards, in terms of decoding the format of the document and understanding the concept of learning progression. Though the state repeatedly told teachers to focus on Grade Level Expectations (what students should know) rather than State Performance Indicators (what they will be tested on), it was clear from discussions among teachers during and after the workshops that they would focus on the latter. By concentrating teachers' attentions on specific skills or statements of fact, they did not have to bring the ideas together.

More and more test scores have profound effects on the livelihoods of teachers, so it should not be surprising that teachers pay more attention to the content of those tests and less attention to the standards themselves. Unfortunately, the few questions on the tests that concern evolutionary theory tend to focus on factual recall rather than comprehension. In fact, several teachers complained that considerations for the test made it risky to cover evolution, since it would eat up class time with arguments and leave less time to cover topics with a greater pay-off in terms of scores. It is ironic that standardized tests, the only means a state department of education has to convince teachers to cover standards, can actually function as a dis-incentive for teachers to cover the state-mandated curriculum.

In interviews with eighth grade teachers, many disagreed that Standard 5 concerns evolution for 8th grade science since the word "evolution" never appears. At the same time, there were teachers who insisted that evolution is in the Standard, even if not by name. Along with the standards authors, these teachers told me that the meaning of the standard is made clear by the trajectory of the standard across grade levels, where in High School Biology it is entirely and explicitly about evolutionary theory. Another indication noted is the content itself, which comprises only concepts relevant to evolution, like "natural selection." Reflecting these interpretations by teachers, in interviews, the majority of students denied ever hearing the word “evolution” in class, and predictably associated very few of the biology concepts they learned with evolutionary theory. The results of interviews with students will be discussed in the following chapter.

Chapter 7: The complicated relationship between students' beliefs about origins and understanding of evolution

Efforts to teach evolution in public school have met resistance for nearly a century. While proponents of evolution education and its opponents obviously disagree on a number of points, one assumption they tend to share is that when students learn and understand evolution, they accept it as true. This assumed link between understanding evolution and believing in it is based on a rationalistic model of belief. According to this model, people are convinced by reason and evidence to accept or reject various propositions. Therefore, if students understand evolution, then they must accept it. By the same logic, of course, any person who does not accept evolution as true must not actually understand it. Creationists are thus pronounced scientifically illiterate, or even patently ignorant, *by definition*. Needless to say, this does not inspire the most respectful or productive attitude among any who subscribe to this logic.

The model fortunately makes testable predictions about the relationship between understanding evolution and beliefs about evolution. Specifically, beliefs and understandings should be positively correlated since more understanding ought to yield more acceptance. Obviously, we should see the poorest understandings among students who reject modern evolutionary theory most profoundly, and the best understandings among those who most accept it. Furthermore, the model would predict that, if students gain a better understanding of evolution, then they will also come to accept it more than they had before they gained this understanding.

Literature Review

Contradicting this model is the fact that nearly every study from two decades of research has demonstrated that students almost never change their beliefs following evolution instruction (Anderson 1994; Bishop and Anderson 1990; Lawson and Worsnop 1992; McKeachie, Lin and Strayer 2002; Shtulman and Calabi 2008; Sinclair and Pendarvis 1997/1998). The same studies cited above have tried to find a relationship between how students understand evolution and whether they believe that evolution occurs, but the results from decades of research on the topic are ambiguous. The majority of studies report no relationship between belief and understanding (Bishop and Anderson 1990; Brem, Ranney and Schindel 2003; Demastes, Good and Peebles 1996; Demastes, Settlage Jr. and Good 1995; Lord and Marino 1993; Sinatra et al. 2003). The only reliable effect has been found with biology majors in upper-level biology courses, presumably related to the advanced levels of knowledge and understanding involved (Ingram and Nelson 2006; Moore, Brooks and Cotner 2011; Shtulman and Calabi 2008; Southerland and Sinatra 2005).

The ambiguity in the literature may be partially attributed to differences in methodology (Smith 2009), with respect both to measures of understanding and acceptance or belief⁷⁰. Neither

⁷⁰ Evolution education researchers have long insisted on using the term "accept" rather than "believe" in reference to evolution, following an essay by Mike Smith (1994) and framing strategies by the National Center for Science Education. I will discuss the rhetorical difference between terms in the next chapter, but here I feel obliged to justify my use of the term "belief." First, it is important that instruments used in research be correctly understood, and the term is more familiar to most students. Second, the use of the term "acceptance" is supposed to communicate that scientists base assertions on evidence, not personal beliefs. While such usage helps make clear the nature of science, in general, people *do* believe things even in the absence of evidence. Many people believe in evolution despite having little understanding of how it works or even a sense of the evidence that supports it.

is straightforward, and it is relevant to discuss each in turn, beginning with the latter. The crudest method for measuring belief is to assume what respondents believe about evolution based on some other measure of religiosity. Unfortunately, looking only at church attendance fails to recognize that a given church's position on evolution may not be antagonistic. This problem can be alleviated by attempting to identify denominational affiliation. For example, Moore and his colleagues (2011) asked undergraduate survey participants to self-identify as attending a conservative church (on the assumption that they would be opposed to evolution), a liberal church (assuming they would accept evolution) or no church at all, and used students' responses to compare mean understanding across the corresponding groups. However, even considering denominational affiliation or theological orientation of the church (e.g. mainline/liberal vs. evangelical/ conservative), such measures are unreliable indexes of participant beliefs about evolution. A student may attend his or her parents' church, which may or may not reflect his or her personal beliefs. Even among adults, church members cannot be assumed to all hold the same beliefs, even on an issue of scriptural inerrancy. Though church attendance and denominational affiliation are relevant to a students' experience of evolution education, telling us something about the everyday environment in which different students live, they are simply not good measures of belief.

A much more direct way to determine student attitudes toward evolution is to ask them directly. Most studies have used a single item to indicate belief in evolution: a statement to which participants agree or disagree. The precise wording used by each study varies greatly, to the extent that researchers may be measuring qualitatively different things (Smith 2009). For example, consider the following statements:

- 1) All life on earth evolved through a natural process.
- 2) Humans evolved from non-human animals.
- 3) God created humans in their present form.

While all three statements are ostensibly about evolution, the second specifically mentions humans evolving, a proposition many people find to be more controversial than the idea that other living things evolved. Moreover, the first statement characterizes the process of evolution as "natural," contradicting potential beliefs about an evolutionary process that is guided by God. The third statement is obviously focused on beliefs about creation rather than evolution. Though it might seem to be the inverse of the second statement, a subtle reader may interpret it as being consistent with the view that God used evolution as a way to create humans. A theistic evolutionist could thus conceivably agree with both statements without contradiction. Results from the same population would presumably be different depending on which statement was used.

Another issue with single item measures is that they force participants into diametrically opposed positions that obscure a prevalent middle ground between the two. As will be noted below and in the methods section, if attitudes about evolution are conceived as existing on a continuum between strict young-earth creationism on one extreme and strictly naturalistic evolution on the other, then most people fall somewhere in-between, allowing for evolutionary change *and* the involvement of a divine creator.

Better approximations come through survey-style questions that ask students to agree or disagree with various statements of beliefs, or to choose among multiple beliefs. In this spirit, a few studies have used Rutledge and Warden's MATE instrument, which produces a composite score based on acceptance of 6 concepts related to evolution. A smaller group of studies specifically looked at creationist beliefs (Harrold and Eve 1986; Lord and Marino 1993;

McKeachie, Lin and Strayer 2002). Anderson (1994) examined specific beliefs like 6-day creationism. McKeachie and colleagues (2002) used responses to a multiple choice question with evolutionist and creationist alternatives. Lawson and Worsnop (1992) looked at what they imagined to be creationist beliefs along with a host of other beliefs, but they do not systematically test the creationist beliefs by themselves against understanding of evolution. The most sophisticated instrument to identify student beliefs used in such studies was employed by Brem et al (2003). They used survey responses to categorize participants into one of six belief groups ranging from strong creationist to strong evolutionist. This instrument made it possible to see variation in beliefs, and to detect more subtle changes in belief over time.

Measures of understanding also have been inconsistent across studies. A couple of studies have relied on grades (McKeachie et al 2002, Harrold and Eve 1986), despite the existence of many confounding factors that contribute to student grades in a semester-long course. For example, cultural differences between students and their instructors may have impacted their grades (Bourdieu and Passeron 1977).

One source of inconsistency is a failure to determine *what* exactly students need to “understand” regarding evolution. Modern evolutionary theory is built upon knowledge of population genetics, the fossil record, computer modelling, and ecology, among many other topics. A student may understand how natural selection functions as a mechanism driving evolutionary change without understanding the genetic and epigenetic factors that give rise to the variation on which natural selection acts. Likewise, she may understand both of the above without an understanding of the role of speciation events in the emergence of new species or in how phylogenetic relationships are conceived by biologists. “Understanding” evolution would seem to require understanding each of these processes, as well as how they fit together. Many of the supposed arguments against evolution lodged by its critiques are based on misconceptions of one of them. Nevertheless, measures of evolutionary understanding have tended to focus exclusively on the mechanism, while ignoring the other components.

Measuring understanding is further complicated by the introduction of measures of *knowledge* about evolution. A student may have an understanding of how evolution is supposed to work, without specific knowledge about phylogenetic relationships among species. For example, he may know that species have changed substantially over time through the process of natural selection, and yet be unaware that cetaceans are descended from land-dwelling mammals.

Instruments that test for knowledge about evolution risk conflating understanding and belief. An extreme example of this is Chinsamy and Plaganyi (2008) whose test to measure *understanding* includes the following statements (to which students give Likert responses):

- a) Evolution has been proved beyond any reasonable doubt.
- b) All life on earth evolved through a process of evolution.
- c) Evolution is a scientific idea that explains biodiversity of life on earth.
- d) Natural selection is the mechanism that drives evolution.
- e) Humans have evolved and are still evolving.
- f) Evolution happened millions of years ago, and does not happen anymore.

The authors doubtlessly recognize these statements as factual knowledge. Items (a), (b), (c) and (e) are all statements about the reality of evolution simply. However, it would be extremely strange for someone who does not believe in evolution to agree with any of those statements regardless of how well she understood the theory. Items d & f, while not confounded with belief, are poor indicators of understanding. Obviously a student could know that natural selection is supposed to be the mechanism of evolution without any comprehension of what natural selection

is or how it works. Likewise, knowing that evolution continues to occur does not even require knowing what evolution is. A student who equated evolution with growth and development or acclimation to new environments would give a correct response despite a wholly inaccurate understanding of evolution. Though most instruments used to measure understanding do not include such a large proportion of problematic statements, most contained at least a few, which could be enough to drive a weak correlation capable of being significant with a large enough sample.

Cognitive psychologists and education psychologists have relied on more sophisticated measures of understanding. For example, the Conceptual Inventory of Natural Selection is a multiple choice test with common misconceptions included among possible responses (Anderson, Fisher and Norman 2002). Likewise, Jensen and Finley developed an open answer test, wherein students are given a specific scenario of evolution (e.g. cheetahs getting faster, cave salamanders losing their sight over time) and asked to explain the mechanism by which the change occurred (1995). Done properly, they avoid confounding belief and understanding, while also approximating the extent to which students can actually use their conceptualization of natural selection to reason about novel examples, which also avoids confusing memorization skills with understanding. Notably, by looking only at those studies that use such sophisticated measures of understanding, none have found correlations between belief and understanding except among advanced college biology majors (e.g. Shtulman and Calabi 2008; Southerland and Sinatra 2005).

Due to these methodological issues, the relationship between belief and understanding remains unclear. In the rest of this chapter, I will address this persistent lacuna. I present results from research with high school students in two different districts in Tennessee. These results afford unique insight into the complicated relationship between beliefs about evolution and understanding of evolutionary theory. Following a description of the methods involved, I discuss the results from the middle and high school students. As will be seen, student beliefs about evolution were correlated with their understanding of evolution. However, other findings were inconsistent with the rationalistic model of belief. Instead, I will argue that the relationship is better accounted for by a model of belief based on social commitments, which will be described in the Discussion section.

Method

This research incorporates data elicited from one-on-one interviews and follow-up surveys with 8th grade and Biology students and their teachers from two Tennessee school districts—one in the eastern part of the state, and the other in a rural county in middle Tennessee. The interviews were conducted at the end of the academic year, after the students had taken the state standardized tests, and after all materials had been covered. Interviews took place at the schools, in semi-private areas, unobserved by teachers, other students and other school personnel. The interviews lasted anywhere between 40 minutes and an hour and a half, depending on how talkative the student was. Students were made to feel comfortable, given reassurance regardless of responses, and generally treated respectfully throughout the interview. Questions were asked in a conversational style, which encouraged many of the participants to explain more about their views and experiences. Questions were rarely misunderstood by participants. When a student's response suggested confusion, the question was re-worded and clarified. They were free to take breaks, to go off topic, and to ask questions of the interviewers. Responses from students were recorded on datasheets but also digitally recorded and transcribed.

The author personally conducted more than a quarter of all interviews, whereas the others were conducted by graduate research assistants.

Materials and Procedures

The interviews covered a range of topics, including students' religious backgrounds, recollection of how evolution was covered in class, and understanding of evolution and social networks. In the religious portion, the interviewer asks the participant whether she identifies with a specific religious tradition, then elicits denominational affiliation and frequency of attendance. The participant is then asked to tell what he or she believes is the most central or important message of said religious tradition, and to comment on the proposition that the Bible "contains a 100% accurate historical account of the world." Later in the interview, students are asked to recall how evolution is covered in their class, followed by the elicitation of more propositional statements, on whether they experienced any conflicts between evolution and their faith, whether evolution is supported by evidence, whether it has problems or weaknesses, whether a Christian can believe that humans evolved from non-humans, and whether the idea of common descent seems believable.

Scenario task. Understanding the mechanism of evolution was established through an instrument based on Murray Jensen's evolution test, which gives participants real world scenarios in which a species changes over time and asks them to explain how the change occurs (Jensen and Finley, 1996). This instrument elicits a cognitive model of evolutionary change by having students apply this model to a hypothetical scenario and think through its implications. Past research on evolution education has demonstrated its ability to detect student misconceptions about evolutionary theory (Brem, Ranney and Schindel, 2003; Jensen and Finley, 1995; Jensen and Finley, 1996). One potential problem of the original task, as designed by Jensen, is that students were invited to give explanations that matched their personal beliefs. Thus, those who did not believe in evolution often invoked supernatural mechanisms to explain the changes in species described in the scenarios. Unfortunately, this prompt would make it impossible to determine how creationist students conceptualized the mechanism of natural selection, since they would presumably give an answer that reflected their belief in a divine creator. In order to encourage students to explain a mechanism of change that reflected their understanding of evolutionary theory, we asked students to pretend that they were evolutionary biologists, and to answer the way they believe an evolutionary biologist would answer. If a student appeared to be answering according to her religious beliefs, she would be reminded to answer how she thinks an evolutionary biologist would answer the question. The vast majority of students seemed capable of performing the cognitive feat of pretending to be an evolutionary biologist. In very few cases, students told the interviewer that it would be impossible for them to take such a perspective, and this portion of the interview was consequently skipped.

Belief questionnaire. After the one-on-one interview, students completed a multiple-choice questionnaire regarding their beliefs about the origins of humans, other living things and the world as a whole. The questionnaire has five items, four of which are multiple-choice with write-in options and one with a written response. It is crucial to recognize at the outset that these responses reflect self-ascribed identities on the part of participants, and should not be presumed as internally held and stable attitudes or beliefs. The items were designed to facilitate categorization of participants along a continuum of identities or *positions* staked in the creation-evolution debate. This system of categorization is based partly on two years of ethnographic fieldwork and partly on Eugenie Scott's "creation/ evolution continuum" (Scott, 2000). At one end of the continuum is the young-earth creationist (YEC) position, which claims that the earth is

less than 6,000 years old and humans were created by God in six 24-hour days, as described in *Genesis*. Next is the old-earth creationist (OEC) position, which accepts scientific estimates of the age of the earth (~4.6 billion years), but still believes in the *Genesis* creation account. The position at the center, referred to as theistic evolution with special creation (ThEvC), continues to hold that humans were divinely created, but it allows for the evolution of nonhuman life. The next position along the continuum, theistic evolution (ThEv) allows that humans and other life evolved, but insists that God guided the process. At the other end of the continuum is naturalistic evolution (NatEv), with God either absent or playing a non-essential role in the origin of humans, other living things and the world. This category includes students who positioned themselves with purely naturalistic explanations (agnostic or atheistic evolution) and with the view that God initiated the process and then allowed it to proceed without interfering (deistic evolution). Again, it is important to remember that these were positions with which students identified themselves, and are not necessarily true reflections of stable “beliefs” in the minds of students.

The consistency of responses serves as an internal check of validation for the instrument, and it is evidence against guessing on the part of students. Excluding the fifth question, which is open-ended, and excluding write-in responses to the other questions, there are 160 possible combinations of answers. Only 50 of those combinations would have been identified with one of the five positions described above. Random guessing would produce an unclassifiable response 68.75% of the time. Out of 150 students who completed this questionnaire, all except two gave responses that fit one of these five positions. The unclassifiable students were removed from the analysis. The instrument is further validated by checking for consistency with the interview. All students who identified as atheist, agnostic or otherwise non-Christian answered the belief survey in a way consistent with the natural evolutionist position, which would, of course, be predicted.

Sites

The participating districts in the research will not be identified, due to the sensitivity of issues involved. In order to maintain anonymity, we will refer to the high school and middle school in the east Tennessee district as East High (EHS), and East Middle (EMS), respectively. We will refer to the schools in the middle Tennessee district as Central High (CHS), and Central Middle (CMS). For both districts, the participating middle schools are feeder schools to the participating high schools, meaning that students matriculate to the high school after completing 8th grade.

The east Tennessee district exists in the eastern region of the state, near the Appalachian Mountains, in a mostly rural county that nevertheless includes a fairly large town with more than 25,000 people and has experienced urbanization in the last decade. Despite the proximity of urban areas, the schools in this district where we worked served the more rural county rather than the urban center. The school board for the district has demonstrated animosity to teaching evolution in the recent past, though the administrators and teachers in place at the time of the study seemed mostly to support it, as evidenced by their decision to host this research project.

The middle Tennessee district exists in the middle region of the state, more than an hour drive from Nashville, the state capital. This district is entirely rural, supporting a population that engages primarily in farming. While the district naturally includes a county seat, the population of this town is less than 5,000 people, with only one high school and a single high school biology teacher serving the entire district. The administration is supportive of teaching evolution, though

the consensus among teachers and principals is that evolution is a sensitive issue in the county. The science teachers in the district have an unofficial policy against saying the word “evolution” because it has the potential to upset kids.

In both districts, most of the students engaged in many outdoor activities, including hunting and fishing, which afforded them a degree of familiarity with Tennessee wildlife not expected of urban students. Another consequence of the rural location of the schools was that more than 90% of the student population was white. Finally, like most rural regions of the South, the populations of both districts was primarily poor (below the state median income), undereducated (mode for each was high school or equivalent), and politically conservative (voters in the 2008 presidential election voted overwhelmingly for McCain).

The religious composition of each district was also similar: dominated by theologically conservative denominations, including Southern and Independent Baptist churches, Churches of Christ, Assemblies of God and non-denominational apostolic churches. The only mainline churches in the middle Tennessee district were United Methodist, a theologically diverse denomination that includes conservative evangelicals as well as moderates. Based on the author’s fieldwork, the composition of United Methodist churches tends to reflect the surrounding areas, such that those in conservative rural areas like the Central District will tend to reflect more conservative attitudes. The eastern Tennessee district included one of the more theological liberal mainline churches (Presbyterian Church, U.S.A.), though none of the participating students attended this church. Both districts also included a Catholic Church, which served adherents in surrounding counties as well.

Based on interviews with teachers, the evolution instruction in both high schools was comparable. Reported time spent on evolution was similar among all teachers, and students reported a nearly equal amount of conceptual knowledge on the subject of evolutionary theory. Based on this data, it appears that students in Central High received equal amounts of instruction in evolution as those in East High (about 6 days, near the end of the semester, just before the state standardized tests). Regarding religious background and affiliation, the percentage of students with evangelical religious backgrounds was nearly the same, though there was more denominational diversity in the Central district.

Participants

Due to practical considerations, the students in the participating districts comprise non-random samples. All students attending class with the participating science teachers in 8th grade and high school biology were allowed to participate as long as they had a guardian sign a consent form. This sampling method was the same for all schools, so any possible sampling bias would be equally applicable to each of the samples. Additionally, the direction of potential bias ought to have been in the direction of students who pay more attention in class, who are responsible enough to bring a consent form home, have their parents sign it, and bring it back to school. In this sense, the students interviewed are likely to be among the higher achieving students in their respective classes, which ought to give a more accurate image of the teachers’ effectiveness in teaching the subject.

Care is needed to distinguish the various sample populations at different schools and in different grades. In cases where individual teachers were only able to collect very small numbers of consent forms (e.g. 5 forms), their students tended to occupy more extreme positions such as either young earth creationists or naturalistic evolutionists. When teachers collected larger samples (e.g. 15 or more students), all recognized positions were represented and most students

held moderate positions like theistic evolution. The source of the difference seems to be the effort expended by teachers to encourage students to bring back consent forms. With little effort on the part of the teacher, only students most interested in the topic (i.e. those with extreme positions) returned the form. With more effort by the teacher, a sample of the class that is representative of the range of positions is attainable. For this reason, only students in these larger samples were used to make claims about representativeness in the population as a whole.

For the middle Tennessee district, the complete samples were used, as each sample was taught by a single teacher who was able to get a large sample of students. Central Middle School is represented by twenty-four 8th grade students, who completed both the interview and the belief survey. Due to the low population in this rural district, there was only one high school biology teacher. The sample for Central High, with 34 students, comprises nearly the entire cohort of Biology students for the year.

In the eastern Tennessee district, students were drawn from one high school, divided between two buildings and multiple science teachers. Thirty high school students participated in the eastern district. Nineteen students were in 9th grade, whereas the remaining eleven were in 10th grade, divided among three biology teachers. Sixteen of the 9th grade students were taught by the same biology teacher, though one did not complete the Belief Survey. In order to minimize the influence of various teachers' approach to evolution, and due to the potential for sampling bias noted above, most of the analyses are conducted on the remaining fifteen 9th grade students. Thirty-four students from East Middle School participated, but only twenty-six completed all parts of the interview and survey. Eight of the students did not complete the Belief Survey. One student's responses were disregarded due to critical errors on the part of the interviewer. Therefore, the total sample used in the analysis is twenty-five 8th grade students, all of which were taught by the same science teacher.

Results

Understandings of the Mechanism of Evolution

Two instruments were used to measure students' understandings of evolution, though data from only one—the Scenarios Task—will be discussed in this paper. Student responses on the scenarios task were digitally recorded and later coded by the author. This coding process involved identifying specific concepts invoked by students in their explanations. In this way, a total of twenty-four concept codes were created and refined. The author then went back through the responses of each student to find evidence for the presence of each of those 24 concepts in their explanations and marked a “1” or “0” depending on the presence or absence of the concept.

Five of these concepts were categorized as “Darwinian,” based on their close associations with, and only with, neo-Darwinian evolutionary theory: differential survival, differential reproduction, variation of traits within population, mutations as a source of variation, and mutations as random. I then calculated the sum of Darwinian concepts as a measure of the depth of understanding students demonstrated in their explanations. In this way, I produced a score for every student, which could then be used in later analyses. I similarly created a measure of the total number of “Lamarckian” concepts invoked by students, named after the theory of evolution proposed by Jean Baptiste Lamarck in the 18th Century. Lamarck's ideas relied on the agency of the evolving organisms to effect change, often through ideas of use-and-disuse or an internal desire to develop a new trait, and the subsequent inheritance of those acquired characteristics by offspring. Codes categorized as Lamarckian thus included inheritance of acquired characteristics and the notion that the organism is causing the change itself.

While students were asked to explain changes for three different species: the arctic fox, the cheetah and Tennessee cavefish, only the first two were used to calculate these scores. I excluded explanations of Tennessee cavefish losing their sight for three reasons. First, it is actually an extremely difficult question, which even evolutionary biologists continue to debate. Second, possibly

related to the first, student explanations were highly variable, incorporating notions of pollution and disease, for example. Third, and most importantly, the difficulty of explaining how the loss of a trait could increase fitness tended to skew students toward Lamarckian

explanations even in cases where a student had displayed a sophisticated understanding of Darwinian mechanisms in other questions.

Using these coded responses, I evaluated whether students demonstrated a better understanding of evolutionary theory following their course in high school biology than following 8th grade science. Not surprisingly, there was substantial evidence that this was true. First, I compared students at Central Middle to their older peers at Central High. High school students invoked an average of 1.06 Darwinian concepts, whereas middle school students invoked 0.125 such concepts. A Welch Two Sample t-test confirmed that this difference was statistically significant ($t = 3.2635$, $df = 42.648$, $p\text{-value} = 0.002172$). These numbers are somewhat misleading, however, as the gains in understanding were not equally distributed across the samples. More specifically, the percentage of students who gave Darwinian explanations increased from 8% in Central Middle to 33% in Central High. This difference in frequency was also significant (Fisher's Exact for Count Data, $p\text{-value} = 0.03112$). Furthermore, considering only those students who invoked Darwinian concepts, those at Central High invoked more concepts (mean = 3.17) compared to students at Central middle (mean = 1.5).

Central High students also had a more sophisticated understanding of inheritance than their counterparts at Central Middle. High school students referred far more frequently to genetics (including mutations, genes, mutations as source variation, and the idea that helpful traits are passed on to offspring) in their responses (Welch Two Sample t-test, $t = 4.7647$, $df = 43.468$, $p\text{-value} = 2.136e-05$). Though these concepts were not frequently incorporated into a neo-Darwinian explanation of change, they may have contributed to an overall decrease in the use of Lamarckian explanations. Central Middle School students invoked the idea that acquired

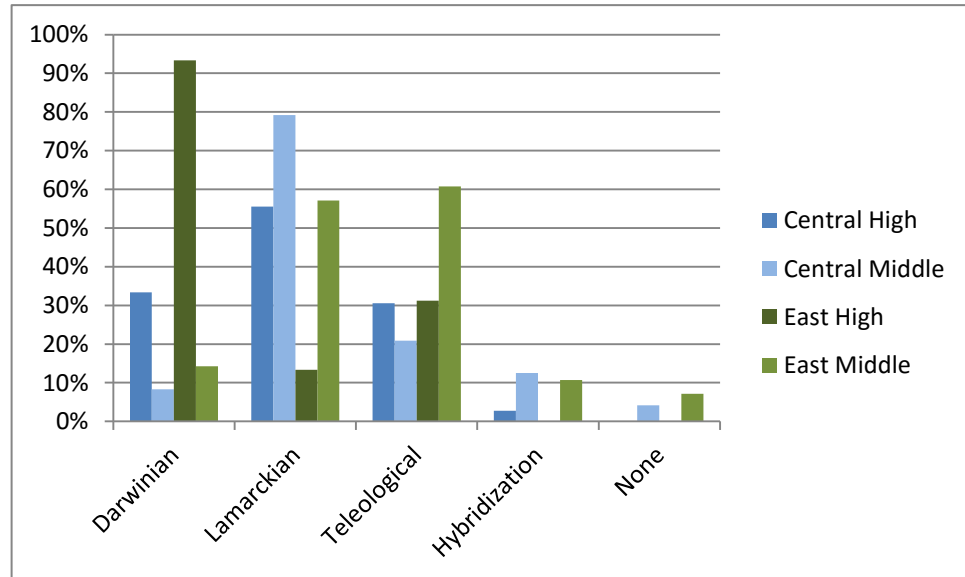


Figure 2: Comparison of mechanisms invoked to explain evolutionary change during Scenarios tasks, by school. Schools in Central District are blue; schools in East District are green. Darker bars are high schools; lighter bars are middle schools.

characteristics are inherited twice as often as Central High students (Welch two-sample t-test, $t = -2.6343$, $df = 49.199$, $p\text{-value} = 0.01124$).

The same pattern was seen in the Eastern district, where the high school students invoked an average of 2.60 neo-Darwinian concepts, and middle school students invoked an average of 0.32 such concepts. This difference was highly significant (Welch Two Sample t-test, $t = 6.1121$, $df = 20.807$, $p\text{-value} = 4.776e-06$). Notably, this increase is far higher than in the Central District. The improved understanding was also far more widely expressed. Among East Middle students, only 14.3% invoked neo-Darwinian explanations. By comparison, 93.8% of East High students invoked at least one Darwinian concept, and most invoked more than 2 such concepts. Again, understandings of genetic inheritance were more sophisticated (Welch Two Sample t-test, $t = 2.1754$, $df = 28.923$, $p\text{-value} = 0.03792$). Whereas nearly half of East Middle students invoked the idea that acquired characteristics can be inherited, only 1 out of 15 of the East High students referred to this idea, such that there was a significant drop in the use of this concept (Welch Two Sample t-test, $t = -3.4025$, $df = 40.953$, $p\text{-value} = 0.001503$).

Because middle school student participants had such little understanding of neo-Darwinian mechanisms of evolutionary change, it may be easier to visualize how understandings have changed from middle to high school by presenting what percentage of students in each school gave particular kinds of explanations. Based on the responses, I identified four mechanisms given most frequently, including “Darwinian” and “Lamarckian” mechanisms, as well as “Hybridization” mechanisms, which postulate that new traits are introduced by hybridization events between genetically distant species (e.g. cheetahs and deer)⁷¹; and “Teleological” explanations, which presume that adaptations occur naturally, when they are needed. Note that, because students were asked about two scenarios, they sometimes invoked more than one mechanism.

The results are summarized in Figure 2, on page 173, which depicts the percentage of participating students who invoked each of the four mechanisms, at some point during the interview, or who invoked none at all. Among middle school student participants (lighter colored bars), Darwinian mechanisms were virtually absent, whereas among high school students (darker bars), many more of the students invoked Darwinian mechanisms at some point. Misconceptions like hybridization and Lamarckian mechanisms tend to decrease. As can be seen, student understandings of evolutionary mechanisms improve dramatically by the end of high school biology. If better understanding convinces students to accept evolution as being true, then we ought to expect a concurrent shift in beliefs about evolution between 8th grade and high school biology.

Beliefs about Origins

Figure 3 on page 175 compares belief distributions across middle and high school students for the two districts. The first thing to note about the graph is that the distributions are remarkably similar regardless of geography or grade level. The majority of students cluster in the

⁷¹ A survey of the literature on misconceptions in evolution understanding did not identify any other study reporting such a mechanism. Nevertheless, it was invoked by the students I interviewed frequently enough to prompt me to create a code for it in analysis. As Figure 1 shows, the mechanism was most popular among middle school students, who had very little understanding of Darwinian mechanisms. These students’ teachers were aware of the idea and recognized that it was incorrect. It appears these students defaulted to such a mechanism on their own. This idea of cross-species hybridization events appears to contradict psychological essentialism and should be further investigated.

middle. It is important to note that, if students were divided based on one question, such as a statement of acceptance of evolution, a fairly arbitrary line is drawn somewhere in the middle of the distribution. For each of the four samples, the most common position is that of Old Earth Creationist. The second most common are the two theistic evolutionist positions, which together would be as large as the Old Earth Creationist group. The two smallest groups are the Natural Evolutionists and Young Earth Creationists.

Based on Figure 3, one may be tempted to conclude that there is a small shift in belief from the middle schools to their respective high schools.

However, a variety of statistical tests of significance of these apparent differences fail to rule out the possibility that they are due purely to chance. First, by ranking each position on a scale from science denial to acceptance (i.e. YEC (1), OEC (2), ThEvC (3), ThEv (4), NatEv (5)), it is possible to compare the median positions between high schools and their respective feeder middle schools. In the Central District, the median shifts from the equivalent of OEC to ThEvC between middle and high school samples. A Wilcoxon rank sum test with continuity correction ($W = 481$, $p\text{-value} = 0.4462$) could not reject the null hypothesis, that the true location shift is not equal to 0. The difference in medians between East Middle (3) and East High (2.5) is even smaller. Even by combining the districts, the differences in medians between middle (2) and high schools (3) is too small to rule out chance (Wilcoxon rank sum test with continuity correction, $W = 1442$, $p\text{-value} = 0.4297$).

The Wilcoxon Rank-Sum test compares medians between samples, but it is possible that the distributions of belief positions between middle and high schools may have shifted in other ways. A Kolmogorov-Smirnov test was used to detect overall differences in distributions. For the Central District, the maximum cumulative difference between samples was 0.09722, whereas the critical difference to establish a shift at even a 90% confidence would be 0.32. Likewise, for the East District, the maximum cumulative difference was 0.1, far below the critical difference for the sample, which was 0.397. Thus the small differences observed between distributions may be due merely to random chance, and does not seem to reflect a systematic shift in positions.

Finally, I examined belief shifts across acceptance or denial of two specific propositions—that humans evolved from non-human animals, and that living things on earth evolved—derived from the belief questionnaire. Frequency comparisons revealed that a slightly higher proportion of students at both high schools accepted both propositions than their peers at

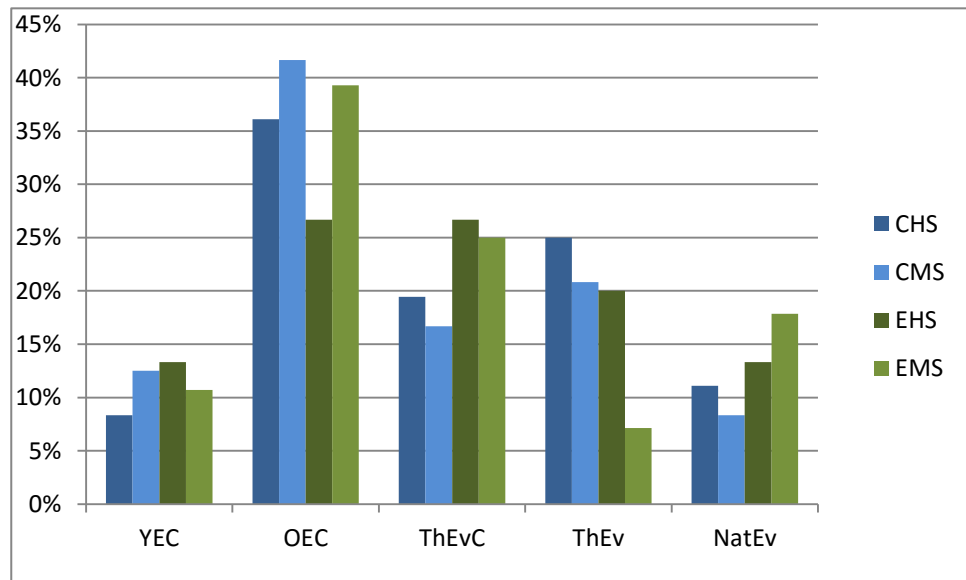


Figure 3: Distribution of students assigned to five categories of belief about evolution, based on responses to belief questionnaire, compared across schools.

the middle schools. A series of Chi-Squared tests determined that none of these differences were significant, including the largest observed differences between acceptance of general evolution in the Central District (X-squared = 0.5451, p-value = 0.4603) or the East District (X-squared = 0.3926, p-value = 0.5309). To ensure maximal statistical power and thus minimize the possibility of a type II error, the two districts were combined and tested with the same results regarding both acceptance of evolution generally (X-squared = 0.7969, p-value = 0.372) and acceptance of human evolution specifically (X-squared = 0.8425, p-value = 0.3587).

In conclusion, by any measure, neither the East Tennessee schools nor the Middle Tennessee schools demonstrate any significant shift in belief after Biology instruction. Since we know that understanding has increased dramatically from 8th grade to high school biology (9th or 10th grade), the lack of concurrent shift in belief suggests a limited effect of understanding on belief. While it is certainly possible that students' beliefs will continue to change as they reflect further on the implications of their new understandings, a pattern that has been reported in other studies, it is clear that a potential change of attitude toward evolution could not be supposed to explain a relationship between understanding and belief described below.

Beliefs and Understandings

At this point, we have scores that represent student understandings of evolutionary theory and student beliefs about evolution and origins. The relationship between these two factors can be analyzed in a variety of ways. With an interest in replicating analyses published by other researchers previously, I divided the students at Central High into two groups: those who accept evolution and those who deny evolution, as I did in the previous section.

Notably the former group includes the ThEvC category, comprising students who accept evolution for all life, but believe that humans are an exception that were divinely created. Simple, one item measures of acceptance would tend to miss that nuance. I compared the two groups (Accept Evolution vs. Deny Evolution) on the mean number of Darwinian concepts they invoked and found that

the Accept group on average invoked more than three times as many Darwinian concepts as the Deny group (1.5500 concepts vs. 0.4375 concepts). The difference is significant (Welch Two Sample, $t = 2.269$, $df = 31.81$, $p\text{-value} = 0.03019$). I ran the same test on East High students, and found a less striking difference (mean of 2 vs. 3 concepts), which was not significant.

However, before any such analysis can be properly interpreted it is instructive to look at how the data is actually distributed. Plotting the mean number of Darwinian concepts invoked by

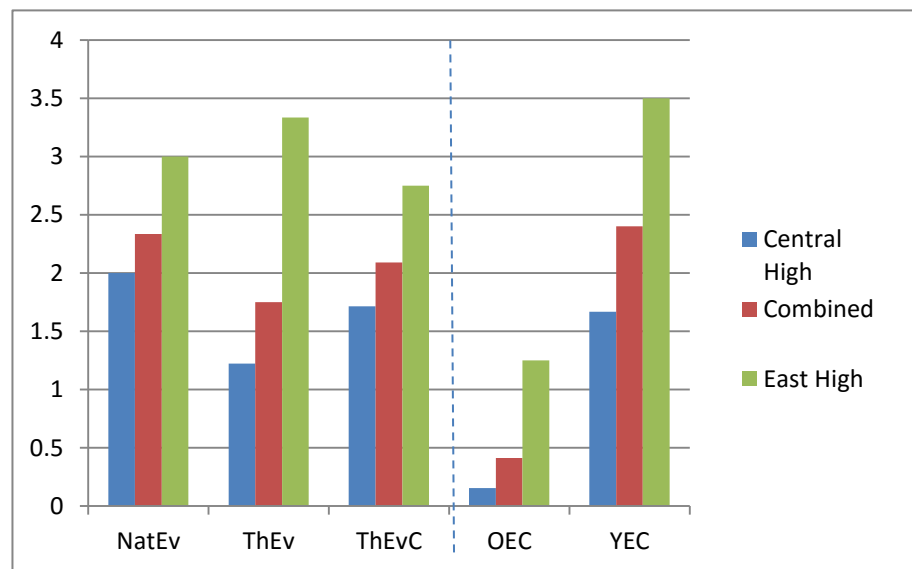


Figure 4. Mean number of neo-Darwinian concepts invoked by each belief group at both high schools, shown separately and combined. The dotted line marks the dividing line between students who “accept evolution” and those that “deny evolution.”

students in each belief group in Figure 4 on page 176 it is clear that *young-earth* creationists, who take a position more at odds with modern scientific claims *than any other group*, were invoking as many concepts as naturalistic evolutionists. In fact, the number of neo-Darwinian concepts invoked was nearly even across all belief groups, with only one exception: old-earth creationists. This pattern holds across high schools, despite the fact that students at East High averaged far more Darwinian concepts than their counterparts at Central High. The earlier mentioned statistical difference between the mean concepts invoked by students who accept evolution compared to those who deny it is driven by the very low levels of understanding among old-earth creationists, which outnumber the young-earth creationists in the sample 4 to 1. Due to the small number of young-earth creationists, it is difficult to investigate the robustness of this result. However, it suggests that young and old earth creationist beliefs have different relationships with understanding, and it would be misleading to lump the groups together.

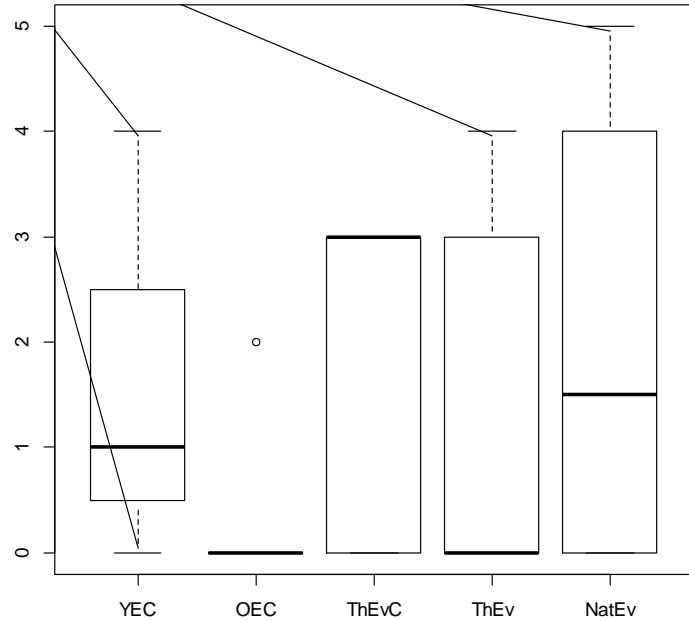


Figure 5: Sum Darwinian concepts invoked by Central High students in Scenarios Task, by belief group. The bold line is the median, box includes the upper and low quartile, and the whiskers show the range. The dot on the OEC bar is an outlier.

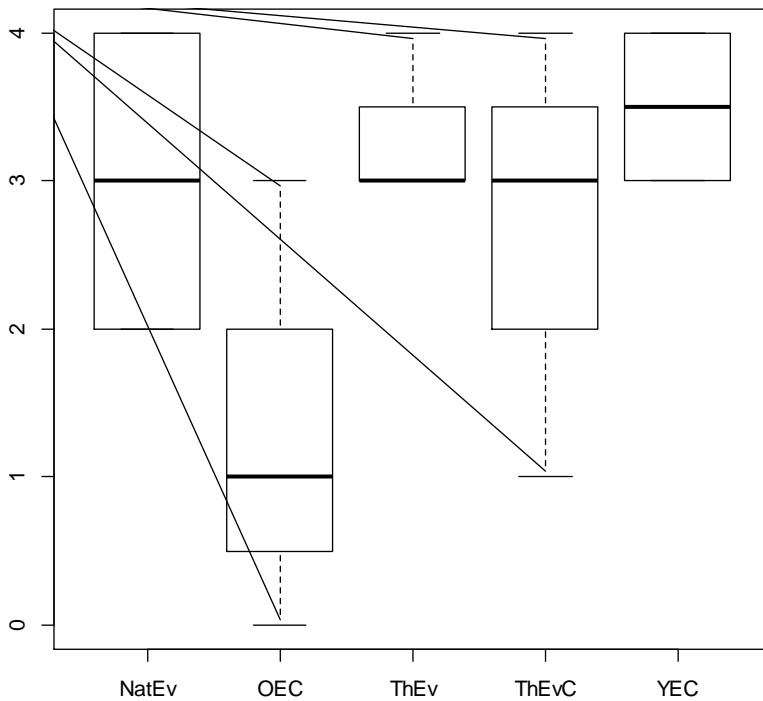


Figure 6: Sum Darwinian concepts invoked by East High students in Scenarios Task, by belief group.

The difference is even more striking shown on a box-and-whisker plot, which is based on medians rather than means (more appropriate for this non-parametric sample). Figure 5 and Figure 6 on this page plot this data for Central High and East High, respectively. On both plots, students who identify with old-earth creationist beliefs invoke far fewer neo-Darwinian concepts students in other groups. Nevertheless, there are glaring differences. The students at Central High were much less likely to draw on a Darwinian model to explain evolutionary change. At least one student in every belief group at Central High did not invoke a single neo-Darwinian concept. For some

groups, the majority of students did not, though at least a few were able to invoke two or more such concepts. Among students identifying with old-earth creationism, by contrast, 10 out of 11 did not invoke a single Darwinian concept.

The distribution for East High is somewhat different, owing largely to the fact that students overall had much better understandings of evolution than their counterparts in Central High, as already noted. Whereas the former suffers from something of a basement effect, the much lower position of the OEC bar is readily apparent here. As above, this group falls out from all other groups.

In order to determine whether these differences were significant, I used a Welch Two Sample t-test to compare the old-earth creationist students with their peers at each of the high schools. At Central High, the difference was highly significant ($t = 3.4717$, $df = 28.509$, $p\text{-value} = 0.001668$) such that the true difference between Old-Earth creationists and their peers can be given with 99% confidence to be between 0.289 and 2.533 more neo-Darwinian concepts. The observed difference was an average of 0.1538 concepts invoked by OECs, and 1.565 concepts invoked by everyone else. There was also a difference at East High, albeit less drastic, which was nearly significant ($t = 2.666$, $df = 4.299$, $p\text{-value} = 0.05199$). There, old-earth creationist students were observed to invoke 1.250 concepts, whereas their peers invoked an average of 3.091 concepts.

Discussion

For the remainder of this paper, I will argue that the three major findings noted in the previous section have specific implications for the nature of the relationship between beliefs and understandings. To summarize these three findings: first, beliefs about evolution and understandings of how evolution work are related, insofar as students who accept evolution demonstrated more understanding of evolution over all. Second, understanding of evolution is demonstrably more accurate among high school students than among 8th grade students in both of the school districts, and yet acceptance of evolution is statistically indistinguishable between middle school and high school. Third, of those students who reject evolution, those students who reject more of modern scientific claims (i.e. young-earth creationists) paradoxically understood much more about evolutionary theory than those who reject fewer such claims (i.e. old-earth creationists).

Before discussing these results, it is necessary to point out that any relationship between a student's beliefs and that student's response to evolution is not deterministic. At Central High, there were students in all belief groups that were unable to explain specific instances of evolutionary change in terms of neo-Darwinian concepts. At East High, students in all belief groups invoked on average more such concepts than the vast majority of students at Central High. Nevertheless, beliefs and understanding are clearly not independent. To interpret these results it is most convenient to look at the first finding, which relates most clearly with our main question, and then to discuss how the second and third findings relate to it.

The positive correlation between beliefs and understandings can be interpreted in three possible ways, though only one is consistent with the other findings and available evidence. The first interpretation is based on the rationalistic model of belief, described in the beginning of this chapter. Recall that this model posits that people are convinced by reason and evidence to accept propositions as being true. In other words, understanding leads to acceptance. In the case of evolution, the account would claim that the weight of evidence and the persuasiveness of the logic would dictate that any person who is knowledgeable of the theory and the evidence would

be compelled to accept it. By the same logic, if a person rejects the theory of evolution, then that person must not understand it. Under the rationalistic model, we would of course expect a positive correlation between understanding and acceptance, as is observed. However, we would also expect that young earth creationists would have the poorest understandings, given that they reject most of what modern science asserts about the physical world (not only geology and biology, but also physics and astronomy). Furthermore, the model would predict that high school students would be, on average, more favorably disposed toward evolutionary theory, as a reflection of their increased knowledge. Therefore the findings from this study are inconsistent with a rationalistic model of belief.

By placing students' understandings before their beliefs, as a cause of those beliefs, the rationalistic model of belief relies on an implicit model of learning, which has been characterized as "cold" conceptual change (Pintrich, Marx and Boyle 1993). Under the model, students are expected to engage with activities, and to reorganize their cognitive models after learning about observations that contradict their expectations (Carey 2000). Cold conceptual change has been criticized for conceiving students as basically passive in the educational process, ignoring their motivations to learn and the role of trust in the pedagogic relationship (Pintrich, Marx and Boyle 1993). It also tends to conflate conceptual change, or changes in understanding, with changes in beliefs about reality, since understanding and observations are mutually dependent.

The second interpretation, in contrast to the first, begins with the assumption that students are agents in the educational process. Students *respond* to instruction by actively constructing knowledge based on their existing understandings and expectations. Furthermore, students enter the classroom with commitments to particular conclusions, such as the truth or falsehood of evolutionary accounts, based on their social identity. Following Rappaport, these social commitments are essentially what we mean by *beliefs* (1999). Those who identify as Christian feel social pressure to maintain those commitments, with motivational consequences. Researchers have long noted the relevance of motivations for learning (see for example Haywood 1992; Kang et al. 2005; Linnenbrink and Pintrich 2002; Medin et al. 2002). For example, research on the psychology of belief suggests that students are likely to seek out evidence that seems to support existing beliefs or which appears to contradict counter claims (Nickerson 1985). Accordingly, what I will call the *social commitment model* recognizes that a student's commitment to accepting or rejecting evolution governs that student's response to evolution instruction. Whereas the rationalistic model posits that understanding drives belief, this alternative model posits that student beliefs (or commitments to positions) about evolution actually affect how well they learn, thus driving understanding.

Students from evangelical backgrounds were certainly motivated to reject evolution. On the portion of the interview where students reflect on how evolution was covered in class, students were prompted to say whether Christians could believe that humans evolved from non-human animals and then to explain their answers. Sixteen out of 36 students at Central High and 4 out of 15 East High students were unequivocal about the impossibility of a Christian believing in human evolution. Several said that Christians were "not supposed" to believe in human evolution⁷². Many were aware that there are Christians who do believe in evolution, but that those Christians are not completely certain in their faith⁷³, or are not "true"⁷⁴ or "real"⁷⁵

⁷² Participant #1301020614

⁷³ Participant #1302031913

⁷⁴ Participant #1002121917, #1101071313

⁷⁵ Participant #1102190513

Christians. The clearest statement on this issue came from a male student at East High, “They might call themselves a Christian. Revelation says that they aren't. That's Revelation, chapter 3, a letter to the church of Laodicea.”⁷⁶ Another student was less eloquent in expressing the same thing. Regarding the idea that humans were specially created, he said, “It's from the Bible. If you don't believe it, then you're sort of not a Christian or a Baptist. It's sort of turning your back on the Word and stuff.”⁷⁷ More than half of those who thought Christians should not believe in evolution either specifically mentioned the Bible or referred to the creation account in *Genesis* in order to justify their position. Thus any student who might believe that evolution is *not* antithetical to Christianity is simultaneously aware that many of their peers at school (and many more at church) believe that “real” Christians do not accept evolution. In fact, 30% of the students who believed they were “allowed” as Christians to believe in human evolution nevertheless reported feeling personal conflict between evolution and their personal faith.

According to the Social Commitment model, students have publicly committed themselves to a position on the reality of evolution, either believing in it or not. These commitments motivate the students to conclude that evolutionary theory is either understandable or nonsensical, depending precisely on said commitments. A student who has made a commitment before family and friends to reject evolution is motivated to conclude that evolution does not make sense. For most of these students, their response to evolution instruction ranges from antipathy to apathy. When they encounter something that does not make sense, it is in their interest to cultivate the impression that evolutionary concepts are not merely difficult to learn, but are actually nonsensical. The student thus has no motivation to revise misconceptions or learn more to reconcile contradictions. As one student remarked, “It's not true, so why should I bother to learn it?” Likewise, a student who has determined that evolution explains the diversity of life on earth is motivated to find that evolutionary theory sounds reasonable, even in spite of apparent contradictions and puzzling phenomena. In contrast to the first student, this student is happy to assume that such contradictions are a result of misunderstandings or gaps in knowledge, which could be reconciled with further study. The result is that students who already were inclined to believe evolution end up with a better understanding than those who were inclined not to believe it.

Through evolution instruction, understanding improves, albeit in a lopsided fashion, and beliefs stay basically the same, consistent with the findings in this study. The model is furthermore consistent with other responses on the interview. Looking at the high school samples, students who said that Christians were allowed to believe in evolution agreed significantly more that the idea of common descent was believable ($X^2 = 5.0667$, $p = 0.02439$) and that there was evidence that supported evolution ($X^2 = 13.6421$, $p < 0.001$). Conversely, students who said that Christians were not allowed to believe in evolution agreed significantly more that the theory of evolution has serious problems ($X^2 = 6.1162$, $df = 1$, $p\text{-value} = 0.01339$).

The social commitment model also helps to make sense of the strange case of young earth creationists that have relatively good understandings. For students who come to class already convinced that evolution must be wrong, most respond to it in the way described above, essentially boycotting the lesson and “zoning out.” However, some students may have taken a more active role in seeking out what they perceive to be problems or fatal flaws in the theory. To

⁷⁶ Participant #901041914. The student appears to refer to Revelation 3:15-16, which admonishes “lukewarm” Christians.

⁷⁷ Participant #901130717

do so, they may talk with youth ministers at their church or search for evidence against evolution on creationist websites. I met personally with several youth ministers at Baptist and Methodist churches in eastern Tennessee. All of them reported having talked with student members about creationism, and most were able to recommend to me several websites to go to for creationist arguments and claims. Indeed, all of the students who adopted a young-earth creationist position attended evangelical churches, usually twice or more each week. The average frequency of church attendance among young-earth creationist students is 2.25 times per week, whereas the average for the rest of students was 1.24 times per week.

Thus students motivated to find problems with evolutionary theory would eventually find their way to creationist resources, such as any of a variety of legitimate-looking websites dedicated to “debunking” evolution⁷⁸. Some such students may have been satisfied merely to see that these resources exist, indicating that rejecting evolution is a respectable or reasonable position. Since most of these websites do not mention their endorsement of a young age of the earth on their homepage, this hypothetical student could come away satisfied in their rejection of evolution without adopting the more radical young-earth position. Though the relatively recent nature of creation can be calculated based on genealogical charts provided in the Old Testament, the age of the earth is not explicitly given in the Bible, making it unlikely that students would adopt such an extreme position under different circumstances. Only those students who received extensive guidance from an adult or who researched the issue at length on creationist websites would arrive at a young-earth creationist position. This helps to explain why most of the creationist students continued to believe in an old earth. It also suggests why the students who adopted a young-earth position also tended to be much more knowledgeable about evolutionary theory. On one hand, students who spend more time learning about criticisms of evolution from a web resource would be more likely to read on those websites arguments for the importance of believing that the earth is very young. On the other hand, students from an evangelical background, who were impressed by the logic of and/or evidence for evolution that they learned about in high school Biology, would be more motivated to seek out such resources and spend time reading the arguments they espouse.

In sum, students with commitments to an evangelical community seem to respond to evolution education in one of two ways: through apathy and through antipathy. Those who choose the former will continue to reject evolution, but not necessarily the idea of the earth being very old, having accepted the reality that is presented by television, in most books and elsewhere. These students will simply boycott lessons in class on evolution, and will come away with understandings much lower than their classmates. Only the latter group, who seek to master and disprove evolution by learning as much as they can to debunk it, are exposed to arguments about the importance of a relatively young earth for maintaining a consistent position vis-à-vis the inerrancy of scripture. It is these students who both know the most about evolutionary theory and become young-earth creationists.

Admittedly, there is a third possibility that may account for the findings. Rather than belief causing understanding or vice versa, it is possible that both belief and understanding are driven by a third, unidentified factor. One candidate is parents' education, which has the potential to both affect the students' attitude toward education and the church they choose to attend. Students coming from homes where parents have a high school education or lower may generally

⁷⁸ The Institute for Creation Research (icr.org) and Answers in Genesis (answersingenesis.org) have extensive web and print resources for any student interested in finding arguments that purport to disprove evolutionary theory and prove that the world was created less than 6,000 years ago.

perform more poorly in school, explaining their lower understandings of evolution. At the same time, these parents are more likely to hold creationist beliefs and teach them to their children. In contrast, parents with a college education may both instill the importance of school in their children and teach them a view of origins more in line with modern science, i.e. theistic or naturalistic evolution.

This possibility cannot be ruled out at present. The dataset does not include information on parents' education level, but it is possible to approximate the education of parents based on data I had on the age of parents relative to age of the student. Given the difficulty of attending college as a young parent, it is unlikely that a parent who is not at least 22 years (the modal age of college graduation) older than his or her child will have a college education. Research on maternal age at first birth is consistent with this assumption (e.g. Heck et al. 1997). In order to approximate education levels of parents, I calculated the age difference and categorized students at Central High into two groups: those with parents less than 22 years older than them, and those with parents more than 22 years older. Admittedly, this is a crude approximation, but if parental education level is indeed driving this very clear relationship between beliefs and understanding, the Chi-square distribution ought to be at least suggestive. Looking at the analysis, there is nothing to support the hypothesis that parent age when the student was born is related to the student's beliefs about origins ($X^2 = 2.1915$, $df = 2$, $p\text{-value} = 0.3343$). The only notable result is that the three students in the sample who identified with naturalistic evolutionist beliefs all had older parents. Still, theistic evolutionists and old-earth creationists were equally likely to have parents of either age group.

Summary

In this chapter, I have presented data from interviews with students in middle and high schools from two districts in rural Tennessee. I analyzed data on how these students understood neo-Darwinian evolutionary concepts and what they believed regarding evolution and human origins, with the purpose of clarifying the relationship between them. In particular, I tested the predictions of two alternative models describing this relationship. The rationalistic model posits that an adequate understanding of evolution compels students to accept it as true. This model is implicit in calls for additional evolution instruction in schools as an antidote to low levels of public acceptance. It predicts that students with better understanding ought to accept evolution and those who reject it ought to have poorer understandings. It further predicts that increased understanding ought to be accompanied by a shift toward more acceptance of evolution. By contrast, the social commitment model posits that students enter the classroom with commitments to particular positions or beliefs about evolution, and that these commitments govern their response to evolution instruction. It predicts that students with commitments to rejecting evolution ought to find ways to convince themselves that it is false, either through apathy or antipathy, with consequences for learning. Students with commitments to accepting evolution will seek out better understandings in order to justify their acceptance. It further predicts that beliefs ought to remain constant over time, even as understanding increases. The findings are consistent with the social commitment model and inconsistent with the rationalistic model.

Early antievolutionists, like William Jennings Bryan, were convinced that teaching evolution to young people was destroying faith on an alarming level. Though the accuracy of this claim has been questioned by historians (Lienesch 2007), it is reasonable to allow the possibility that teaching evolution was originally a significant source of loss of faith at that time. That said,

it is clear that contemporary students have tools necessary to reject evolution when it is perceived as a threat. While a minority of students from creationist churches ended up believing in evolutionary origins, comparable rates were seen in middle schools (in the absence of evolution instruction) and in high schools (immediately following evolution instruction), suggesting a limited role of evolution instruction in a young church-goer's decision to accept the account. These findings suggest that, for topics that have become markers for particular identities, such as evolution or climate change, students' commitments to their truth or falsity are relevant to their classroom performance. At the same time efforts to alter those underlying commitments *through* additional instruction are unlikely to meet with success.

Chapter 8: Conclusion

The Two Sides of the Conflict

Lest we forget in the midst of all the attention to creationists, theirs is not the only view relevant to evolution education in Tennessee. There would be no conflict over teaching evolution in Tennessee were it the case that all residents of the state rejected it. After all, if there were no efforts to include evolution in the public school curriculum, then there would be no creationist opposition to it. As we have seen, the presence of evolution in the Tennessee Science Framework reflects the existence of people in the Department of Education and Board of Education who take no objection to teaching it. Their commitment to evolution education is demonstrated by the opposition they worked against throughout the process. Furthermore, their ability to get evolutionary concepts into the Science Framework is only made politically possible by voters in the state who are either apathetic or sympathetic to teaching evolution as an element of scientific literacy.

The commitment evinced among the authors of the Framework can be traced further to the biology teachers across Tennessee who choose to include lessons on evolution in spite of a variety of challenges, from betrayed-feeling students and angry parents, to the risk of “wasting” valuable class time by arguing rather than preparing for state standardized tests. They join a long tradition in Tennessee of “bootlegging” science into the classrooms, and they are heroes to Tennesseans and others who support teaching evolution. Throughout the project, I met a great number of people in this group. While my own encounters with them were concentrated in cities like Nashville, I met them in Dayton and other rural towns in East and Middle Tennessee. I met them in churches and other such gatherings. In some places, like the Sunday Assembly or a Unitarian Universalist service, their position on evolution education can be nearly assumed: references to creationists are met by eye rolls, shaking heads, and dropped jaws.

Finally, in those districts involved in this study, beyond the majority of students who attend an evangelical church and object to aspects of evolution on religious grounds, there are others who are either indifferent to it or glad for it. There are also students who identify as Christian but who do not claim to feel any conflict about accepting evolution. For them, learning about evolution is a chance to learn more about creation. There is also a small minority of students that accept evolution and identify as non-Christian. I found examples of such students in every district I sampled, and examples in other districts occasionally come to light (e.g. Giordano 2012; Myers 2012). It is relevant to note that practically every student who identified as non-Christian (including atheist, agnostic, non-religious and Wiccan) indicated a belief that evolution is true.

These students are not mere aberrations or anomalies, but constitute a subcultural group that defines itself in opposition to the much more dominant evangelical group. In interviews, many of these students spoke disparagingly of “Christians” and indicated an awareness of religious biases of teachers and other school personnel. A few such students have spoken out against what they perceive as a violation of church and state separation in these schools, though the majority of them are relatively silent in their opposition. The existence of such students, many of which told the interviewers that their parents did not agree with their privately held views, is notable because it serves as a reminder that teenage students have their own agency. They are not mindless receptacles of whatever claims they hear from their teachers. At the same time, they are not independent of the dominant discourses in their communities. As noted above,

they identified in opposition to “religious” students, accepting the dichotomy of choices presented to them—between evolution and the Bible. Having rejected the Bible, they default to evolution, even in cases where their levels of understanding of the concepts behind the theory were impoverished.

The situation we see today in Tennessee, as elsewhere around the country and even internationally, is not the inevitable consequence of inherently opposed beliefs, but rather the product of more than a century of historical developments. Opposition to teaching evolution emerged slowly and in tandem with the idea that evolution ought to be taught. The result of that protracted struggle is that today whether or not state science standards include evolution is regarded as culturally and politically significant. Its inclusion indexes progressive attitudes and a modern-orientation toward science. Meanwhile its exclusion suggests that science was bartered for superstition and ignorance. Children are caught up in this conflict, confronted with the choice between scientific literacy and being true to their faith. It plays out every day in classrooms and schools, while watching television or perusing the internet, and through conversations between people who allied themselves, by choice or obligation, to one side or the other.

The Evolution-Creation “Debate”

The issue of teaching evolution is often referred to as the creation/evolution controversy, conflict or debate. While all of these terms imply a disagreement between individuals or groups, “debate” evokes the most specific imagery, of two opponents on a stage, behind podiums, making arguments and rebuttals in turn. It suggests that the nature of the disagreement is dualistic, or more appropriately, duelistic—evolution vs. creation. In a classic debate, two advocates argue opposing positions, ignoring any number of overlapping positions that may be possible between these extremes. Moreover, the rational aesthetic that is connoted by the term “debate” lends the impression that the conflict is over propositions, logical arguments, ideologies and beliefs. Presumably, the resolution comes about when one side or the other is either convinced or crushed by the weight of evidence.

Crucially, there are actually two different frames for thinking and talking about debates. The first is the idealistic debate. When we think about a “debate,” we may imagine some ideal forum in which contrasting positions are pitted against one another. The debate has a format and set of rules designed to ensure that both positions will be represented fairly, with equal space afforded each side to marshal evidence and make a logical case. There is the moderator, taking the role of courtroom judge, and two opponents, arguing either for or against some proposition. The debaters, in this ideal forum, are not so much persons as advocates for their respective positions. Through cross-examination, each debater is able to expose weaknesses in the opposing argument, such that only the soundest of arguments are able to be maintained. As long as both are knowledgeable of the topic and familiar with the format, and as long as the moderator is unbiased, the outcome of this idealized debate should be the position that is better supported by evidence and rational argument. Within this frame the, debates are all about the contestation of opposing ideas. The contest itself comprises arguments and counter-arguments to rationally support or refute claims on truth.

The other frame makes reference to a social performance. Rather than a clash of ideas, per se, a debate features dueling opponents who stand-in for their positions. In this view, debates are not really about ideas at all; they are actually about showmanship. A debate is not going to establish the truth of the matter, but rather determine the better debater. Instead of a forum for settling arguments, a debate is more like a public performance, which both circumscribe the conflict and also provide opportunities for participants (both debaters and audience) to stake out

and display commitment to positions within said conflict. Both of these frames are relevant when discussing the evolution-creation debate, and they are reflected in commentary by advocates of either side.

The idea of an evolution-creation debate is reinforced and maintained through actual, occasional public debates between advocates for evolution and creation. The last such major debate, as of this writing, occurred on February 4, 2014, between Bill Nye “The Science Guy,” a former host of a children’s show on science, and Ken Ham, President of the Creation Museum in Petersburg, Kentucky. It took place in a large auditorium in the Creation Museum, and was video recorded and posted on YouTube, and then later aired on C-SPAN. By some estimates, the Nye-Ham debate has been viewed by over 7.5 million people.⁷⁹ Examining this event and discourses surrounding it serves a window into the wider “debate.” While the debate itself lasted about two hours and forty-five minutes, the conversation around it began well beforehand and continued for weeks afterward.

One of the more notable aspects of the Nye-Ham debate is the fact that it took place at all. Many national players in the wider “debate” over evolution and creation, such as the National Center for Science Education (NCSE), have policies against debating creationists. Even in this case, Nye’s fellow proponents of teaching evolution criticized him for agreeing to the debate precisely because appearing on the stage with Ham lends the appearance of credibility to his position and reinforces the idea that there is disagreement among scientists over the reality of evolution. In fact, there is a consensus among scientific experts that large-scale evolution has occurred during the billions of years earth has existed, such that there is no “debate” or “controversy” among scientists. According to these criticisms, the notion of a “debate” on evolution results merely from an erroneous and misleading framing of the issue by creationists, who wish to cast doubt in the minds of the public on the scientific support for evolution. “By standing on a stage alongside Nye,” Pete Etchells argues in an article for *the Guardian*, “Ham appears to have a legitimate and equally opposing viewpoint to him, suggesting that evolution is somehow controversial and poorly evidenced.”⁸⁰

Given the received wisdom on debating, it is worth asking how the Nye-Ham debate came to be. On August 23, 2012, an internet forum called Big Think posted a mostly unedited video on YouTube⁸¹ that featured Bill Nye, a former host of a children’s television show on science called “Bill Nye the Science Guy,” saying that creationism is bad for children and that U.S. schools must teach evolution unadulterated with creationism in order to maintain a competitive edge over the rest of the world. Among his arguments was that when one tries to deny evolution, “the world becomes fantastically complicated,” citing things like dinosaur bones, radioactivity, and “distant stars that are like our star but at a different point in their life cycle,” which are best explained through the idea of “deep time and billions of years.” He continues:

It [Evolution] explains so much of the world around us. If you try to ignore that, your worldview just becomes crazy, untenable, self-inconsistent. And I say to the grown-ups, if you want to deny evolution and live in your world that’s completely inconsistent with everything we observe in the universe, that’s fine. But don’t make your kids do it, because we need them.”

⁷⁹ <http://alarryross.com/over-3-million-tuned-in-for-historic-bill-nye-and-ken-ham-evolutioncreation-debate/>

⁸⁰ Accessed at <http://www.theguardian.com/science/head-quarters/2014/feb/05/bill-nye-vs-ken-ham-creationism-science-debate> on June 9, 2015.

⁸¹ <https://www.youtube.com/watch?v=gHbYJfwFgOU>

The video was viewed more than 4.6 million times within a month of the original posting (Lovan 2012). It quickly attracted the attention of Answers in Genesis, a creationist organization that oversees the Creation Museum, an exhibition hall in Petersburg, Kentucky that claims to present evidence that the earth is only about 6,000 years old, based on genealogies listed in the Bible, and that all life was created in the first few days of earth's existence, as implied by a "literal" reading of *Genesis*. The group posted their own video⁸² as a response to Nye a mere 6 days later, on August 29. The video cuts back and forth between two "creation scientists"—David Menton and Georgia Purdom—responding to specific things Nye had said.

It is clear, when viewing Bill Nye's original video that he was not trying to bait creationists into some kind of public fight. On the contrary, he appears to have been largely unaware that even purveyors of creationism seriously doubt the scientific status of evolution. This is evident in his plea, when Nye suggests that creationist parents should accept that their children need to learn about it in order to contribute to the scientific advancement of the country as a whole. This suggestion only makes sense if Nye presumes that these parents recognize that the science is settled and that creationist accounts of origins are mere flights of fantasy. He does not entertain the much more likely possibility that these parents doubt the very scientificity of evolution and would not therefore agree that denying evolution is harmful to their children's understanding science or reality.

By contrast, the response from Purdom and Menton insists on the debatability of the issue. One way they did this was by structuring their video in a debate-type format, rebutting specific assertions from Bill Nye as though they were being scored, even at the expense of building an overall argument. For example, Menton's first argument targets Nye's claim that teaching creation hurts the United States by pointing out that creationism is taught in some other countries as well. It is difficult to see how Menton's point undermines Nye's argument, though it does establish a debate framework for the rest of the video. Secondly, Purdom insists that children, her own included, should learn about "both sides"—both evolution *and* creation. By establishing the existence of two sides, she makes the topic debatable. Third, Menton shows his audience that there is more than one way to see things by offering a perspective-shift. Whereas Nye claims the world is more complicated when trying to square a literal creation account with the scientific evidence, Menton claims it is more complicated to understand the complexities and diversity of life as the result of evolution than to simply accept it as the creation of God. Even if the audience is not convinced to accept the alternative perspective Menton offers, they cannot deny that the alternative perspective *exists*. Finally, Purdom posits the existence of two different *kinds* of science, again shifting Nye's grounding by not only calling into question Bill Nye "the Science Guy's" mastery of science itself but also raising the specter of doubt with regard to which ideas qualify as science.

The Answers in Genesis video was ultimately successful, not by convincing anyone that the creationist position was correct but rather by establishing the topic as debate-worthy. As evidence of that success, additional videos were posted over the following weeks rebutting the Answers in Genesis video. Then the President of Answers in Genesis, Ken Ham, posted his own video response to Nye, challenging him to a debate. Once Nye had accepted Ham's challenge, a wave of commentators supportive of evolution wrote essays to either support or criticize Nye's decision to debate Ham. Again, these criticisms struggled to re-establish that the issue was not debatable, that there was only one viable scientific position to hold, but they were doomed by the fact that they were in fact *debating* the assertions of Answers in Genesis. Even the eventual topic

⁸² <http://www.youtube.com/watch?v=r-AyDtD6sPA>

chosen for the debate reflects this tension over whether there is reason for debate. “Is Creation a viable model of origins?” is focused precisely whether *creationism* is an idea worthy of consideration, and does not even mention evolution or suggest that its status is up for debate.

The two frames of debates—idealistic and social performance—both become apparent in the commentary that surrounds an actual public debate. Individuals are clearly aware of both ideas of debates, as they tend to use the contrast between the idealistic debate and the social performance debate in order to account for potentially losing the debate. If an idea is correct, then a loss must either be due to a failure of the debater or to some rhetorical tactics employed by the opponent. Therefore, we see examples of evolutionists and creationists each emphasizing these performative aspects in the weeks leading up to the big event.

Reflecting the social performance debate frame, Josh Rosenau, who helped to advise Nye prior to the debate, remarked that a “debate is a tool for showing who’s a better orator, not necessarily who’s right.”⁸³ Rosenau observes that the “facts” were already on Bill Nye’s side, but that marshalling facts and evidence against young-earth creationism would have limited effectiveness. More important than marshalling evidence and careful argumentation is the art of the show. It was important that Nye composed himself in a respectful manner to his opponent. Nye was acting as an “ambassador” for science. As “the science guy,” he needed to convey in himself qualities ideally thought to reside with science itself—accessibility, objectivity, and truthfulness—while avoiding displaying those negative tendencies also associated with science—elitism, over-confidence, and authoritarianism. Meanwhile, Ken Ham sought to embody qualities valued highly among his fundamentalist brand of Christianity, particularly the certainty the Bible promises to provide. In both cases, it matters more who is arguing than what is said.

The debate gave participants and commentators alike opportunities to stake out their positions in the matter and publicly display their commitment to the position. Notably, this is true even of those whose position was different from either Ham or Nye. For example, Casey Luskin, at the Discovery Institute, wrote an online article decrying the debate as “A huge missed opportunity” to discuss a third position—intelligent design⁸⁴. In the article, Luskin uses the debate as a way of framing the work of the Discovery Institute as different from both Nye’s “materialistic” evolution and Ham’s young-earth creationism, thereby intimating itself as the more moderate and therefore reasonable position. Other middle grounds were staked out by affiliates with the Biologos Foundation, a Christian advocacy group that emphasizes the compatibility between science and Christian faith. The President of the group, Deborah Haarsma, wrote about “another choice” between Ham’s brand of young earth creationism and an atheistic evolution account, which she called “evolutionary creationism,” a position that denies any contradiction between a scientific view of evolution and the *Genesis* account of creation.⁸⁵

This public performance aspect is further reflected by the fact that, in the Nye-Ham debate, as in most such public debates, the outcome was not clear. There was no formal system of scoring or judging a winner, and instead the audience was invited at the beginning and end of the debate to decide for themselves⁸⁶. Most audience-members at the Creation Museum were already convinced that creationism was scientific before the debate, and exit polls indicate that

⁸³ <http://ncse.com/blog/2014/02/how-bill-nye-won-debate-0015369>

⁸⁴ http://www.evolutionnews.org/2014/02/the_ham-nye_deb081911.html

⁸⁵ <http://biologos.org/news/january-2014/ken-ham-vs.-bill-nye-biologos-offers-another-choice>

⁸⁶ This same approach was taken by ABC news: <http://abcnews.go.com/US/things-missed-bill-nyes-evolution-creationism-debate/story?id=22373841>

they maintained those convictions. Reports that followed the debate, including interviews with attendees and online comments, were no more helpful. Those who supported Ham's young-earth creationist position tended to claim that Ham won, whereas those who supported evolutionary accounts tended to side with Nye. Most commenters, who focused on the rhetoric, style and demeanor of the debaters, and not their positions, agreed that Bill Nye had done a better job arguing his position. Based on the ambiguity of outcome, which was built into the format itself, it is clear that the purpose of the debate was not establishing whether one position or the other was correct.

In the end, the Ham-Nye debate was clearly not a disembodied arena in which ideas collided and positions lived or died on their own merit, but was rather a struggle between individuals socially situated, and "judged" by people with public commitments to a given position, motivated to perceive the debate in a way that confirms those commitments. It is precisely this image of a debate that I wish to invoke to characterize the phenomenon I studied in Tennessee. Interlocutors in the "debate" over whether and how evolution is taught in schools are socially situated, with commitments to specific positions. Just as an actual debate is not a means of determining the soundness of a position, it is inaccurate to imagine that the larger "debate" is about propositions and logical arguments, weighed one against the other. Participation in the "creation-evolution debate" is a public ritual that provides space for participants (including the audience) to display their commitment to particular positions. A key site for this ritual is the science classroom, as it exists in public schools, though it is enacted in other sites as well, including the Tennessee legislature, in the media and potentially any other public forum.

Implications

Thus contrary to prevailing conversations on evolution and creation, which are focused on various ideas and whether they are compatible, I have presented an account focused on social interaction and everyday practice. My account was not meant to disparage ideational discussions or suggest that ideas are irrelevant (they surely are not), but simply to draw attention to an aspect of the situation that tends to be overlooked. In doing so, I bring to the fore a perspective on the motivations and experiences of students, teachers and others that has potential to change, or at least nuance, the conversation. The findings of this dissertation have implications for anthropology, for the ongoing situation in Tennessee schools, and for future research projects. In this penultimate section, I will discuss each of these implications in turn.

An Epidemiological Account of Evolutionary Education in Tennessee

In Chapter 1, I outlined an approach to studying evolution education based on an epidemiological model first proposed by Dan Sperber. I chose the epidemiological framework for studying efforts to expand the teaching of evolution because it is centrally concerned with the transmission of a set of ideas. As envisioned by Sperber, this approach is based on the recognition that in order to transmit ideas, it is necessary to transform them, from a mental representation (an idea) to a public representation, and then to a new mental representation in the mind of another person. However, the research presented in this dissertation also reveals that Sperber's model is under-theorized in two important ways: first, with regard to the public representations themselves; and second, with regard to the role of motivation in how both mental and public representations are produced.

In his original paper on cultural epidemiology (Sperber 1985) and the book in which it was elaborated (Sperber 1996), Sperber is explicitly focused on persuading anthropologists that knowledge of psychology is crucial to understanding processes of cultural transmission like enculturation. His cultural epidemiology helped to explain why certain kinds of ideas are more common in diverse human societies than others. Criticizing “mind-blind” approaches to studying culture, Sperber argued that cognitive processes are required for reconstructing the intended meaning of a communicator and therefore for social learning more generally. Accordingly, Sperber focuses almost entirely on the mental representations (ideas) and their construction rather than the public representations produced to convey those ideas from one person to another. By contrast, as elaborated in Chapter 3, anthropologists have mostly focused on what people do and say, which would be included among Sperber’s public representations. For my own part, I endeavored to create an epidemiological account of evolution education that accounted for transformations in ideas/representations while taking seriously the kinds of social processes neglected by Sperber.

It is not really possible to start at the beginning of the chain of transmission related to the effort to teach evolution in Tennessee. As we saw in Chapters 2 and 3, calls for teaching evolution started to appear decades before this project began and were manifested in science standards recommended by scientific organizations at the national level. It is, nevertheless, possible to locate a somewhat arbitrary beginning in the mind of Dr. Linda Jordan, the state science consultant in the Tennessee Department of Education, who was apparently motivated to enact her desire for an expansion of evolution content in the Tennessee Science Framework being developed in 2008. Within the epidemiological approach, the Framework, specifically the version of Standard 5: Biodiversity and Change over Time that would eventually be approved in 2009 by the Tennessee Board of Education, may be conceived as a public representation of Dr. Jordan’s mental objective to expand the teaching of evolution. Immediately though, we run into a problem in that the Framework was itself negotiated by a number of different people, each with their own sets of ideas about what content should be included. Thus, Dr. Jordan’s ideas are transformed not merely by the act of converting them into a public representation, but also by the political process of negotiation and revision that ultimately produced the document, as detailed in chapters 4 and 5. The most substantial example of the results of this process is that, in middle school grades, the term “evolution” was replaced by “change over time” in the final draft of Standard 5. Even though Jordan recognized her original intention in the approved Framework, it had been made deliberately ambiguous in order to satisfy constituents opposed to teaching more evolution.

This ambiguity in Standard 5 has immediate repercussions during the next step in the process, wherein individual teachers and curriculum specialists at the district level must interpret the Science Framework into some notion (i.e. mental representation) of what students need to know. The Tennessee Department of Education organized Standards Awareness Workshops throughout the state in order to help teachers through this process of interpretation. An examination of what kinds of ideas were presented during these Workshops reveals a complication to the epidemiological framework provided by Sperber. Specifically, it is not obvious what exactly these “representations” are actually representing—the actual content, calls to teach the content, or methods of teaching it. As noted in chapter 6, I expected the Workshops to attempt to clarify the content in the Framework, in order to ensure that teachers were prepared to teach it. Workshop organizers, by contrast, assumed that teachers were either already familiar with the content knowledge or were responsible for developing gaps in their knowledge through

independent study. Instead, the organizers used the Workshops to clarify how the Framework ought to be read and used, particularly noting the difference between Grade Level Expectations (GLEs) and State Performance Indicators (SPIs) described for each Standard. Their emphasis on the overall structure of the Framework document, particularly with regard to building content from one grade to the next as learning progressions, could have indirectly indicated to teachers that concepts in Standard 5 were meant to be related to evolution.

However, teacher themselves understood the workshops to be providing something else—materials and activities that they would be able to use in their classrooms to teach the new standards. Due to these expectations, teachers tended to ignore and even mock the efforts of organizers and presenters to tell them how to use the Framework, paying much greater attention to specific activities they believed they would be able to incorporate into their classrooms. Participating teachers then took those ideas, already filtered by their selective attention and interests, back to their respective districts, where they were presented again in the form of new public representations, and again interpreted and understood by their colleagues. Along the way, it is inevitably the case that many key ideas were lost, as we saw with the notion of “embedded standards” or the request to focus on GLEs rather than SPIs in lessons.

When teachers turned their attention to interpreting the Framework to determine what they were supposed to teach, an epidemiological approach would predict that these interpretations would rely on the conceptual knowledge they already possessed and their beliefs about the intentions of the authors of the Framework (Sperber 1996). Indeed, the authors expected teachers to fill-in gaps in their own understandings through independent research. I spoke with some teachers who relied on the classroom textbook to better understand the content, while others spent extensive time researching and compiling a substitute “textbook” when their district refused to purchase up-to-date science textbooks that included evolution.

A teacher’s knowledge was doubtlessly relevant to their understanding of the content in Standard 5, but it was not the only relevant factor to determine how teachers taught the Standard. Truly, middle school science teachers had relatively poorer understandings of evolutionary theory than high school biology teachers, and they were less likely to cover evolution as a topic. In participating school districts, which were biased toward greater support for evolution education (administrators who were willing to participate in this research project) only half of 8th grade science teachers, compared with all of high school biology teachers, were supportive of teaching evolution. During interviews, many 8th grade science teachers indicated that their interpretation of Standard 5 was ultimately motivated by considerations about the effects of teaching evolution, coming from their communities. Most such teachers did not interpret the state science standards to include evolution, though it was unclear whether this was due to poor understanding (e.g. not realizing that natural selection, adaptation, genetic mutations, and fossil evidence for change over time are all components of evolutionary theory), or to willful misinterpretation in order to avoid teaching about evolution.

While high school biology teachers were more supportive of teaching evolution and had noticeably better understandings of the theory, they were typically prevented from spending much time on evolution because the unit was paced, by district-level authorities, to come at the end of the year. If pacing did not go on schedule (a common occurrence), then the unit on evolution was skipped or abbreviated. Despite the fact that state standardized tests are supposed to test knowledge of the standards, teachers in my admittedly small sample did not suffer lower test scores when they avoided teaching evolution. This finding is consistent with the fact that

sample test items that were intended to address the evolution standards did not typically test understandings of the theory.

As a result of ambiguity in Standard 5 and a lack of state oversight, teachers had considerable flexibility in producing classroom instruction (public representations). While the research did not deal in representative survey data, anecdotal evidence and student reports suggest that many science teachers in Tennessee supplement coverage of evolution with creation science materials or intelligent design. When this happens, it is generally supported by the community, administrators and school board members. Furthermore, it is made possible through the efforts of several creationist organizations that produce arguments and even classroom materials designed to disparage the evidence for evolution and champion creationist accounts of origins. Long-term fieldwork at one site in eastern Tennessee documented means by which school directors promote religious behavior among teachers and encourage science teachers to subvert evolution standards without such activities being noticed by the state, the media, or watchdog organizations. Community members opposed to such practices chose not to complain due to fear of ostracism from the community.

In the final link in this chain of transmission, students were presented with a set of public representations that they needed to interpret in order to form a mental representation of evolution. Again, Sperber's approach predicts that these students use existing conceptual knowledge to translate these public representations into understanding. Previous research has found that students often misunderstand evolutionary theory by substituting scientifically inaccurate Lamarckian mechanisms to explain how change occurs. Analysis of interview data from students confirmed a prevalence of such misconceptions, but this alone could not account for discrepancies in understanding of evolution among different groups of students. As discussed in Chapter 7, there was a correlation between acceptance of evolution and student understandings of the theory, but it was not the case that understanding caused acceptance since the proportion of student who accepted evolution remained the same before and after high school biology despite a marked increase in understanding. Instead, the pattern appeared to be driven by how students responded to evolution instruction, based on social commitment to particular beliefs. Students have more interest, in other words, in producing both public and mental representations of their own pre-existing commitments than they do in accurately translating classroom instruction and materials into understandings of evolution.

While my primary concern was anthropological, concerning the contours of an ongoing social conflict relevant to people's experience of power and truth, the above account is also relevant to understanding policy implementation. When thinking about policy, it may be necessary to distinguish this epidemiological account from similar ideas in policy research that could be called the "leaky pipe" and "telephone game" models of policy implementation. In the first model, policy makers create a policy, which is then implemented across an institution. However, in each step along the chain of implementation, something is lost such that the end result is in some way weaker than the original intent. The relevant difference is not the outcome per se (which is basically the same) so much as the processes that are responsible for that outcome. The leaky pipe analogy takes as its centerpiece fundamentally erroneous notions of both implementation and policy. Unlike a pipeline, institutions involved in public schooling are disconnected throughout the process. Furthermore, the flow in these institutions is not owed to the force of gravity in a top-down structure. Curriculum is not pumped into an LEA through the administrator's office and then on to the classroom. Rather, it is produced by teachers who answer to that office. Finally, unlike water in a pipe, the curricular content is not itself

transferred through the pipes, from beginning to end. Rather, it is created anew by the various actors throughout the system.

In the telephone game, a whispered message is relayed from one person to the next. As it is inevitably misheard and/or misremembered, the message quickly becomes garbled. By the end of the chain, it is unrecognizable compared to the beginning. The telephone game analogy comes closer to the epidemiological account provided here, by centrally including transformations to the message, which must be reproduced at each link. However, it fails to take into account the means and motivations by which individuals transform the message along the way. In the case with the implementation of the evolution standard, various actors interpreted it in a way that was sensitive to their concerns. It would be like a telephone game in which everyone hears the original message, and they are able to selectively understand the message whispered to them based on their opinion of that message. While in both cases the outcome may be unrecognizable, the reasons for that outcome are very different, as are potential solutions.

Ultimately, this epidemiological account is most useful for what it reveals at the points of transformation about the roles for not only psychology, which was conceived by Sperber to play a key role from the beginning (Sperber 1985), but for anthropology as well. Through its application, we see the limits of a purely cognitive account and come to remark on the ways that identity, social commitments, institutional organization, political power and cultural context shape the outcome of transmission. By focusing on mental representations, Sperber's epidemiology fails to consider the ways that the production of public representations constitutes a socially relevant performance. As an anthropologist, my contribution to Sperber's approach is to look more closely at the public representations that surround the conflict.

The same issues that arise in Sperber's model are similarly present in much of what has constituted cognitive anthropology from its origins to the present. I began this project as a cognitive anthropologist, with methodological training and theoretical focus on how people think. While this background was useful, I found it unable to adequately account for much of what I saw and heard. Even something like evangelical Protestantism, with an overt emphasis on belief, is unintelligible by beliefs alone. Cognitive theories of religion provided interesting accounts of why certain views of God would be more compelling to people (Boyer 2001), but they told me nothing about how teachers treat evolution and how students respond. As I dug into the ways that anthropologists of the past had studied religion, and the insights they had carried away from those studies, I recognized the cognitive accounts as incomplete. Cognitive anthropologists were not wrong to explore the ways that people think, nor to find more systematic means of doing so. Their mistake was to jettison the discipline's collection of insights into activity and practice. By focusing my attention on this latter aspect, I hope to have demonstrated why it is valuable.

Evolving Developments

The second major implication of the research is to better understand continuing developments in Tennessee and elsewhere relevant to evolution education. The failure of evolution education to translate into more public acceptance challenges assumptions about how people believe. Court decisions, professional scientists and the weight of scientific evidence have all come to the side of evolutionary theory, and yet somehow people are not persuaded. If the weight of such authority has no purchase here, it threatens the narrative of conflict over evolution education. After all, the body of evidence shows that better understanding of evolution has only limited effects on believing. If teaching evolution does not cause anyone to believe in it, then anti-evolution forces have no reason to oppose its teaching. And if more coverage of evolution in

science teaching standards does not actually cause teachers to include it in the curriculum, then criticizing states for having less coverage would be a wasted effort. It threatens the Enlightenment narrative of truth and reason's triumph over superstition and falsehood. And finally, it threatens the conceptual change theory of learning, which predicts that, as students encounter information that challenges their ways of thinking, they will eventually reform their understandings. The results of my doctoral research encourage rethinking their relationship between beliefs, knowledge and authority.

A different account would note that standards matter *because* they are official. Officially only evolution is supposed to be taught in Biology classes in Tennessee's public schools, not creation science and not intelligent design-based criticisms of evolutionary theory. The fact of being part of the official standards and included in the official textbooks is a kind of legitimation for the theory in itself. Several students explicitly recognized this, referring to the fact as evidence that supports the theory. As long as the State has legitimacy, it is expected that public school curriculum should include only legitimate knowledge. People who accept the legitimacy of evolutionary theory also accept the legitimacy of the public mandate to teach it. One student even mentioned the fact that evolution is included in the standards when asked for evidence in favor of evolution. Those who reject evolution also reject the legitimacy of the mandate, and are compelled to find ways to publicly denounce it. This is obviously the motivation behind practices such as stickers in textbooks in Georgia and Alabama, mandated announcements about the questionable status of evolutionary science in the Dover School District, and other public actions to contradict the state's apparent endorsement of evolution via the standards.

The most recent effort to de-legitimize evolutionary theory, along with several other "contested scientific theories," is the Academic Freedom law, mentioned at the end of Chapter 2. This law explicitly bars administrators from firing or otherwise punishing teachers for how they present evolution in their classrooms. Though currently part of Tennessee law, the bill faced opposition from multiple sources. I was included in an email exchange among several interested groups that included the Tennessee branches of the ACLU and Americans United for the Separation of Church and State, as well as the National Center for Science Education. Their strategy was to recruit scientists to testify against the bill before the Tennessee legislature and in the media. In the hearings leading up to votes on the House and Senate bills, Nashville teachers and professors testified against the bill, calling it "stealth creationism" that would bring embarrassment to the state. These testimonies were severely criticized by lawmakers who pointed out that the bill included no references to creationism or religion. The careful wording of the bill and its explicit references to academic freedom made it difficult for its opponents to make a clear case against it. Instead, they gave convoluted accounts of connections between the authors of the bill and the Discovery Institute, which also avoids explicit religious associations. At times, I felt that their testimony sounded like a conspiracy theory, and I doubted the legislators were compelled by it.

Eventually though negative attention from the press, apparently convinced the bill's sponsors in both House and Senate to "table" the bill rather than vote on it on the legislative floors. They waited almost exactly one year before reintroducing the bills and quickly passing them. From there the bill went to Governor Haslam for signature. He allowed the Academic Freedom bill to become law without signing it, a symbolic and very quiet kind of protest. He explained his decision not to sign by saying that he did not think the law would improve education in the state while recognizing that the support in both legislative bodies was strong enough to override a gubernatorial veto.

While criticized as “stealth creationism,” the law does not actually make it legal for teachers to include “non-scientific” critiques of evolutionary theory, such as creationism. It may, however, have the effect of encouraging the inclusion of creationism based on three factors. First, in the wording of the law, “evolution,” along with “global warming,” “stem cells,” and “human cloning,” are mentioned specifically as “contested” theories. To the extent that including evolution in the official state science standards lends the theory legitimacy in the eyes of students, this legal designation of the theory as “contested” could be expected to undermine its legitimacy. Second, because the law forbids administrators like principals from disciplining teachers regarding how they teach evolution, such administrators may be reluctant to warn teachers even against violations that are not protected, such as explicit creationism or its cousins, creation science and intelligent design theory.

Finally, these two issues are further compounded by coverage of the bill in the media. As noted, the bill was routinely labeled “creationist.” This moniker was somewhat accurate in that it came from creationists. Specifically, it came from the Family Action Council of Tennessee (FACT), the same explicitly conservative Christian lobbying group behind the “Don’t Say Gay Bill.” FACT adopted the language of the bill from the Discovery Institute, which had advocated Intelligent Design Theory in the past. Considering its source, the motivation behind the bill was not likely giving teachers more freedom to discuss controversial topics in the classroom. Unfortunately, for many reporters and bloggers, being a creationist bill meant that it allowed teachers to teach creationism, and it was often mistakenly described as such in editorials published in the *Tennessean*. This characterization of the Academic Freedom is technically inaccurate, in that nothing in the law gives any legal cover to teachers for discussing creationism, creation science, or even Intelligent Design. All such ideas have, after all, been ruled already by federal courts as religiously based and non-scientific. Nevertheless, these characterizations in the media may be accepted by administrators and teachers, who would proceed under the impression that such “weaknesses” could be included by a teacher without a possibility for punishment.

It is not clear, at this point, the actual effect the law will have in classrooms. There are many relevant factors: how administrators interpret the law, how teachers interpret it, how parents and students interpret it, and how school board members and other community members interpret it. It would be simplistic and false to presume it will operate everywhere in the same way. If all aforementioned actors believe that the law allows teachers to include claims from creation science or intelligent design theory, then it is very likely these misleading and dishonest claims will be taught in the science classroom. However, given the uniformity of views in such a schooling community, it is also likely that such claims were already being made. Likewise, in a community where all the relevant actors believe the law explicitly excludes creation science and intelligent design theory, on the grounds that they are *not* scientific, it would be very unlikely for these claims to be taught.

The biggest complication is that both situations, where everyone agrees, are much more the exception than the rule. It is those situations in which people disagree over temptation that lawsuits and court battles occur. If a teacher believes it allows creation science, but a school director does not, there’s a chance of a lawsuit. If a teacher believes the law actually protects the teaching of evolutionary theory as one of the best scientific theories of the modern world, and a parent or director does not, there’s a chance of a lawsuit. If a teacher is actually fired or punished for being ineffective, but he also teaches intelligent design, then there’s a chance he will use the law as grounds for a lawsuit.

As a researcher, I am extremely interested to see how such a lawsuit will play out. However, as a citizen of Tennessee, I am concerned about the financial impact of a lawsuit on an already underfunded educational system. It may be many years in the making. In Louisiana, where a very similar law was passed back in 2008, there have so far been no legal challenges. Regardless of the outcome of these laws, we can be certain that, as long as people are convinced that certain scientific claims are a threat, there will be efforts to undermine the teaching of such ideas to their children.

Directions for Future Research

The third major implication follows directly from the central thesis—that social context is important—to how the topic ought to be studied in the future. This dissertation contends that people respond to evolution in different ways, depending on their positionality, itself shaped by experiences and relationships formed in their communities. This view has implications for understanding the struggle over teaching evolution, which may not at first seem obvious. When the debate was merely ideational, it was possible to imagine that the characteristics and identities of the people involved were mostly irrelevant, with the exception perhaps of religious affiliation and occupation (e.g. teacher). Residence has also been considered to be relevant, mostly due to assumptions about religiosity and affiliation in urban vs. rural areas. Now that we recognize the social situatedness of the struggle, we can no longer ignore other dimensions of the lived experience of various people.

When first conceived, my project was inadvertently focused mostly on white, male subjectivities. Such a focus is consistent with the main body of research in evolution education, including also historical scholarship on the Scopes Trial of 1925, and on Charles Darwin and his contemporaries. During my fieldwork, I focused on white Protestant churches, where I already knew evolution was a highly salient issue. I furthermore followed previous research in ignoring gender in topics of evolution education, which effectively means that my account defaults to male perspectives. I looked at gender within these churches only peripherally, noting explicit gender ideologies within them—men were told to serve as the head of the family, and wives were told to submit to their husbands. However, I did not systematically explore the relevance of these gender ideologies for how students and others might respond to evolution.

When I began to analyze the interview data, I noted that female students from evangelical backgrounds were far more likely than their male counterparts to take certain creationist positions, which were in turn linked to demonstrating fewer Darwinian concepts. They were less likely to say that a Christian can believe in evolution, and less likely to say that common descent is believable. They were also less likely to say that certain species may have been related, in the card sorts. Reflecting on my ethnographic fieldwork in Baptist churches, it occurred to me that there were discursive parallels between protecting female virginity and protecting the minds of children from “dangerous ideas,” such as evolution. Whereas boys were prepared for spiritual leadership and decision-making, girls were impressed with ideals of purity of mind and body, which must be guarded against potential seducers. Nowhere is this connection more obvious than in retellings of the Garden of Eden story, a staple in sermons, in which Eve is charmed by the Serpent into tasting the forbidden fruit of knowledge, and then in turn tempts Adam to share it with her. The fruit itself binds knowledge to sex, and the woman is established as conduit for sin, a vulnerability that demands vigilance. If one’s social situation shapes experience of the evolution conflict, then it would be useful to pay attention to the often very different social reality of women as compared with men. Future research ought to explore this dimension in order to help balance the account.

At the same time, greater visibility for and familiarity in white evangelical traditions for researchers has contributed to a striking lack of attention to perspectives on evolution coming from communities of color. The focus of this and past research furthermore raises questions about the extent to which the issues associated with the evolution-creation controversy are primarily white issues. In my literature searches, I have found only two articles on race and evolution, which was focused on the early 20th Century (Moran 2003). However, if the social situation of students and others is crucial to understanding how they view and respond to evolution education, then it is necessary to consider other perspectives. If it is, after all, a purely white issue, then it is important to recognize it as such rather than allow white evangelical Christianity to serve as synecdoche for the U.S. Christian church more generally. And if this is an issue that affects black communities as well, then it is crucial to understand those effects. It is possible, for example, that opposition to evolution could alienate students of color from institutions of education, limiting economic opportunities (Graves and Bailey 2009). If this source of alienation were combined with other sources, such as those deriving from systemic racism and the overwhelming absence of people of color in the STEM fields, then it is possible that such struggles could exacerbate that imbalance.

What Role for Anthropology?

In the Introduction, I noted that anthropologists have so far taken an active role in promoting the teaching of evolution in public schools. The AAA has produced an official statement calling on anthropologists to:

...use their knowledge both of evolution and of human social and cultural systems to assist communities in which evolution and creationism have become contentious. (Scott et al. 2000)

I have attempted as much as possible to fulfill this commitment throughout the research process. Many of my findings are relevant to the community conversations. For example, if students raised in evangelical churches and taught to reject evolution are unlikely to change their mind through instruction, then it doesn't make much sense for a teacher or parent to agonize over its presentation in a classroom. I have shared my findings, in the interest of promoting understanding to participating schools as well as the public in Nashville. However, I have much more trepidation in fully endorsing the next part of the statement:

Anthropologists should help the public and public officials understand that good science education requires that evolution be presented in the same manner as other well-supported scientific theories, without special qualifications or disclaimers. (Scott et al. 2000)

As a statement, it makes sense to have a professional organization lend public support for scientifically accurate presentations of human origins. I am though conflicted over the assertion that "good science education requires" evolution to be taught. I recognize this as part of the same discourse I described in chapters 2 and 4 that has emerged out of and been shaped by the struggle over teaching evolution. This discourse reflects a history of othering creationists, defining them as ignorant and opposed to science. That such a discourse is present among anthropologists was made apparent for me in 2014, when I presented a paper at the American Anthropological Association conference in Washington, D.C. that was met with chuckles and even laughter from the audience. The experience gave me an opportunity to further reflect on the tension within anthropology on a topic like this.

The paper, which I was presenting in a session on education policy, was the basis for Chapter 6 in this dissertation. It described a case in which official state policy—in this case codified in science standards—was transformed by teachers through the ways they interpreted the curriculum and conceived their role in teaching it. My intent was to complicate how we think about policy implementation and the agency of teachers.

I used quotes to make clear that these transformations involve real people, situated in specific, local contexts. The teachers' interpretations were based on a combination of pragmatic considerations, often related to high-stakes testing, and their own understandings of the content. At the heart of all of these considerations was the recognition among the teachers that aspects of the science curriculum were likely to alienate many of their students, specifically by undermining the legitimacy of their cultural identity, personal commitments and culturally-informed epistemologies.

When I heard the laughter, I realized that my plan had backfired. As an anthropologist, I am committed to several things simultaneously. I am committed to understanding the people with which I do fieldwork, to listen carefully to what they tell me and learn from them about how they see the world. I am committed to ensuring that the trust they give me when they agree to participate in the work is not betrayed. And I am committed to communicating what I learn to the wider academic community, including my fellow anthropologists.

The audience was not laughing at any joke I had made, nor were they laughing at me personally. They were laughing about my informants and the communities in which they work. Afterwards, as I was discussing the incident with Rebecca Hodges, the co-organizer of the panel, she asked, "When is it appropriate to laugh at what an informant says?"

Though laughing at informants is, of course, *not* typically seen as appropriate for anthropologists, the reaction of the audience members is understandable within a larger context. Anthropology as a discipline values insight from all four (or five) fields, including biological anthropology. That we humans are, like all species, evolved organisms, is as central to our common ground as is cultural relativism or attention to how culture shapes experience. Though the degree to which those of us regard our evolved nature as relevant for understanding human behavior, it remains the case that most textbooks for Introduction to Cultural Anthropology courses include a chapter near the beginning that describes human evolution.

Many anthropologists follow the public controversy over evolution, championing the cause of teaching evolution as an integral component in scientific literacy. In other words, we have a dog (cock?) in the fight, and thus care about the outcome. Indeed, the symbolic importance of the fight over teaching evolution may have, like Geertz's cockfights, exceeded its practical consequences. Teaching evolution has come to symbolize the ability of science—empirical and rational—to triumph over its foes—ignorant and unreasonable. In order for the drama to work, those teachers who undermine the teaching of evolution must be cast not as villains, but as fools.

I unwittingly played into this stereotype when I presented a quote from one of the teachers, and it was this portion of my talk that received the most laughs. In the extended quote, the teacher explained the difference between "change over time" and "evolution." Unfortunately, this explanation included several misconceptions about evolution and biology more generally. The most straightforward to note is the following excerpt of that quote:

If we evolved from apes then we wouldn't have any apes left. If everything evolved from something else then we wouldn't have the other animal because nature would de-select for that animal. So it doesn't make any sense to me.

Many readers are undoubtedly familiar with this objection. I encountered it quite often during my fieldwork. It is needless to point out that the objection is based on a misunderstanding of speciation, common ancestry, and the fact that specific traits may be more or less adaptive in different environments and ecological niches. It is needless to point this out, and yet I did so anticipating that many readers would be doing the same thing. Our urge to refute such ideas is as strong as the temptation to laugh at them. Indeed, the responses (refutation and mockery) are two variations on the same urge: for mastery. Members of the audience laughed as a way to demonstrate that the teacher's objection was not valid. Furthermore, by laughing, members of the audience did not merely communicate that the teacher should not be taken seriously, but also that they *knew better*.

As anthropologists, we are, I believe, committed to efforts to understand other people and their cultural perspectives. We are critical of "othering," and we are cautious about the role of knowledge in producing and maintaining hegemony. When we take political stands, it is to defend against cultural domination, to lend legitimacy to the efforts of those being culturally marginalized to assert their rights to resist that domination. Often these commitments extend into situations in which the beliefs of our field interlocutors differ from our own with respect to reality. For example, medical anthropologists encounter understandings of disease and corresponding treatment that contradict the claims of Western biomedicine. In such cases, the anthropologist does not collaborate to correct the misconceptions of their informants, but instead to discover ways of translating differences in cultural models between doctors and patients. Likewise, educational anthropologists encounter ways of knowing about the world among indigenous students that run counter to Western science, and ask how to design culturally sensitive science education that integrates these perspectives so as to avoid alienating such students.

Though we seem capable of recognizing our proper role when faced with minorities, indigenous groups and subalterns, we have considerably more trouble doing so with maligned groups like creationists. More than thirty years ago, Susan Harding wrote about the challenges of relating her research on Fundamentalist Christians to academics. They are thought of as "the cultural other": ignorant, silly and dangerous. Harding felt compelled often to defend her subjects against colleagues (Harding 1991). While decades have passed, among intellectuals, the religious and cultural right remains an other. Given their perceived power within the larger society, we are tempted to demonize and laugh at them, rendering their perspectives less valuable and illegitimate.

Anthropologists face rather odd beliefs and practices on a regular basis. We accept generally that it is not the place of anthropology to decide people's truths. We may try to understand those truths, their bases and what people do with them. Normally, we have the benefit of distance to regard such ideas as interesting but not strictly relevant to our daily lives. When we study people who live in the same communities as us, who vote, who run schools that our children attend, we lose that distance. The idea of a witchcraft organ seems theoretically interesting or even quaint when it exists "over there," but the belief that the earth is only 6,000 years old common among young-earth creationists, feels personal.

I certainly have experienced my own ambivalence about how to represent efforts to oppose evolution education. I have not found any simple solutions. In reflecting on this recent experience at the conference, I cannot escape my own complicity. When I speak to a general audience about anti-evolutionism, I typically make it a point to preface the discussion by emphasizing the importance of understanding these perspectives and recognizing them to make

sense within a particular cultural frame. I typically give the audience a primer in cultural relativism, and I warn against anger or ridicule in favor of dialogue. In fact, a paragraph on just such a point was originally in my paper for the AAA conference. In the interest of coming in under the time limit, however, I cut it out. In retrospect, this was a mistake.

More troubling to me still is that I did nothing to stop it. When I heard the laughter, I did not condemn it. I did not pause, look up from the paper, and remind those who laughed that I was not sharing this information for entertainment purposes. I did not remind them that these perspectives were valuable and shared in a spirit of trust. Instead I continued reading, surprised, concerned, but ultimately without protest.

When I approached school administrators and teachers about taking part in research on how the sensitive topic of evolution was treated in their schools, I explained that the purpose of the project was to better understand their perspectives. I explained that these perspectives are valuable for relating the conflicts and challenges they face to a wider audience, to make it comprehensible. Some of these participants expressed reluctance or fear about sharing their personal views on evolution as well as their understandings of it. I reassured them that it was not my intention to deride or judge them. What I did not fully appreciate at the time was the extent to which my responsibility to them extended beyond the ways that I intentionally represented them to the ways those representations were understood by others.

Tennessee, since the Scopes “Monkey” Trial, Tennessee has had a reputation and has occupied a special place in the culture wars discourse. While not the only state to forbid the teaching of evolution for the second quarter of the 20th century, the national attention that came with Scopes ensured it would be the most remembered. My work is regressive if it manages merely to perpetuate the stereotype of the ignorant creationist teacher. Certainly, many of the teachers’ understandings were incorrect from the perspective of modern biology as I understand it. These understandings seem to be relevant to how these same teachers cover evolution. How do I present this fact without perpetuating the stereotype?

This experience serves as a reminder of the complications that come with fieldwork, but it reiterates old debates about whether anthropology as a discipline can both take political positions and maintain a commitment to understanding the human experience.

Excecutive Summary

The ongoing public debate over teaching evolution in schools is typically disembodied from the social reality in which it occurs, and is framed as a collision of mutually incompatible beliefs or claims about reality—Bible-based creationism vs. naturalistic science. However, this account ascribes to beliefs an agency of their own, independent of the humans that profess them. Indeed, focusing on beliefs has been problematized by anthropologists of religion, who insist instead on the importance of practices that publicly communicate social commitment. Moreover, framing the debate as being about a clash of ideas makes it intractable—resolution requires convincing individuals to change their minds, a strategy that is unlikely to be successful.

In order to rescue the conflict from this abstract world of ideas, my project examines practices relevant to teaching evolution as they occur in local contexts—specifically at several sites in Tennessee. I conducted ethnographic fieldwork in churches and homes in one East Tennessee town, while also studying the local school district from outside. Through conversations with parents, students, pastors and other community members, I gained fluency in the discourse on teaching evolution—how it is *and is not* talked about. I also worked inside of the state education system, tracing an effort to “teach evolution” from the writing and negotiation of Standard 5, in the Tennessee Science Framework, to the interpretation of that document by teachers in various districts, and on to the responses of middle and high school students in their classrooms.

The resulting dissertation argues that individuals participating in evolution education (bureaucrats, teachers and students) are acting and thinking within a social realm without which the enterprise and controversy make little sense. They are motivated to signal to others their identities. They generally want other people around them to like them, or at least not be mean to them. And they have more interest in communicating their commitments to various positions in the “debate” than being strictly concerned with the compatibility of beliefs in some ideational realm. I support this claim through six chapters, each of which focuses on a different aspect of the enterprise of teaching evolution.

In Chapter 2, I examined at the intertwined histories of evolution, creationism and public education. Though both sides lay claim to a primordial validity to their respective position, neither would exist without the other. Creationism did not emerge as an ideology until the beginning of the 20th Century. The forms of creationism that exist today—creation science and Intelligent Design creationism, to name the most notable—developed in relation to the debate itself, as solutions to legal challenges. Likewise, the importance accorded to including evolution in science curricula has only grown through efforts by anti-evolutionists to undermine it.

In Chapter 3, I discussed the ways that belief is a public practice as a way of reconciling several tensions. First, despite the fact that Protestant Christianity has both historically and contemporaneously explicitly emphasized faith and belief over social acts such as rituals, my ethnography of churches in a community in East Tennessee demonstrated ways that personal beliefs are made public through particular activities. Second, whereas discourses on the evolution-creation controversy typically hold “beliefs” to be stable mental objects with their own agency, anthropologists have seriously problematized beliefs as objects of study. Drawing on anthropological work on religion, particularly Rappaport’s ideas about social commitments as well as various ideas from the emerging sub-field of anthropology of Christianity, I develop a conception of believing as an activity that must be sustained through practice. At the same time, statements of belief are verbal performatives that commit the speaker to a particular orientation

in regard to the truth or falsehood of evolution. I use this conception of belief to understand the public nature of private belief among the evangelicals I encountered in eastern Tennessee and the ways that teachers, students and others responded to calls to teach evolution.

Then, in Chapters 4 and 5, I provide an account of the development of the Tennessee Science Framework, based on interviews with its various authors, email records from the lead author, and three different drafts of Standard 5. I show that inclusion of evolutionary content relied heavily on concerns among state actors about professional identity and public relations for the state. For example, the governor and education commissioner ordered more “rigorous” science standards in order to signal to technical businesses that Tennessee is pro-science. However, a draft that presented an ambitious effort to expand teaching of evolution into 8th grade science was met with opposition from certain members of the public who drew on a history of antievolutionist discourse to express their position. The lead authors attempted to mollify their concerns by removing direct mentions of “evolution,” while maintaining many key evolutionary concepts in less obvious form. The resulting text of Standard 5 in 8th grade, which was eventually approved by the State Board of Education, is thus deliberately ambiguous.

In Chapter 6, I describe how the ambiguity built into Standard 5 was exploited by a number of teachers who were motivated to avoid teaching evolution. I discuss Standards Training Workshops, which the Tennessee Department of Education organized in order to teach teachers how to read the new Science Framework, but which did not endeavor to explain which concepts were in the Standards. Throughout the Workshops, I was aware that the teachers were living and interacting in their social environments. I combine field notes and interviews with 8th grade science teachers, to describe how these teachers negotiate with the Science Framework and implemented it in their classrooms in a way that was influenced by concerns about what they were signaling to their students about themselves and about the true nature of things.

In Chapter 7, I discuss findings from structured interviews with students attending middle and high school in the participating school districts. I compared students’ reported beliefs about evolution and creation with the understandings they were able to demonstrate in the interviews. I found that the distribution of beliefs remain basically the same between 8th grade students and high school students who had recently been taught about evolution. At the same time, those high school students who indicated a belief in old earth creationism were least likely to understand what evolution is or how it works compared to their peers. While there was a correlation between correct understandings and acceptance of evolutionary processes, a small group of students identifying as young-earth creationist had levels of understand on par with their evolution-accepting peers. My interpretation of these findings is that students respond to coverage of evolution in ways they believed were consistent with personal, religious commitments. Students with commitments to reject evolution responded to its teaching either by “zoning out” and maintaining a generically creationist identity, or by attempting to master evolution through active, critical study, which tended to result in the development of a young-earth creationist identity.

Finally, I explain in the Conclusion how this approach helps to bring new insights to the controversy over teaching evolution. Foremost, it is necessary to recognize that there are two sides (at least) to the conflict. Our understanding of it, in fact, seems to be largely informed by the framing of a debate between evolutionists and creationists. This debate analogy takes two contradictory forms—as an ideological battle and as a public performance. It is the contention of this dissertation that the public performance aspect of the conflict itself, as it plays out day-to-day, has been under-utilized, and that it delivers important insights into its nature. I discuss how

this understanding fills-in gaps in the epidemiological approach developed by Sperber, while also highlighting a major shortcoming in cognitive anthropology more general. It also helps us to make sense of more recent developments regarding evolution education in the state, such as the Academic Freedom Law passed in 2013. Finally, it suggests directions for future research on the controversy, focused along neglected dimensions—gender and race. I conclude this final chapter and the dissertation with a brief discussion of the appropriate role of anthropology in this thorny issue.

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Appendix A: Summary of Components of Structured Interviews

Summary of interview components (arranged by domain)

1. Belief/ Religion
 - a. Religion Interview
 - b. Belief Survey
 - c. Curriculum Recall
2. Understanding/ Knowledge
 - a. Sorting tasks
 - b. Concept Map
 - c. Scenarios
3. Epistemological Beliefs/ Nature of Science
 - a. NOS interview
 - b. NOS survey
4. Social Situation
 - a. Educational/ living background
 - b. Curriculum Recall
 - c. Social Network

List of interview components (in order asked during interview):

- a. Educational/living background
 - i. School
 - ii. Time in district
- b. School subjects Ranking Task
- c. Nature of Science Interview
 - i. Fact, theory, law distinctions
 - ii. Why science excludes supernatural
 - iii. Whether science is influenced by beliefs of scientists
 - iv. Limits of scientific knowledge
- d. Family Sorting Task
 - i. Taxonomy: (black bear, caribou, coyote, deer, elk, fox, hyena, leopard, lynx, tiger, wolf, pronghorn)
 - ii. Ability to identify species (not for all students)
 - iii. Explanations for similarities
 - iv. Relatedness among species
 - v. Spontaneous comments
- e. Religion Interview
 - i. Denominational affiliation
 - ii. Church attendance
 - iii. Name of church

- iv. Statement of ethos (e.g. What is the most important message of Christianity?)
 - v. Position on scriptural inerrancy
 - vi. Authority Ranking Task (for questions about physical world, including: Bible/religious authority, Scientist, Parents, Science Teacher, Science Textbook)
- f. Kingdom Sorting Task
- i. Taxonomy – (oak, dandelion, chimpanzee, human, tuna, shark, squirrel, brown bat, dolphin, penguin, robin, hawk)
 - ii. Category names/justification
 - iii. Ability to identify genera (not for all students)
 - iv. Relatedness among species
 - v. Spontaneous comments
- g. Concept Map Task
- i. Concepts taught
 - ii. Concepts learned
 - iii. Concepts related to evolutionary theory
 - iv. Conceptual map of evolution
- h. Curriculum Recall
- i. Whether and how much evolution was taught
 - ii. Preference on learning about it
 - iii. What evidence there is for evolution
 - iv. Whether the student believes evidence
 - v. Perceived problems for evolution
 - vi. Perceived misconceptions in others
 - vii. Whether their religion allows them to believe in evolution
 - viii. Whether they feel conflict between faith and evolution
 - ix. Whether common descent makes sense at an “intuitive” level
- i. Scenarios (Thinking Like a Biologist)
- i. Explanation of mechanisms for three examples of species changing over time
 - ii. Multiple choice question among mechanisms to explain how antibiotic resistance emerges
 - iii. Question to clarify relationship between chimps and humans
- j. Social Network
- i. Parental relations
 - ii. Parent ages
 - iii. Parental agreement with student
 - iv. Whether student talks to parents about evolution
 - v. Peer relations
 - vi. Peer agreement with student
 - vii. Whether student talks to peers about evolution
 - viii. Social network data for some schools

- k. Belief Survey (separate from interview)
 - i. Student position on disagreements between creationists and evolutionists
 - ii. Understanding of human evolutionary timescale (for evolutionists)
- l. Nature of Science Survey (separate from interview)
 - Four dimensions: Kuhnian, Popperian, Creationist, and EvolutionistReferences

Appendix B: Catalog of Methods

Semi-structured interviews

Semi-structured interviews are, of course, less formal than structured interviews. I began the interview with a short list of questions to guide the discussion, but follow-up questions were idiosyncratic. I tried to keep the meeting conversational to make the participant feel comfortable. Thus I tried to ask questions when I thought they were appropriate within the context of the discussion. One sub-population I interviewed in this way included associate and youth pastors at churches in each of the field sites. Another sub-population was teachers, bureaucrats and professors involved in state-level education initiatives, like standards development and implementation. Many of these interviews were digitally recorded; all were recorded in field notes during and immediately after their conclusions.

The topic of conversation with teachers and others involved in education differed substantially depending on the position of the person in the processes investigated. The basic content of the interviews with pastors were as follows: what they believe about evolution and its compatibility with Christianity, what they prefer to tell parishioners on the subject, either in sermons or in private, and their position on teaching evolution in schools. Usually these questions involved follow-up questions. For example, pastors who dismissed evolution were asked to explain why they felt this way, the specific problems they saw, and their flexibility on the issue. Though none of these interviews can be analyzed systematically, they provided me with valuable information on related discourses and background on the issues from various perspectives. I was also able to use experiences related to me by some of the pastors to better understand the "Christ-centered worldview," which is essential for comprehending the creation/evolution controversy.

Text and other cultural materials

I consulted a wide variety of textual resources in the course of this project. Particular texts will be described and analyzed in later chapters, particularly textbooks and various drafts of the standards. I collected materials on education, the standards, NCLB, and topics related to evolution and creationism primarily from *The Tennessean*, Nashville's principle newspaper, but also from online news sources. Additionally, I collected relevant programs, pamphlets, flyers and tracts either given to me or made available to the public by churches or organizations like Americans United and NCSE.

Included among textual cultural materials are websites dedicated to one or another position in the evolution/creation debate, to news, or encyclopedic knowledge (wikis). These are notable principally because of their wide availability and consumption. Every creationist with whom I have met has made reference to one of three websites: by ICR, Apologetics Press, or Answers in Genesis. In particular, the Discovery Institute maintains an impressive set of websites, dedicated to carrying out various prongs of the Institute's attacks on methodological and metaphysical naturalism in science. They produce press releases that are picked up by Google and go to email subscribers. All have newsletters and publications. On the side of evolution there is NCSE, UC-Berkeley, talkorigins.org, infidels.org, and Wikipedia.org. One of the most thorough databases of arguments against a young earth is accessible through a site called answersincreation.org, which is run by a collection of old earth creationists, progressive

creationists and theistic evolutionists. A library of arguments, on all sides of the debate, is available to anyone with access to the internet

Cultural materials also come in the form of audio and video content, which are more and more often being produced for educational purposes. One example of this is a set of DVDs, produced by Focus on the Family and a branch of the Discovery Institute, referred to as the Truth Project. The DVD boxset is meant to be viewed as part of a course taught at churches across the country. These videos are important to understanding the epistemology of many creationists as well as the arguments they use to support their beliefs. The three creationist websites mentioned in the last paragraph are each involved in producing videos, available on DVD or streaming, that outline creationist arguments. Equally important is the NOVA evolution series, a series of video programs that explain various aspects of evolutionary theory to a lay audience. The series is occasionally aired on PBS and is available to rent or stream. Other commercial, full-length, documentary style films exist, representing positions from creationists and evolutionists. To this list, I could add audio files and clips from radio programs. In particular, NPR and affiliate stations frequently run stories that take the fact of evolution as a given. By contrast, Christian radio networks throughout the state regularly air interviews and public talks that evince a creationist point-of-view. I reviewed as many such video and audio materials as was possible given constraints in time, giving preferential treatment to those materials likely to have been consumed by substantial numbers of people in Tennessee.

Structured Interviews

I developed an hour long interview which combines tools from educational and cognitive psychology as well as anthropology, to gather information on religious beliefs, understanding of evolution and science, acceptance of evolution and recollection of how it is covered in the science class. I interviewed students, teachers and parents in four school districts. In order to make it easier for the reader to refer back to these descriptions later, I describe each part of the structure interview in a separate sub-section. At the beginning of the interview, respondents, who are not identified on the datasheet or in the audio recordings, are asked to give their grade, school and the amount of time they have lived in the area. Interviewers also asked students about their favorite subject to study in school, as a kind of ice breaker question.

Subject rankings

After the introductory part of the interview, respondents are presented with 5 cards, each with a different school subject: math, science, language arts, history and art. They are asked to put the cards in order of their favorite subject to their least favorite. These rankings are recorded before the respondents are asked to rearrange the cards in the order their parents would give in terms of importance. Finally, they are asked to arrange the subjects according to how the school ranks them, in terms of resources spent covering them.

Nature of Science

Many creationist arguments against evolutionary theory hinge on popular conceptions of the nature of science, a fact that has long been recognized by scholars studying the creation/evolution debate (e.g. Bowler 2007; Fuller 2006; Pennock and Ruse 2008; Ruse 2001; Toumey 1991). For example, the charge that evolution is “only a theory” suggests confusion about the way that scientists use the term theory. Also, many people believe that evolutionary history is out of the proper realm of science because scientists can only study observable

phenomena, usually in a laboratory. Understanding how participants conceive the nature of science is therefore just as relevant as how they conceive of evolutionary theory itself. There are a number of methods available for assessing nature of science views, but most can only measure the degree to which respondents match one particular view of science. Lederman and colleagues, who are critical of likert-style tests, have developed an open-ended instrument called the VNOS-B (Lederman et al. 2002). Because the VNOS-B takes more than 30 minutes to administer, it is impractical for an hour long interview. Instead, the co-investigator is using several of the most relevant questions from that instrument. Responses to this interview will be supplemented by the NOS survey described above.

Sorting Tasks

The co-investigator will document ideas about common descent with modification and speciation by using two card-sort tasks, referred to as the family sort and the kingdom sort. Card-sorts are typically used to provide data on folk-taxonomies and the relative distance between species for a given subject (Lopez et al. 1997; Ross 2004). For the family sort task, I selected items based on well-known species with varying degrees of relatedness. The cards depict closely related mammalian species from 3 well-known families (wolf, coyote and fox from the canids; tiger, leopard and lynx from the felids; and deer, elk and caribou from the cervids), as well as three species classified in the same sub-order with them, but in different families (black bear, spotted hyena and pronghorn, respectively). Two species in each family are closer on current phylogenetic trees than the third species. For example, wolf and coyote are in the same genus: *Canis*, while fox is in genus *Vulpes*. Likewise, tiger and leopard are in genus *Panthera*, whereas lynx is in genus *Lynx*. While not in the same genus, deer and caribou are in the same subfamily (capreolinae), while elk are in a different subfamily. Additionally, sub-order feliformia, which includes the felids and hyena, and sub-order caniformia, which includes the canids and bear, are both part of the order Carnivora. In other words, cladisticians would organize the 12 species into clear categories based on relatedness, that nest nearly symmetrically. Once participants have completed the sort, the interviewer asks the participant whether the closest species (whose cards were never separated) could possibly be related to one another. The question is repeated at each level of the taxonomy until the respondent denies that members of a given group could be related. The task is particularly relevant to this research because the Tennessee science standards explicitly advocate teaching how taxonomies are related to evolution. Using distance data and a participant's willingness to believe species are related, it is possible to characterize the degree to which participants understand common descent.

The phylogenetic relations among white-tailed deer (*Odocoileus virginianus*), caribou (*Rangifer tarandus*) and elk (*Cervus canadensis*) are corroborated by multiple criteria for analysis, including morphology (Groves and Grubb 1987), molecular markers (Gilbert, Ropiquet and Hassanin 2006), vocal calls (Cap et al. 2008). In all the above-cited cladistic analyses of cervids, caribou and white-tailed deer are consistently found to be most closely related. These analyses also place elk on a separate branch, belonging to Old World deer as opposed to the New World branch occupied by white-tailed deer and caribou, though both branches are part of family Cervidae. Pronghorns (*Antilocapra americana*) branch off earlier (Kuznetsova, Kholodova and Danilkin 2005), but are still considered to belong to infraorder Pecora, which also includes giraffes and bovids, although the exact relations among these four families is disputed (cf. Beintema et al. 2003; Gatesy et al. 1999; Matthee et al. 2001). In other words, I would predict that experts in ungulate systematics would sort the items according to the following schema:
Pecora

- A. Antilocaprids
 - 1. Antilocaprinae
 - a. Pronghorn
- B. Cervids
 - 1. Cervinae
 - a. Elk
 - 2. Capreolinae
 - a. White-tailed deer
 - b. Caribou

The corresponding distance matrix would look like this:

	Deer	Caribou	Elk	Pronghorn
Deer	0	1	2	3
Caribou	1	0	2	3
Elk	2	2	0	3
Pronghorn	3	3	3	0

Similarly, the relations among the grey wolf (*Canis lupus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*) and black bear (*Ursus americanus*) have long been established (Delisle and Strobeck 2005). Wolves and coyotes are most closely related, with foxes lying on a nearby branch, and all are part of family Canidae. Black bears belong to family Ursidae. Families Canidae and Ursidae are both part of infraorder Caniformia, one of two basic branches in order carnivora.

The other branch is infraorder Feliformia, which includes Families Felidae and Hyaenidae. Spotted hyenas (*Crocuta crocuta*) belong to Family Hyaenidae, whereas Family Felidae comprises all true cats. The tiger (*Panthera tigris*), leopard (*Panthera pardus*) and Canadian lynx (*Lynx canadensis*) all belong in this family, though the lynx is classified in a separate sub-family, lineage and genus from the tiger and leopard (Johnson and O'Brien 1997).

The basic phylogenetic relations among the species included in the sort have been agreed upon for at least 20 years and are reflected in the most up-to-date cladograms available (Agnarsson, Kuntner and May-Collado 2010). It is thus possible to infer that experts would sort these items according to the following schema:

- Carnivora
 - A. Caniformia
 - 1. Ursids
 - a. Ursus
 - i. Black bear
 - 2. Canids
 - a. Vulpes
 - i. Red fox
 - b. Canis
 - i. Grey wolf
 - ii. Coyote
 - B. Feliformia
 - 1. Hyaenids

- a. Crocuta
 - i. Spotted hyena
- 2. Felids
 - a. Lynx
 - i. Canadian lynx
 - b. Panthera
 - i. Tiger
 - ii. Leopard

The corresponding distance matrix would be as follows:

	Coyote	Wolf	Fox	Bear	Hyena	Lynx	Tiger	Leopard
Coyote	0	1	2	3	4	4	4	4
Wolf	1	0	2	3	4	4	4	4
Fox	2	2	0	3	4	4	4	4
Bear	3	3	3	0	4	4	4	4
Hyena	4	4	4	4	0	3	3	3
Lynx	4	4	4	4	3	0	2	2
Tiger	4	4	4	4	3	2	0	1
Leopard	4	4	4	4	3	2	1	0

It is important to note that the expert taxonomy and corresponding distance matrices should not be considered the "correct" answers to the family sort. Respondents were not asked to reproduce scientific taxonomies while sorting, and were encouraged to use any criteria they felt was most relevant. Furthermore, these scientific classifications are based largely on information not available to students, who were classifying based on the photographs and prior knowledge alone.

The distance matrices constructed from respondent sorts are compared across respondents and with the expert models in order to assess the degree to which similar strategies were being employed. Most important for the purpose of the study was whether respondents used notions of common ancestry for the taxonomies, and the extent to which this was predicted by understanding of evolution and belief in the theory. The reason that expert taxonomies are relevant is that they reflect, in the most accurate way available, the actual relatedness of the species. In this way it is possible to determine, when respondents do use relatedness as a sort strategy, to evaluate the intuitiveness of scientific classifications. Since a degree of overlap is inevitable, it is most interesting to see the point at which relatedness ceases to be intuitive. The species were chosen to give the most fine-grained data possible. Thus most respondents will intuit that coyotes and wolves are related, but what about foxes? And if foxes are related, what about bears? What about all carnivores? All mammals? The last part of the family sort explicitly asks respondents to judge whether species in each category could be related, moving up through the taxonomy until relatedness was denied. Finally, which characteristics (size, color, shape, diet, etc.) are used most reliably to judge relatedness?

The second sorting task, the kingdom sort, includes species from both plant and animal kingdoms. In the animal kingdom, four classes are represented, all vertebrates. There is one

osteichthyes, one condrichthyes, three aves, and five mammals. Three of the species may be classified by laypersons differently than by scientists. The dolphin is classified as a mammal by scientists, but may be considered to be a fish because of its appearance and aquatic habitat. Likewise, penguins are technically birds, but may be confused with mammals or fish because they do not fly. Bats are mammals, but many people may classify them with birds since they fly. In each case, a respondent must make a choice between superficial and internal characteristics in their classification.

The chimpanzee and human are also included as items in the kingdom sort. There are several reasons for their inclusion. First, it makes it possible to ask whether humans are considered by the respondent to be animals, or whether they belong to a separate kingdom entirely. Including chimpanzees, which are more similar to humans than any other animal, makes it more likely humans will be classified as animals and thereby compared with other items. Second, seeing the two items encouraged respondents to comment on the idea that humans and chimpanzees are related. It is notable that, at this point in the interview, the interviewer has made no mention of evolution, and students were not usually aware that the interview concerned the topic. It is thus a measure of the salience of the topic whether the respondent makes a comment about it. Third, whether respondents put the human and chimpanzee together and at what level they do so become data points to use for comparison across respondents and with responses to other parts of the interview, and could serve as a predictor of belief in evolution.

Religion

Religion is clearly relevant to evolution education, and yet it poses multiple challenges to study in this context. First, administrators of public schools are often sensitive to talking about religion openly, as it exposes the school district to legal challenges. I had to tread carefully on which questions to ask since the interview had to be approved by administrators before research could begin. Second, I was concerned about either offending students or making them nervous with personal questions about religion. The solution to these first two problems was to preface this section of the interview with a warning about the nature of the questions and a reminder that the student was not required to answer them. Of more than 300 interviews, only 3 students declined to answer questions on religion. The third problem was more methodological: of those questions suitable to ask, which would give responses useful for study? I chose 5 questions, all open-ended. The first elicited self-identifications of the respondent's religion. The second asked about formal affiliation with a church or other place of worship. The third asked about frequency of attendance at the above-mentioned place of worship. The fourth question prompted respondents to give the "most important message" of their religion. The intention was to get a flavor of the respondent's religious ethos. The final question was specifically about religious scripture and whether it should be considered to be inerrant, that is, 100% historically accurate. Interviewers were instructed to react neutrally to student responses, so as not to create any sense of approval or disapproval.

Authority rankings

As an added corollary to the religion part of the interview, respondents were asked to rank different "authorities of knowledge" : parent, teacher, textbook, pastor and scientist. They were prompted to imagine having a question about the physical world, and that it was very important to get the most accurate answer possible. They then put cards with each of the above authorities into order from most reliable to least reliable. In this way, I obtained data on the

relative trust given each of these authorities. They were also asked to predict how their parents would rank the authorities and finally how their science teacher would rank them. In this way, it is possible to estimate the students' perceptions of others in their environment.

These rankings can be analyzed in several ways. First, the student's rankings could be compared with those of parents and teachers in order to determine whose they more closely reflect. Students' perspectives of teacher rankings could be compared along with the teachers' actual rankings. The ranks themselves could be used as proxies for other relevant information. For example, the relative rank given to science teachers as authority could be interpreted as a score of trust in the teacher, which could then be correlated with how the teacher approaches the topic of evolution and on how similar the teacher's beliefs are with the student's. Finally, rankings could be compared across respondents using a cultural consensus analysis to find agreement among various sub-populations, in order to establish whether evangelical students, or other groups, have a particular model reflecting the reliability of different authorities.

Concept map

The first interview for exploring knowledge structures, called concept mapping, was developed originally in 1972 by J. D. Novak and his colleagues at Cornell in order to assess the effect of science instruction on children's concepts (Novak and Cañas 2006). Because it has been used for decades in science education research, a wealth of literature is available that develops, assesses and validates the method (cf. Dietrich and Steiner 2005; McClure, Sonak and Suen 1999; Ruiz-Primo and Shavelson 1996; Stoddart et al. 2000). It is most ideal for measuring conceptual change in individuals over time, as during the course of instruction. Conceptual mapping involves having participants visually represent the connections among concepts on a diagram, either by drawing or manipulating a set of cards labeled to represent various related concepts. This task is relatively open-ended, helping to ensure that the investigator's preconceptions can have only a minimal impact on the results. It also allows participants to indicate relations among concepts that can be non-linear (Novak 1990). Since these maps are elicited in a way to include as many aspects as possible, analysis can note the presence or absence of particular concepts and the degree of development of various components. Measures of complexity can also be scored according to the number of links in the map and number of related concepts named. An advantage of this method is that, while it is similar to methods that ask participants to define a concept, it oversteps methodological difficulties inherent in such a purely linguistic task, standardizing the means of relating the relevant concepts. The principle disadvantage is that, in most versions of the task, participants require substantial instruction before being able to produce these maps, though they have been used successfully for assessing teachers' knowledge structure of evolution, administered by mail with short instructions and an example (e.g. Rutledge and Mitchell 2002). The co-investigator will employ a modified version of the concept map, based on a freelist of concepts related to evolution, with follow-up questions for each concept mentioned.

The protocol for this modified task is as follows: First, participants are read a list of terms, and asked whether each was covered during science class. The terms are: genetic mutation, survival of the fittest, irreducible complexity, adaptation, natural selection, biodiversity, taxonomy, fossils and evolution. Most of the terms were selected because they are mentioned specifically in the science standards. The term "survival of the fittest" was included despite being absent from the standards because it is frequently associated with evolutionary theory in popular media. The term "irreducible complexity" is actually borrowed from Intelligent Design proponent Michael Behe. The reason for its inclusion is to test whether the

teacher had gone outside of the approved curriculum to introduce ID critiques of evolution. It also served to establish whether students were answering randomly or not paying attention.

After students have answered which of the terms were mentioned in class, the interviewer goes back through the list and, for each of the terms that *were* mentioned, asks the student to explain what the term means or what he/she remembers about it from class. Vague answers were usually followed-up for clarification. Student responses can be definitions, examples or anything that comes to mind. In many cases, a student confirms the term was discussed in class but does not remember what it means. A single line for each response is included in the data sheet, signaling to the student and interviewer that very long, detailed explanations are unnecessary.

Next, the interviewer goes through the list of terms, reading off only those terms the student remembered from class, and asks whether each of the terms is relevant to evolution. If the student believes the concept is relevant to evolution, he or she is asked to explain how it is related. An ideal response includes the term in question and the term 'evolution.'

This version of the traditional concept map has four basic levels of data: which concepts students report hearing (helpful for determining what teachers covered), which concepts the student can adequately explain (approximating the student's conceptual ecology in the biology domain), which concepts are thought to be related to evolution (equivalent to the number of connections on the concept map, and thus proxy for the complexity or richness of the student's understanding), and how many connections were accurately explained (an even more stringent measure of the fullness of the student's overall concept of evolution).

Curriculum recall

One of the unique strengths of this project is that I did not rely only on teachers' self-reported coverage in the classroom. Instead, I asked all students whether evolution was covered, how long it was covered, and whether any alternatives were discussed as well. Students' testimonies are valuable because they have less incentive to cover up any action by the teacher that could be legally questionable since they are in no risk of punitive action and since they may be unaware of rules against introducing religion in the classroom. In the same portion of the interview, students were explicitly invited to share their thoughts on evolution: whether they wanted it to be covered and whether they wanted to study it more. They were also asked to recall evidence in support of the theory as well as any problems they saw in it. The first question was designed to detect whether the teacher was providing evidence in support of the theory. The second question were aimed to detect any of the supposed weaknesses often presented by advocates of Intelligent Design, such as those found on the Discovery Institute's website. If students were consistently reporting such weaknesses, it would suggest that the teacher was introducing them into his curriculum. Finally, in this part of the interview, respondents were asked two questions about religious belief and evolution. First, interviewers asked whether the respondent believed that a member of his or her religion could believe that humans evolved from another species. Second, they asked whether the respondent felt any personal conflict between religious beliefs and evolution. The purpose of asking two separate questions was two-fold. On one hand, it invited respondents to think twice about the compatibility of religion and evolution, so that if either question did not make sense, the other might clarify. On the other hand, the two questions really were different since all members of a religious group do not necessarily believe the same thing.

Scenarios

The Scenarios interview is used to elicit respondents' understandings of mechanisms that drive change in species over time. It has many precedents in the literature (e.g. Anderson, Fisher and Norman 2002; Millán Benítez, Carmona Piña and Zárate 1997; Nehm and Reilly 2007; Nehm and Schonfeld 2007) though the examples I used were adapted mainly from Murray Jensen's evolution test (Jensen and Finley 1995), but also from Bishop and Anderson (1990). It presents participants with real world examples of adaptations and asks them to hypothesize evolutionary explanations that would account for them. One advantage of this method is that it encourages participants to demonstrate the extent of their understanding without being forced to deal with many abstract concepts. It is also coded similarly with tasks that ask participants to give examples of evolution, without the methodological problems of comparing across multiple kinds of examples, or the problem whereby a participant's inability to think of a good example on their own restricts their ability to demonstrate their understanding of evolutionary theory.

Respondents were explicitly asked to disregard their own beliefs about evolution and imagine how an evolutionary biologist would attempt to explain changes. Some students claimed to be unable to do this, citing their very strong anti-evolutionist beliefs, whereas others pleaded ignorance upfront, but most were willing to at least attempt to give an explanation. Interviewers used follow-up questions to force students to be as specific as possible and to reduce ambiguity in mechanisms. For example, a respondent might say that foxes grew thicker coats because the animals needed them to stay warm. The interviewer would then need to clarify several things: how long did this take? Did the need of the animal itself cause the change? And finally, were changes that occurred during an animal's lifetime passed on to offspring?

For the purposes of analysis, responses are coded by the co-investigator and two other persons regarding factors included in the explanation and forces invoked by the respondent. The responses are not transcribed, so the coders were able to listen to the tone of the interviewer and respondent during question and answer. If all coders agreed on a response, that code was accepted. Disagreements prompted discussion. If consensus could not be established, the response was deemed "unclassifiable." Recognized mechanism codes are: darwinian, lamarckian driven by organism, lamarckian driven by environment, hybridization, and other.

Three examples of evolution in action are presented in the interview. Respondents are also asked to select an answer from multiple choices on a fourth example, having to do with antibiotic resistance. Supplementing the card-sort, the interviewer will also ask whether evolutionary theory would predict that chimpanzees could eventually evolve into human beings. Positive answers will indicate a misunderstanding of the evolutionary notion of common descent with speciation.

Social network

The last section on the structured interview elicits social network data from respondents. Earlier in the project, respondents were simply asked to name 7 people that are important to them. For the interviews conducted during the Spring of 2011, the instructions were more restrictive. Each student was asked to give two parent-like figures in his or her life. This could be the actual parents or just someone they thought about as a parent. Then, the student was asked to list five classmates with whom they talk often. This protocol was adopted to ensure the networks would be analyzable, since many students had been giving names of students at other schools or even people not in school. The interviewer also asked how old each person was, how they know each other, and how frequently they interact. At the end of the interview, the student

is asked whether each of the people on his or her list would agree with the student about evolution, and whether the student has ever talked about the subject with the person.

This data can be analyzed in two different ways. First, disconnected from any other network data, as a simple measure of how many of the students are friends with other people that have different beliefs about evolution. The second way would build a network based on data from each participating student. That network would be used in conjunction with data from other data on beliefs about evolution in order to ask several questions. How accurate are students in estimating that an acquaintance would agree with them? Is there asymmetry between creationists and evolutionists in how frequently they engage with students who believe otherwise? Based off a distance matrix produced from the aggregated social network data, is the match between two students' models of science, positions on origins or understandings of evolution predictable?

Surveys

Nature of Science Survey

Two surveys were given along with the structured interviews, though typically afterward. The NOS Survey is an instrument designed to measure the similarity of participants' views of science on two dimensions. Participants agree or disagree with a set of statements corresponding to four different models of science. Along one dimension, a participant may agree more with positivist statements about science or with social-constructivist statements. Along another dimension, she may agree more with statements based on creationist claims or with those based on responses from evolution advocates. This instrument thus is both dynamic and quantitative and can be analyzed with cultural consensus models as described below.

Other NOS surveys measure the degree to which respondents agree with the "correct" view of the nature of science. The results of such surveys are useful for determining whether respondents' models of science match those of mainstream academics in philosophy of science, but they cannot tell us much about the respondents' models of science otherwise. Thus rather than a single dimension, the results of this NOS survey are analyzed as four dimensions: Objectivist, Relativist, Creationist and Evolutionist. I designed this tool in order to document competing models of science. It comprises 24 statements, all of which mention "science" or "scientists." Four views of science are represented by six statements each. Two sets of statements are drawn from two competing models of science. The first set is drawn from more relativistic views of science, while the second is drawn from more objectivist views. These two sets of 6 statements were chosen to maximize distinctions between these two models of science. Thus, each Objectivist statement has a corresponding Relativist statement that seems to directly contradict it and vice versa. The other two sets of statements are based on arguments for and against evolutionary theory, though all references to evolution have been removed.

The six statements based on critiques of evolution are interesting because they make claims about science generalized from arguments against evolution. For example, many critics of evolutionary theory claim that the theory has been thoroughly debunked but that scientists try to hide or ignore the contrary evidence. If a subject believed this to be true of all scientists (not only "evolutionists"), it would seriously impugn the trustworthiness of scientists. The other six statements are based on counter-arguments coming from proponents of evolution. When critics claim that scientists try to hide evidence that disproves an established theory, the defenders of evolution claim that scientists try to share evidence with the public, even when it conflicts with an established theory.

It is important to note that these four models of science are not mutually exclusive. It is also not obvious at the start that those respondents who are most hostile to evolution will agree with "Creationist" statements, as there are no references to evolution in the statements themselves. And this leads to interesting research questions: if a student has been exposed extensively to creationist arguments, does it affect their overall view of science? Or is it compartmentalized and considered only relevant when thinking about or arguing against evolution?

Belief Survey

The second such survey was called the Belief Survey. While the structured interview included questions on religious belief, these questions were open-ended, inviting respondents to go into depth on various aspects of belief or unbelief. These interviews provided a wealth of data for understanding the diversity of beliefs, but has limitations in terms of comparing beliefs on particular points most relevant to the study. The belief survey was thus introduced in order to force respondents to adopt explicit statements and thereby situate themselves on a continuum of positions between young-earth creationism and atheistic evolution. The responses are multiple choice, though participants always had the option of writing in an answer if none provided seemed accurate. The write-in answers usually corresponded with one of the other options, and were thus recorded as such in the database. Those that did not match closely with another option were coded as missing responses. The survey asks how old the earth is, how long humans have existed, where humans originated, and the role of God in how species originate. The last question is open-ended, asking respondents to reflect on how their ancestors may have looked during the time of dinosaurs. This question was intended to quickly identify students who accepted the claims of groups like Answers in Genesis, that humans and dinosaurs coexisted. However, it also elicits intuitive ideas about self-hood related to evolution, since the question specifically asks about the respondent's own ancestors. It is possible, in other words, that a student says elsewhere that he believes humans evolved from other animals, and yet, when asked to imagine back in time, to actually trace his family tree into the ancient past, he cannot picture a point in which his ancestors were anything other than human, even if they were very primitive cavemen.

Using the responses to the survey, I am able to assign respondents to one of many positions including young earth creationism, old earth creationism, theistic evolutionism with human exception, theistic evolutionism including humans, deistic evolutionism, and agnostic or atheistic evolutionism. This allows for much more fine-tuned analysis than any simple creationist/evolutionist dichotomy. This distinguishes the study from others who have investigated the relationship between religious belief and attitude toward and understanding of evolution. Many of these others drew a distinction between students who thought God was involved in any way and those who thought He was not involved, calling the first group creationist and the second evolutionist.

It is important to point out that the categories I used in the final analysis were focused on the role (or non-role) of God in the origin of humans and other life, and not on the existence of God. One particularly confusing label I adopted is "theistic evolutionist." Many evangelical scientists who accept the conclusions of modern science on the reality of evolution call themselves "theistic evolutionists," referring to the fact that they are both theists (believing that God is active in the world) and evolutionists (believing that life arose through the naturalistic process of evolution). I do not wish to dispute their chosen labels, but must note that I am using the term differently. In my categorization schema, *theistic evolutionism* refers to the idea that

God is involved in the process of evolution. I use the term *deistic evolutionism* to refer to the idea that God does not interfere in the process of evolution. According to this schema, the self-described theistic evolutionists mentioned before would be considered deistic evolutionists because they accept naturalistic evolution.

The reason for my decision to use these terms in such unorthodox ways is two-fold. First, as noted, I am primarily concerned with how participants conceive God's role in the origins of humans and other life; God's more general relationship to the world was secondary to that. Besides, all participants in the study who believed in "God" were coming from theist, specifically Christian backgrounds. There was thus no need to make distinctions among the type of God in which people believed. Second, I needed a term to describe the position, voiced frequently by people I met during ethnographic work, that God guides evolution along. If "theistic evolution" is reserved for theists who accept naturalistic evolution, then no other term is available. Though the position would be consistent with that of Intelligent Design (of the explicitly religious variety), it is not a good match. Advocates of ID are principally concerned with claiming that there is scientific evidence that a designer/creator was involved in the origin of life and/or the process of evolution. However, the people with whom I had met seemed entirely unconcerned with questions of evidence (this was much more a concern of creationists), and much more committed to the idea that God is involved, that He is active in creation. Rather than invent a new term, I simply adapted the existing terms.

As noted, the Beliefs Survey has 5 questions. It became apparent during analysis, however, that two of the questions were of limited usefulness in determining a student's beliefs about origins. The second question, in particular, which asked about how long humans have existed, relied too much on students' knowledge and perception of geologic time scales. Because students seemed unaware of the general timeline of human evolution, even those who accepted the premise were all over the place on this question, responding anywhere from 10,000 years to millions of years. The fifth question, which asked students to describe their ancestors at the time of dinosaurs, was also a poor indicator of other beliefs. As a rule, creationist students consistently answered that humans were either the same as we are today or were "cavemen." Students who accepted evolution, however, were inconsistent. A few answered in a way consistent with the claims of modern paleontology—that our ancestors were small and rodent-like. Others assumed they were like apes or monkeys. The rest were indistinguishable from the answers of creationist students. In the end, I determined that both of these questions relied too much on knowledge of evolutionary timelines to be reliable indicators of beliefs about origins.

The remaining three questions (#1,#3,#4) were thus the basis of the coding system for belief categories. The first question, on the age of the earth, was used to distinguish between creationists who accept an old earth (on the order of 3.5 billion years) and those who insist on a young-earth (6-10,000 years). Virtually no respondents who selected the young-earth option on the first question chose non-creationist options on the other two questions. The few who did were deemed unclassifiable based on their survey responses. They either answered carelessly (in which case their other responses are in doubt) or they hold an entirely idiosyncratic position on origins which I never encountered during three years of ethnographic fieldwork nor in the literature on the topic.

Question 3, on the evolution of species, had five possible responses, not including the blank for writing in a response. The first (option A) of the five responses was conceived to indicate the most vehement disavowal of evolution: "Species never change; they are as God created them originally." Option B was conceived to match the position of the young-earth

creationist organization Answers in Genesis: “God created basic kinds of organisms, but they have since changed a little in order to adapt to local environments.” While the intended meaning of this response was that change has been limited to “microevolutionary” adaptations, rather than “macroevolutionary” origins of new species, some students, who otherwise answered consistently with a naturalistic evolutionary account of origins, selected Option B. It is possible that they misinterpreted the response to mean something closer perhaps to what Darwin describes at the end of *Origins*, that the Creator breathed life “into a few forms or into one, and that...from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.” The ambivalence of this response complicates the process of coding somewhat.

The third and fourth responses (Options C and D, respectively) begin identically, “Naturalistic evolution is the means through which God creates life...” The third continues, “...He **guides** the process along the way He wants it to go.” The fourth instead says, “...He made the rules and watches it all unfold **without interfering**.” These two responses were conceived to distinguish between what I call theistic evolution (Option C) and deistic evolution (Option D). The fifth response (Option E), “Life evolved on its own, naturally. There is no way to know how it all started,” was intended as the best option for agnostic and atheistic students. While it would be theoretically possible to base the categorization of belief entirely upon student responses to this question, a more complete picture comes with consideration of the next question, which is specifically about human origins.

The responses to Question #4 on the Beliefs questionnaire were similarly conceived to correspond with various positions between and including creationist and purely naturalistic accounts of human origins. Option A, “God specially created humans from dust or by speaking them into existence,” was meant as the best option for a creationist student. All remaining options include some notion of humans evolving from a non-human animal. While some creationists wrote-in a more specific answer or elaboration (e.g. that woman was created from Adam’s rib), no such answer contradicted this Option. The second option (B) was worded, “God specially created humans by causing them to evolve from apes,” in order to comprise the most palatable possible evolution-based option for students who believe God created them. It was conceived to correspond with the Theistic Evolutionist position on origins.

The next option (C), keeps God in a central role in human origins, but is nevertheless consistent with naturalistic accounts: “God set up the process of evolution to work naturally, and then endowed humans with souls when they eventually evolved from apes.” The response is, in fact, modeled on the position of the Catholic Church, and that of Anglican evolutionary biologist Kenneth Miller, author of *Finding Darwin’s God*. Option D, in contrast, is unambiguously nontheistic: Humans evolved from ape-like ancestors through a natural process of evolution. God took no part in the process.” Despite the obvious differences in the responses on the role of God, both would be considered consistent with naturalistic accounts of evolution. Originally, I had conceived options C and D to distinguish between “deistic evolutionists” and “atheistic evolutionists.” However, because these groups were both so small, I ended up combining them into a “naturalistic evolutionist” category.

One notable point that emerges when one looks at Question 3 and 4 is that participant responses to both are not necessarily identical. As a rule, participants tended to be more willing to accept evolutionary change in non-human life than in human life. Thus a new category of belief was made apparent: theistic evolution with an exception for human creation. Looking at Question 4 alone would suggest an especially low level of acceptance of evolution, while

Question 3 would suggest a relatively high level of acceptance. Moreover, the new category forms a kind of missing link between creationism and evolutionism, bridging what would seem like a chasm between zero evolution and total evolution.

For reference, my coding scheme on the Beliefs Survey is outlined in the Table below:

Category	Question 1	Question 3	Question 4
Young-earth creationist	A	A or B	A
Old-earth creationist	B	A or B	A
Theistic evolutionist with human creation	B	C or D	A
Theistic evolutionist	B	B, C, D or E	B or C
Naturalistic evolutionist	B	D or E	C or D

Several things should be noted about the coding schema. First, because Option B in Question 3 was interpreted somewhat ambiguously, it was accepted as a theistic evolutionist response when in conjunction with a response to Question 4 that signaled openness to macroevolutionary change (i.e. humans evolving). Nevertheless, answering Option D on question 4 was deemed inconsistent with even a liberal interpretation of Option B on question 3, so students with such combinations of responses were considered “unclassifiable.” While a theistic evolutionist making an exception for humans could have misinterpreted Option B on question 3, this would make their responses indistinguishable from an Old-earth creationist. Second, a response of Option D or E on Question 3 would be considered consistent with Theistic evolutionism in conjunction with Option B on Question 4, since the latter suggests that God does get involved in evolution occasionally, making the model of origins not strictly naturalistic. However, Option C on Question 4 would only result in categorization of Theistic evolutionist in conjunction with Option B or C on Question 3. If the participant answers D or E on Question 3, then a response of C on Question 4 would signal inclusion in the naturalistic evolutionist category since no responses include the idea that God disrupts or supplements the natural process of evolution.

Students with responses that did not correspond to those allowable in the table were deemed “unclassifiable” and excluded from analyses involving belief. Critically, very few student participants gave responses inconsistent with one of the categories. This is especially noteworthy given that the majority of response combinations (22 out of 40) would not have been classifiable. This suggests that students were not answering randomly (since statistically half of all randomly generated responses would have been unclassifiable). It also substantiates the categories of belief. If participants were holding to a different model of origins they would have appeared as unclassifiables.