THE ROLE AND CHARACTERIZATION OF EPISTEMIC AUTHORITIES IN THE CONSTRUCTION OF UNDERGRADUATE STUDENTS' POSITIONS ON EVOLUTION AND GLOBAL WARMING

by

SAMUEL ROBERT O'DELL, JR.

(Under the Direction of Norman Thomson)

ABSTRACT

An epistemic authority is a source of information that exerts an influence on the formation and acquisition of knowledge in the knower. The epistemic authorities used by undergraduates to construct views about two controversial science topics, evolution and global warming, were investigated at a large Southeastern public university. Four hundred and forty six questionnaires were dispersed and analyzed. Three basic positions were elucidated for evolution and for global warming after inductive thematic analysis of twenty questionnaires, comprising nine evolution/global warming positions on a three by three grid. Fourteen participants, representing all nine positions, consented to in-depth interviews about their epistemic authorities. A wide variety in both the role and characterizations of these epistemic authorities was found. Participants used a wide variety of religious, scientific, and nonspecific authorities to construct their evolution views, while they used a wide variety of media, scientific, and nonspecific authorities to construct their global warming views. Different participants used both general and

specific authorities to construct their positions. Participants were also rated as possessing scientific knowledge or belief using a theoretical lens constructed for this purpose.

INDEX WORDS: Epistemic authorities, Views, Evolution, Global warming, Global climate change, Undergraduates, Inductive thematic analysis

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by

SAMUEL ROBERT O'DELL, JR.

A.S., Walters State Community College, 1987

B.S., East Tennessee State University, 1990

M.S., Middle Tennessee State University, 1998

A dissertation submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of the Requirements for the Degree

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SAMUEL ROBERT O'DELL, JR.

Major Professor:	Norman Thomson
Committee:	David Jackson Steve Oliver Wyatt Anderson

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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DEDICATION

My dissertation is dedicated to my grandfather, Dr. Daniel Herman O'Dell, and my father, Dr. Samuel Robert O'Dell, who followed their dreams of getting their doctoral degrees, and to their wives, my grandmother, Sara Lois Morton O'Dell, and my mother, Nancy Jane King O'Dell, who made those dreams – and this one – possible.

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did entering Mama and Daddy's home, and it continues to be a cherished gift. Bill, "brother-in-law" is more like brother in fact. If I could ever get you to admit that Florida and Georgia Tech are unmitigated evil, you'd be the perfect relative. To Tyler, Will, and Mia: I hope that your Uncle Sam can always make you as proud of him as he has always been of you.

Finally, my parents deserve the most special notice of all. Daddy, you taught me by example, words, and action, everything that a man and a teacher should ever be. No one has ever been a better father or family man, and even though I will probably always fall short of you, all that I ever have to do to be the man I should be is to emulate you. I wish I could have shown you these words in person, but I hope you hear them now. There will never be a day when I don't miss you terribly. I'm so glad that you took the time to tell me the things you felt about you and me. Of all the gifts you ever gave me, that was by far the best, because I can replay those memories any time I wish. There are things I should have done better when you were here, and there are ways in which I wish I'd been a better son. But at least I know that you looked past the shortcomings, and you left me no doubts as to your love and affection for me. I'm so glad that I didn't leave you any doubts about my love and affection for you, and the fierce pride I take in having had you for a father. I said at your memorial service that I would carry you in my heart, and I still do. I love you. Mama, how do I tell you what you mean to me without writing another 300 pages? You have always been the best and kindest of mothers. No matter what the circumstance, I have always had the security of your love, affection, pride, and friendship. You are a wonderful person in too many ways to count, and I cannot even begin to describe all the different ways that you have helped me to get through this. If

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CHAPTER 1

INTRODUCTION

An epistemic authority is a source of information that exerts an influence on the formation and acquisition of knowledge in the knower (Raviv, Bar-Tal, Raviv, & Abin, 1993). Individuals subscribing to an epistemic authority have a high level of confidence in the validity of information provided by the authority (Raviv et al, 1993). They accept this information as truth, incorporate it into their existing conceptual frameworks, and consider it reliable (Raviv et al, 1993). Once this acceptance has taken place, individuals may stop seeking alternative sources of information; therefore, epistemic authorities serve as legitimate social evidence for individuals (Raviv et al, 1993). Further, even though individuals may have both a high degree of accuracy in their search for information and ample cognitive resources, the statements of a perceived high-authority source may completely halt this search as the epistemic authority is considered to be beyond reasonable doubt (Kruglanski, Raviv, Bar-Tal, Raviv, Sharvit, Ellis, Bar, Pierro, & Mannetti, 2005).

Choice of an epistemic authority is dependent upon an individual's subjective judgement of that source (Raviv et al, 1993). Sources become established as authorities dependent on the extent to which individuals believe that they possess a characteristic or characteristics turning her/him/it into an authority (Raviv et al, 1993). These characteristics can be general ones, including but not limited to: social role (e.g., professor, priest), being found in print, and being broadcast in media; e.g., radio, TV,

Internet (Raviv et al, 1993). Characteristics can also be specific ones; for example, a particular news program, a particular televangelist, a particular journal, etc. (Raviv et al, 1993). Depending on the individual, virtually any characteristic may establish a source as an epistemic authority, and virtually any source may be endowed by the individual's judgment with an authority-establishing characteristic (Raviv et al, 1993).

The import of the last statement is of special note: because of this flexibility, individuals and groups differ with respect to epistemic authorities (Raviv et al, 1993). Characteristics of individuals and groups including but not limited to: motivational needs, beliefs about credibility, and sociocultural convictions about reliable sources, may influence the selection of epistemic authorities (Raviv et al, 1993). As a result, multiple individuals or groups may select the same epistemic authority, but for different reasons (Raviv et al, 1993). Different epistemic authorities may be chosen by different individuals and groups for the same reasons (Raviv et al, 1993).

Additionally, epistemic authorities may be generalized; e.g., the authority is considered reliable with reference to a broad spectrum of topics (Raviv et al, 1993). Examples might include an ideological leader or religious text that serves as a source of valid and truthful knowledge in many different areas of life. In children, parents fulfill this role (Raviv, Bar-Tal, Raviv, & Houminer, 1991). Epistemic authorities may also be chosen from a variety of sources by individuals seeking information in a specific area (Bar-Tal, Raviv, Raviv, & Brosh, 1991); authorities may be domain-specific; e.g., considered reliable only with reference to a particular topic (Raviv et al, 1993).

Problem statement

Evolution and anthropogenic global warming are two scientific topics that have been the source of much controversy generated by political and religious conservatives (Mooney 2005). Although a near-universal consensus exists among biologists affirming the legitimacy of evolution as a unifying theme in biology, and a similar consensus exists among atmospheric scientists affirming the legitimacy of anthropogenic global warming, the "controversies" continue to draw both media and political attention (Mooney 2005). However, in science education literature, only one of the two controversies has been extensively investigated.

A literature search of the science education journals *Science Education*, *Journal of Research in Science Teaching*, *School Science and Mathematics*, *International Journal of Science Education*, *Science and Education*, *American Biology Teacher*, *Journal of Biological Education*, and *Evolution: Education and Outreach* from 1980 to present yielded 223 research articles concerning evolution. In the reading of these articles, many attributed participants' negative views of evolution to religion, but none of them attempted to elaborate on these views beyond various definitions and explanations of creationism or fundamentalism. More importantly, none attempted to place all of the participants' (not just the creationists) views into an explanatory framework.

A similar search of science education journals back to 1980 involving the terms "global warming," "climate change," and "the greenhouse effect" in that order yielded only twelve research articles concerning these topics. Given the intense media scrutiny of the global warming/climate change controversy, students' views of this controversy and/or the concepts underlying it are underrepresented in the science education literature.

Although some of these articles explored the views and misconceptions that participants held about global warming and climate change, none attempted to explore how the participants came to hold these views.

Investigations of the role of epistemic authorities in the formation of students' views are also lacking in the science education literature; the author could find no such studies at all. Investigation of epistemic authorities can provide a framework for students' and teachers' views, both for and against the concepts of evolution and anthropogenic global warming; therefore, the following research questions were posed.

Research questions

I. What sources of epistemic authority do undergraduate students consider accurate in informing their knowledge and/or beliefs with regard to current science-related controversies such as evolution and global warming?
    i. What characteristics of these sources, both generalized and domain-specific, inform students' perception of them as an epistemic authority?
    ii. How well do the students' sources align with the appropriate epistemic authorities?
    iii. How do their epistemic authorities establish the students' views as beliefs or, alternatively, scientific knowledge about evolution and global warming?

II. What epistemic commonalities exist in undergraduate students' knowledge and/or beliefs with regard to current science-related controversies such as evolution and global warming?

CHAPTER 2

LITERATURE REVIEW

Definition of terms used in research questions

Role

"Role" has been defined as "a function or part performed especially in a particular operation or process" (Merriam-Webster, 2010). In this study, the role of an epistemic authority is the breadth of authority assigned by participants. According to Raviv et al. (1993),

> There are individuals who believe, for example that people who assume certain roles, such as priests or teachers, are by the nature and definition of their roles, epistemic authorities. There are others who rely on particular individuals whose knowledge they trust. An epistemic authority such as a rabbi may be perceived as having valid knowledge in all, or most, domains [of knowledge], or he/she may be considered an expert only in a particular domain of knowledge, as would be the case with a biology teacher. (p. 18)

For purposes of this study, an epistemic authority perceived as having valid knowledge in all or most knowledge domains is referred to as a generalized authority, while an epistemic authority perceived as being an expert only in a particular domain of knowledge is referred to as a domain-specific authority.

Characterization

Also according to Raviv et al. (1993), the extent to which individuals believe that a source possesses a characteristic or characteristics establishing her/him/it into an authority, establish that source as an authority. Therefore, for purposes of this study, the

characterization of authorities will be the characteristics of a source specifically considered to establish that source as an authority, either generalized or domain-specific.

Additionally, because of the nature of the controversies considered in this study, religious authorities, scientific authorities, media, and authorities that do not fit neatly into either of these domains will be discussed. These are in themselves characterizations; for purposes of this study, these terms also need to be defined. Therefore, authorities from Christian religion are defined as either the individuals or components essential to practicing Christianity as part of a formalized service or denomination, such as priests, the Bible, extra-biblical religious texts governing worship practices, or authors of such texts (an example of this would be the Presbyterian *Book of Order* or one its authors). Scientific authorities are defined as individuals actively participating in peer-reviewed scientific research, organizations comprised of those individuals, or scientific products of those individuals, such as presentations or publications

One more clarification needs to be made: the author is well-aware that disputes with evolution also arise from Jewish and Islamic fundamentalists (Schimmel, 2004). However, in the course of this study, neither of these religions nor any specific terms associated with them (e.g., Torah, rabbi, mosque, imam, etc.) were encountered. Religion tends to be a very important influence in the lives of its adherents (Hood, Hill, & Williamson, 2005), and it is not unreasonable to assume that the complete absence of references to religions other than Christianity as authorities or information sources is indicative of a lack of influence on this study's participants by any religion other than Christianity.

"Media" needs clarification, as well, and it is highly relevant to this study; according to Corbett & Durfee (2004), the media, especially television, is the primary source of information about global warming in the United States. For purposes of this study, "media" will refer to mass media: television, radio, Internet, newspapers, news magazines, etc.

While religion and media are important considerations with respect to evolution and global warming, respectively, the converse is not necessarily true; religion is not necessarily an important consideration with respect to global warming, and the media is not necessarily an important consideration with respect to evolution. Additionally, there are sources that do not fit neatly into any of the aforementioned domains. Therefore, another general domain besides scientific, religious, or media sources should be established. Therefore, with respect to evolution, nonspecific authorities are defined as authorities that are neither from Christian religious nor scientific authorities. Likewise, with respect to global warming, nonspecific authorities are defined as authorities that are neither from media-based nor scientific authorities.

Perception

In philosophy, "perception" has been referred to as the "awareness or apprehension of things by sight, hearing, touch, smell and taste" (Crane, 2005) or "the process by which we acquire information about the world around us using our five senses" (O'Brien, 2004). O'Brien (2004) posited that perception resulting in recognition requires the possession of concepts:

> Looking out of your window, you see that it is raining. Your perception represents the world as being like *that* [italics in text]. To perceive the world in this way, therefore, it is required that you possess concepts, that is, ways of representing and thinking about the world. In this case, you

> require the concept RAIN. Thus, seeing that *your coffee cup is yellow* [italics in text] and that *the pencil is green* [italics in text] involves the possession of the concepts COFFEE CUP, YELLOW, PENCIL and GREEN. Such perception is termed "perceiving that," and is *factive* [italics in text]; that is, it is presupposed that you perceive the world correctly. To perceive that it is raining, it must be true that it is raining. You can also, though, perceive the world to be a certain way and yet be mistaken. This we can call, "perceiving as," or in the usual case, "seeing as". A stick partly submerged in water may not be bent but, nevertheless, you see it as bent. Your perception represents the stick as being a certain way, although it turns out that you are wrong. Much of your perception, then, is representational: you take the world to be a certain way, sometimes correctly, when you see that the world is thus and so, and sometimes incorrectly, when the world is not how you perceive it to be. [Section 1]

Although it has been argued that a form of perception exists that does not require possession of concepts (O'Brien, 2004), that argument is beyond the scope of this study. Rather, for purposes of this study, perception is defined as input plus recognition; e.g., that an observer observes, and then categorizes that observation using the concepts that s/he possesses. For example, an individual might observe a scientist speaking about evolution, see a list of that scientist's credentials, and categorize that scientist as an expert on evolution. That individual could then perceive the scientist as an authority.

Evolution

Evolution beliefs

A general overview of beliefs in the United States with respect to evolution is necessary in order to place these in the context of the study. The conflict between belief and scientific knowledge with respect to evolution lies in religion (Scott, 2004), and Christianity is the predominant religion in the United States (Scott, 2004). Within Christianity, there are subcategories: conservative ("born-again") and mainstream (Scott, 2004). A higher percentage of the conservative Christians regard the Bible as being

literally true and inerrant than do the mainstream Christians (Scott, 2004). The belief that the creation account in the book of Genesis is more or less truth may be referred to as creationism; beliefs about the truth of Genesis differ and are discussed in more detail later. Creationism has remained quite popular in the United States; for example, 45% of participants in a 1982 Gallup poll agreed with the statement that "God created human beings pretty much in their present form at one time within the last 10,000 years or so." (Scott, 1999). In a more recent Gallup poll in 2006, the following summarizing statement was made: "While many people are not completely sure about the validity of each of the explanations for the origins of life, majorities believe that creationism and evolution are at least probably true, while people are evenly divided about intelligent design. By 58% to 26%, a majority of Americans express their belief in creationism [versus evolution]; by 55% to 34%, a majority also accepts evolution [either as opposed to or in some fashion merged with religious beliefs]. But 32% of Americans tend to reject intelligent design, while 31% say it is probably true." (Moore, 2005). Yet another recent Gallup poll taken in 2007 stated that 31% of Americans believe the Bible is "absolutely accurate" and that "it should be taken literally word for word." 47% feel that the Bible is "the inspired word of God," but not literally so, while 19% believe that "it is a book of ancient fables, legends, and history as recorded by man." (Newport, 2007).

Creation/evolution belief continuum.

A continuum may be constructed reflecting the degree of Biblical literalism in beliefs (Figure 1). A brief synopsis of each of the different categories follows. Flat Earthers are the most strict of literalists; they hold that Earth is flat because the Bible speaks of the "circle" of the Earth, not the "sphere" (Scott, 2004). Geocentrists accept

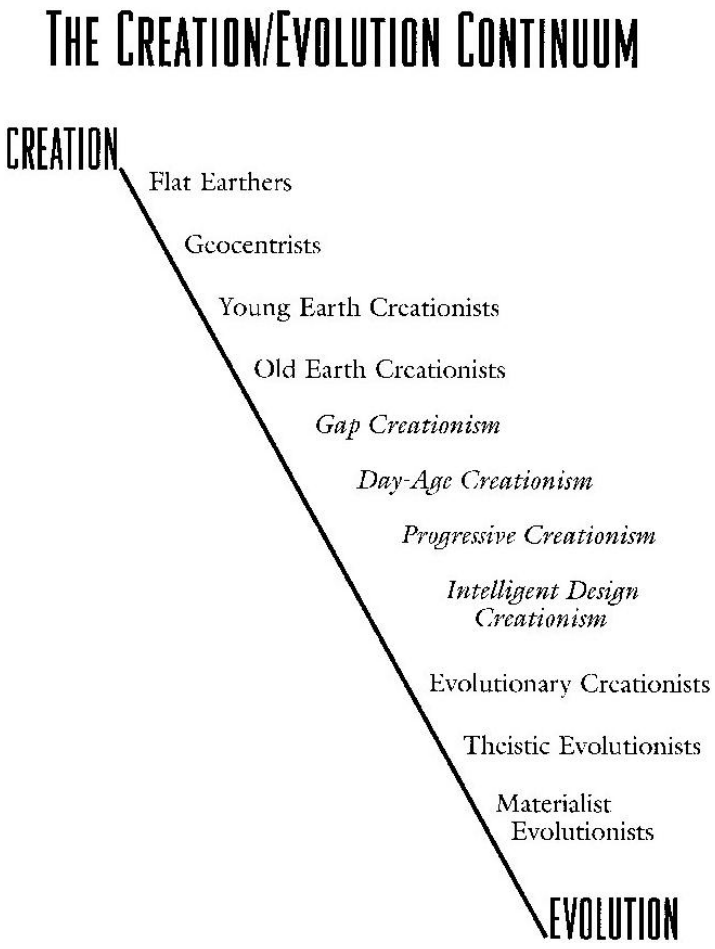

Figure 1. Creation/evolution position continuum. From Scott (2004).

that the Earth is a sphere, but insist that the Earth, not the sun, is the center of the solar system. This belief stems from Biblical verses referring to a "dome of heaven" which the sun, moon, and stars are attached to, which in turn rotate about the Earth (Scott, 2004). Young Earth creationists accept heliocentrism, but reject scientific estimates of the Earth's age, estimating it in the thousands of years due to their belief in a literal creation event and a passage outlining the genealogy of Jesus back to Adam (Scott, 2004). Old Earth creationists have been subdivided; all of them accept the Earth's age as estimated by science, but differ in their reconciliation with the Bible. Gap creationists posit a large time gap between verses 1 and 2 in Genesis, but with two separate creation events; a first

creation that was destroyed, and a second creation that was 6 24-hour days and thousands of years ago (Scott, 2004). Day-age creationists interpret each of the six days in the Biblical creation event as lasting longer periods of time than 24 hours – as long as needed to fit with scientific conceptions of the Earth's age (Scott, 2004). Progressive creationists accept an old earth, with the caveat that every organism in the fossil record was a separate creation event (Scott, 2004). Intelligent design creationists accept the concept of natural selection but deny that it can result in evolution of one kind of organism to another; they hold that an intelligent designer (e.g., God) was responsible for changes in both large body plans and in molecular structure (Scott, 2004). Theistic evolutionists believe that God creates using laws of nature, including evolution; it is the official position held by many mainline Christian denominations, including the Catholic Church (Scott, 2004). Agnostic evolutionists hold that it is impossible to know whether there is or is not a God; therefore, they extend that belief to evolution and hold that evolution may or may not be directed by God (Scott, 2004). Materialist evolutionists are philosophical naturalists; they do not believe that the supernatural exists; therefore, there is place in reality, much less evolution, for God (Scott, 2004). These different points along the continuum may also reflect different levels of acceptance of the epistemic authority of the scientific community.

Review limitations for evolution in science education literature

In the 1980 United States presidential election, Ronald Reagan brought together a coalition of political and religious conservatives, granting an unprecedented level of political power to Christian fundamentalists (Mooney 2005). Reagan already had a record of antievolutionism during his term as governor of California, during which

Reagan's state board of education pushed to weaken the teaching of evolution and endorsed creationism (Mooney 2005). The Reagan presidential administration's obvious sympathies with creationists tacitly shifted the Republican Party's stance to antievolutionism (Mooney 2005). This stance has only grown stronger since then (Mooney 2005) and was especially marked recently by the May 4, 2007 Republican presidential debate, in which three of 10 candidates specifically stated that they did not believe in evolution (Seelye 2007). It is especially interesting to note that none of the other seven candidates were willing to completely dismiss creationism (Seelye 2007). The denial of evolution as a significant phenomenon within one of America's two major political parties, beginning with Reagan's campaign, makes 1980 an appropriate chronological demarcation to begin a literature review on evolution in education.

An examination of the science education journals *Science Education*, *Journal of Research in Science Teaching*, *American Biology Teacher*, *International Journal of Science Education*, *Science and Education*, *School Science and Mathematics*, *Journal of Biological Education*, and *Evolution: Education and Outreach* from 1980 until December 2009 for papers concerning evolution yielded 203 papers. A comprehensive review of all of these papers is beyond the scope of this dissertation; not all of the papers are immediately relevant to this study. In order to determine which papers were immediately relevant, the papers were divided into categories (see Table 1) and subcategories. Here, papers on views and attitudes of college students will be discussed.

Views and attitudes of college students regarding evolution in science education literature

In 1987, Johnson and Peeples investigated the relationship of the understanding of science to the acceptance of evolution by college students, as well as the understanding of science for biology majors in relation to grade level. Using a twenty- statement Likert

Table 1. Categories of Science Education Papers on Evolution.

Category	Subcategory	Subcategory Description	Number of papers
Content and History	Theory and Content	Explanations of evolutionary theory and content	19
	History	Historical events in the study of evolution	7
Curriculum Issues	State Standards	State standards	1
	Textbook Content	Textbook content, both present and past	8
Educational Research	Research Tools	Research tools for study of evolution education	2
	Educational Theory	Educational theory (i.e., conceptual change, etc.) with evolution as context	3
Society, Sociocultural, and Controversy	Conceptions and Understanding	Conceptions about and understanding of evolution in a particular society	5
	Conflict with Religion	Perceived conflict between evolution and religion in a particular society	15
	Impact of Legal Decisions	Impact of legal decisions on the teaching of evolution	9
	Views and Attitudes	Views and attitudes about evolution in a particular society	3
Research into Students	Conceptions and Understanding	Student conceptions about and understanding of evolution	16
	Experiences	Students' perceived impact on themselves by study of evolution	1
	Interventions	Effects of teaching interventions on student views, attitudes, and/or conceptions of evolution	15
	Views and Attitudes	Student views and attitudes about evolution	16
Research into Teachers	Teacher Beliefs	Teacher beliefs about evolution	2
	Conceptions and Understanding	Conceptions about and understanding of evolution in teachers	2
	Teaching Experiences	Experiences in teaching evolution	5
	Teacher Preparation	Teacher preparation specifically devoted to teaching of evolution	4
	Interventions	Effects of interventions on teacher views, attitudes, and/or conceptions of evolution	1
	Views and Attitudes	Teacher views and attitudes about evolution	7
Teaching of Evolution	Activities and Units	Activities and units used in teaching evolution	27
	Resources	Resources and analyses of resources for teaching evolution	3
	Strategies	Suggested teaching strategies for evolution	32

scale questionnaire, they surveyed 1,812 undergraduate students enrolled in biology courses at thirty-four institutions in the West North Central States. 971 participants were biology majors. They found that their participants were "primarily neutral" towards evolution, neither strongly accepting nor denying evolution. The subset of participants that were biology majors were also neutral, although Johnson and Peeples found that "slightly positive responses were obtained for pro-evolution statements" (Johnson and Peeples 1987) and "a statement regarding special creation was scored as neutral" (Johnson and Peeples 1987). This statement in the questionnaire was worded as "Special creation is the means by which God created the earth in its present form." It must be noted that, although Johnson and Peeples rated this statement as neutral, this response received a 3.094/5 (with 5 as "strongly agree") from participants. Additionally, it must be noted that the next statement, "I accept the theory of evolution," received a 3.044/5. Johnson and Peeples did not address this seeming disparity, which may have indicated that the participants did not understand the full implications of the term "special creation."

In 1997, Dagher and BouJaoude investigated how university biology majors in Beirut, Lebanon, accommodated the theory of biological evolution with their existing religious beliefs. Sixty-two undergraduates enrolled in a required senior biology seminar responded to open-ended questions that addressed their understanding of the theory of evolution, their perception of conflict between this theory and religion, and whether the theory of evolution clashed with their own beliefs about the world (Dagher and BouJaoude 1997). Based on their responses, 15 students were selected for an in-depth exploration of their written responses. Four major positions emerged from the

participants: 1) they accepted evolutionary ideas, either justifying them with arguments from an evolutionary perspective or with arguments from a perspective of reconciliation with religion in which evolutionary theory was not diluted or reinterpreted; 2) they did not accept evolutionary ideas, presenting arguments from a religion or antievolution perspective; 3) they reinterpreted the theory presenting arguments from a perspective in which they only applied portions of theory of evolution in an effort to reduce its perceived conflict with religious beliefs (for example, held that all animals except humans had evolved from a common ancestor and humans were specially created); and 4) were neutral, reflecting either a uncommitted or a confused perspective (Dagher and BouJaoude 1997). Different types of objections to the theory were classified along four themes: 1) conceptual difficulties, in which students did not understand the theory; 2) alternative interpretations, in which students attributed phenomena associated with evolutionary theory to God (for example, convergent evolution was attributed to creation to fit a particular ecological niche); 3) nature of science, in which some students espoused an Aristotelian view of science in which a phenomenon must be directly demonstrated to be true; and 4) nature of religion (Dagher and BouJaoude 1997). The researchers also stated that "difficulty in accepting the scientific evidence for the theory as well as students' views of science may be intricately connected to their religious worldviews" (Dagher and BouJaoude 1997).

In 2000, Downie and Barron published the results of a 12-year study that had four major goals: 1) to assess the relative extent of pro- and anti-evolution beliefs in university biology majors and medical students; 2) to investigate the relationship between religious beliefs, and attitudes to evolution and creation in these students; 3) to investigate

students' reasons for either accepting or rejecting evolution; and 4) to compare the levels of students' acceptance of several scientific propositions, including the theory of evolution. The authors' stated intention with the fourth goal was to assess whether the students who rejected evolution displayed a general skepticism towards science, or whether their rejection was specific to evolution (Downie & Barron, 2000). The 3,079 participants were given a questionnaire that divided them into acceptors and rejecters, based on a first question asking whether they accepted or rejected biological evolution. Depending on their answer, participants proceeded to different sections of the questionnaire. The researchers found that the percentage of rejecters among the biology students decreased from a high of 11.3% in the first year of their study to 3.9% in the last year of their study (Downie & Barron, 2000). Contrastingly, 10.2% of medical students, surveyed in the last year of the study, were rejecters (Downie & Barron, 2000). Of the rejecters, 86% of identified themselves as religious, while 57% of acceptors identified themselves as religious (Downie & Barron, 2000). Participants who accepted evolution did so primarily for two major reasons: a mean of 78% of participants cited "I do not think there are any good alternatives to evolution that explain well the origin and distribution of species," while a mean of 36% chose "The evidence for evolution is clear and unambiguous" (Downie & Barron, 2000). During the nine years of the study, 214 participants (an average of 7.8% per year) rejected evolution. They did so primarily for two major reasons: First, an average of 70% of participants who rejected evolution did so because "I accept the literal truth of a religious creation account that excludes evolution" (Downie & Barron, 2000); second, an average of 32% of participants who rejected evolution did so because "The evidence for evolution is full of conflicts and

contradictions" (Downie & Barron, 2000). As for skepticism about science, the results were an indication that rejecters were generally more skeptical and uncertain about scientific knowledge, but these differences with acceptors became much more well-defined with respect to two concepts: tectonic plates and evolution (Downie & Barron, 2000). Rejectors showed a high degree of uncertainty with respect to tectonic plate theory, but a majority regarded the evidence for it as well-established, despite the fact that this theory indicates an extremely old Earth (Downie & Barron, 2000). However, rejecters were very certain that the evidence for evolution was poor (Downie & Barron, 2000). A strong correlation was drawn between religious beliefs and rejection of both evolution and evidence for evolution (Downie & Barron, 2000).

In 2003, Blackwell, Powell, and Dukes stated a "need to develop the initial experience of the teaching of evolution for students in such a way that they can readily identify with and incorporate this information, not only in terms of what they have previously been taught, but with what they already believe or are prepared to believe" (Blackwell *et al*, 2003). In order to develop this experience, the researchers developed a four-part qualitative questionnaire based on differences among dogs and breeds of dogs. A total of 74 freshman seminar students and 51 General Biology students at the University of Alabama were asked to apply questions from the "canine" portion of the questionnaire to principles of evolutionary theory, and the researchers were also interested in seeing the extent of the effect of the responses to this to a fourth "application and significance of evolution" portion of the questionnaire (Blackwell *et al*, 2003). The researchers found that "most students, though cautious, could be interpreted to have at least a degree of openness to the topic of the theory of evolution" (Blackwell *et al*, 2003);

specifically, that "a willingness to at least consider the theory of evolution as having some sort of validity was found in this study to be at the 90% level or greater" (Blackwell *et al*, 2003). Therefore, the researchers concluded that "a measure of acceptance of evolution (or even total acceptance), if not present already, could develop over time in the minds of a substantial majority of students." Although these seem to be exciting results, the researchers did not appear to consider that dog breeds are the result of selective breeding; e.g., artificial selection – and that drawing parallels between this selective breeding and evolution could make their participants more open to the idea of intelligent design, rather than naturalistic evolution.

In 2005, Sadler, in the context of a paper devoted to socioscientific decision-making, investigated whether biology majors and non-science majors varied in the extent to which they employed evolutionary theory in their decisions regarding genetic engineering issues, and how undergraduate student decisions regarding genetic engineering issues were shaped by their perceptions of evolutionary theory. A total of 15 upper division biology majors and 15 upper division non-science majors from a variety of courses at a large public university in the Southeastern United States were recruited as participants. Each participant was interviewed twice between 30 and 60 minutes. None of the non-science majors made comments in the course of their interviews "indicative of an evolutionary perspective" (Sadler, 2005). Contrastingly, eight of the 15 biology majors "displayed reasoning which was influenced by evolutionary theory" (Sadler, 2005). The researchers stated that these results suggested that "individuals' interpretations of evolutionary theory can alter the manner in which they consider personal and social issues" (Sadler, 2005). They also stated that the study revealed that

"perspectives on evolution can also influence socioscientific decision-making, particularly in the context of genetic engineering" (Sadler, 2005). The researchers also found that most of their students thought of evolution in a deterministic manner; e.g., that evolution worked towards progress or towards a goal. They did not consider the influence of religion on this view of evolution.

In 2006, Moore, Froehle, Kiernan, and Greenwald stated that "there has been longstanding support in Minnesota for anti-evolutionism, despite the fact that the state has some of the best (i.e., most scientifically thorough and valid) standards for teaching evolution in the United States." The researchers, among other goals, wished to understand how high school students in Minnesota view the evolution-creationism controversy, and compare those views to those of Minnesota's college students. To accomplish this, the researchers administered a five-point Likert-type scale on views of evolution and creationism to 884 first year students at the University of Minnesota, between fall, 111 students in biology classes at a public school in St. Paul, Minnesota, and 135 students in biology classes at a private school affiliated with the Catholic Church in St. Paul, Minnesota between fall 2002 and spring 2004 (Moore *et al*, 2006). According to the researchers, most students at both high schools rejected claims that "all species were created at the same time, that humans lived with dinosaurs, and that the Earth is only a few thousand years old" (Moore *et al*, 2006). The same students also accepted claims that "some species have become extinct, that the universe is billions of years old, that humans are related to other organisms, that we can know the past even though no humans were there to witness it, that scientists assume that events have natural rather than supernatural causes, and that we can learn about ourselves by studying other

animals" (Moore *et al*, 2006). The researchers found that the first-year college students held views "similar to those of students who are beginning high-school biology" (Moore *et al*, 2006), and cited previous studies demonstrating that biology courses have little effect on many of their beliefs, that "students' beliefs are often extremely resistant to change," (Moore *et al*, 2006) and "teaching students what we want them to know is often ineffective when students already have their own deeply held ideas" (Moore *et al*, 2006). The researchers also found that "evolution-related views of students in religiously-affiliated high schools are not necessarily more scientifically inaccurate than are those of students in public high schools" (Moore *et al* 2006). This is a problematic conclusion to apply to all "religiously-affiliated high schools," as the official position of the Catholic Church is that evolution and religion are not incompatible (Pope John Paul II, 1996), while some Protestant denominations definitively claim that evolution is in conflict with religion (Scott, 2004). The researchers also asserted that students "want biology teachers to include evolution and creationism in their biology classes" and "want to be taught evolution, even if their parents or classmates object" (Moore *et al* 2006).

In 2008, Cavallo and McCall were concerned with "incomplete understandings of potential relationships between students' beliefs in NOS and evolution, and how these beliefs may be related to scientific understandings of evolution" (Cavallo & McCall, 2008) decided to explore interrelationships among students' beliefs about the nature of science (NOS) and evolution, as well as their scientific conceptual understandings of this theory. In order to do this, they examined 81 high school freshmen enrolled in three ninth-grade biology classes in a suburban/rural high school freshman campus in the midwestern United States (Cavallo & McCall, 2008). After administering pretests, a unit

of instruction on evolution using a combination of active inquiry and discussion was taught to attempt to help students gain understanding of the theory of evolution and its supporting evidence; the topics included the history of evolutionary thought, Darwin, evidence of evolution, and how evolution works through natural selection (Cavallo & McCall, 2008). To measure beliefs in evolution, the Measure of Acceptance of the Theory of Evolution Instrument (MATE) was adapted with the addition of two questions and used to measure students' beliefs about evolution. The 22-item questionnaire was based on a 5 point Likert scale and scored with higher scores indicating greater acceptance of evolutionary theory (Cavallo & McCall, 2008). The researchers found that there was no significant change in students acceptance of evolution from pre- to post-instruction, even though there was a concurrent significant positive shift in students' biological understanding (Cavallo & McCall, 2008). They found that student beliefs are "resilient in light of scientifically-based and logical evidence that may contradict such beliefs" but that "students may construct sound understandings of science concepts regardless of whether they believe in the subject matter they are learning" (Cavallo & McCall, 2008). However, the entire project, including the post-test, lasted only four weeks. The persistence of misconceptions is a well-known phenomenon (Posner, Strike, Hewson, & Gertzog, 1982) and the researchers may have missed on a chance to find a correlation between beliefs and long-term persistence of misconceptions about evolution.

In 2008, Deniz, Donnelly, and Yilmaz measured acceptance of evolutionary theory among preservice biology teachers to inform about their likely instructional approach when teaching evolution. From an extensive literature review, nine factors were identified that were potentially related to one's acceptance of evolutionary theory

(Deniz *et al*, 2008). Among these nine factors, understanding of evolution, epistemological beliefs, and thinking dispositions more easily lent themselves to quantitative measurement theory (Deniz *et al*, 2008). Therefore, the purpose of this study was to provide empirical evidence about the nature of the relationship between acceptance of evolutionary theory and understanding of evolution, epistemological beliefs, and thinking dispositions theory, as well as the relationship between acceptance of evolutionary theory and parents' educational level (Deniz *et al*, 2008). A total of 132 Turkish preservice biology teachers enrolled in a biology education program in the School of Education at a university in western Turkey participated in the study. The participants' understanding of theory of evolution was measured using a modified version of an existing 4-point Likert scale. The educational level of participants' parents was scaled using six possible options: elementary -1; middle school - 2; high school - 3; college - 4; masters - 5; and doctorate - 6. The highest educational level achieved by either of the parents was used in the analysis. Participants' acceptance of evolution was assessed by the measure of acceptance of the theory of evolution (MATE). Participants completed an existing 4-point Likert scale on epistemological beliefs. The researchers found a significant correlation between participants' knowledge of evolution and their acceptance of evolution, indicating that "participants who have more knowledge about evolution are more likely to accept the evolutionary theory" (Deniz *et al*, 2008). Thinking dispositions were also significantly correlated with acceptance of evolution, indicating that "participants with cognitive flexibility and openness to belief change are more likely to accept evolutionary theory" (Deniz *et al*, 2008). Finally, a significant correlation between parents' educational level and participants' acceptance of evolution

was found, indicating that "parents' educational sophistication is positively correlated with participants' acceptance of evolutionary theory (Deniz *et al*, 2008). As the correlation between understanding and acceptance of evolution was in conflict with previous results in the literature, the researchers did warn not to "exaggerate the importance of understanding in explaining the variance in acceptance of evolutionary theory" (Deniz *et al*, 2008).

In 2009, Peker, Comert, and Kence stated that "recently, creationism has gained new momentum in Turkey owing to the efforts of some creationist organizations" (Peker *et al*, 2009). Creationists have used vast amounts of funds in a campaign of defamation against Darwinism and its proponents (Peker *et al*, 2009). Therefore, the researchers asked the following research questions: 1) To what extent do Turkish biology, biology education and science education majors accept and understand the evolutionary theory? 2) What is the relationship between students' acceptance and understanding of the evolutionary theory? 3) What are the effects of some socioeconomic and demographic variables (e.g., income level, parents' education level, access to the Internet at home, size of the city where enrolled university is, gender) on students' understanding and acceptance of the evolutionary theory? 4) Are there differences between freshman and senior students with regard to acceptance and understanding of the evolutionary theory?; and 5) Are there differences between students who desire to know more about evolution and those who do not with regard to their acceptance and understanding of the evolutionary theory? To answer these questions, 1,098 freshman and senior undergraduate students enrolled in three different undergraduate programs (biology, biology education, and elementary science education) in 11 public universities of Turkey

were given a three-part survey. The first part consisted of 16 questions concerning demographic and socioeconomic variables, including gender, year at the college, type of high school graduated, parents' level of education, family income level, number of books at home, regular Internet access at home, ownership of a PC, and size of the city where the enrolled university is located. The second part was a Turkish adaptation of the Measure of Acceptance of the Theory of Evolution instrument; three items in the original MATE instrument were taken out in the Turkish version, and four new items were added. To make the MATE Turkish context more relevant, the researchers replaced the two items related to the age of the earth and one related to Bible with items about Adam and Eve, Noah's Ark, and Qur'an. The third and last part of the survey was a 12 question knowledge test that measured students' understanding of evolution theory, selected from an existing evolution test. The researchers indicated that "acceptance of evolution among biology, biology education and science education majors is not any different from previously reported public acceptance rates of evolution" (Peker *et al*, 2009). However, the overall acceptance rate of evolution by participants was considerably lower than that in the United States; this difference was attributed to the "ill-structured high school biology curriculum" (Peker *et al*, 2009) where creationism is being taught along with evolution in high schools as a state policy (Peker *et al*, 2009), and lack of scientific standards in evolution education in most universities in Turkey (Peker *et al*, 2009). The researchers also indicated that acceptance level of evolution of participants was very unlikely to change at college level, but that improving understanding of evolution theory seemed to be easier (Peker *et al*, 2009). Participants' acceptance level of the evolutionary theory remained highly stable across most independent variables; for example, among

seniors, level of acceptance did not differ by the major of study (Peker *et al*, 2009). Additionally, participants' acceptance level did not change significantly by the number of books at home, family income level, ownership of computer, father's education level, type of high school graduated, or size of the city where the enrolled university was located (Peker *et al*, 2009). Only regular Internet access at home, mother's education level, and gender were found to be effective on participants' acceptance level (Peker *et al*, 2009). Acceptance of evolution was higher among females than males. Participants who had more desire to learn about the theory of evolution had better understanding and acceptance level of the evolution theory than those who did not want to learn more about the evolution theory. The researchers concluded that "the radical change in approach towards teaching the theory of evolution in the last three decades resulted in a very low rate of acceptance of the theory of evolution among biology, biology education, and science education majors in Turkey" (Peker *et al*, 2009).

In 2009, Paz-y-Miño C. and Espinosa, citing concerns that little is known about college students' views on evolution, conducted inter-institutional and intra-institutional comparisons at a secular liberal arts private university at a Catholic private university in the Northeastern United States to assess students' views about 1) evolution, creationism, and intelligent design in the science class; 2) students' awareness of intelligent design; students' attitudes toward evolution; 3) students' position about the teaching of human evolution; 4) evolution in science exams; and 5) students' willingness to discuss evolution. Four hundred seventy-six participants at the secular university and 355 participants at the Catholic university responded to a five-question survey to assess their views about these five areas. The results were remarkably similar at both institutions; a

majority of biology majors and just under half of nonmajors supported the exclusive teaching of evolution in the science class, while just under half of nonmajors and about one-third of majors were willing to learn equally about evolution, creationism, and intelligent design. About three-quarters of biology majors and just over half of nonmajors valued the factual explanations evolution provides about the origin of life and its place in the universe. Over three-quarters of the combined participants preferred science courses where evolution is discussed comprehensively and humans are part of it. Just over two-thirds of the combined participants had no problem answering questions concerning evolution in science exams. Almost two-thirds of biology majors and about 40% of nonmajors accepted evolution either openly or privately. This acceptance increased from underclassmen to upperclassmen. One major drawback of this study, however, was that there was no reliability or validity testing of the instrument used in this quantitative survey. Additionally, as with the prior study on religious high schools, the official position of the Catholic Church that evolution and religion are not incompatible (Pope John Paul II, 1996) may have had a positive effect on participants' acceptance of evolution at the religious university.

In 2009, a study by Ladine investigated the attitudes toward evolution of students at a small Christian liberal arts university located in east Texas (East Texas Baptist University, ETBU) and how they would feel most comfortable being approached about evolution in the college science classroom. This was in response to concerns about "a great deal of confusion about evolution" (Ladine, 2009) with possible reasons stated as "misconceptions about evolution, lack of knowledge of the nature of science, or belief that their faith cannot allow them to accept evolution" (Ladine, 2009). Most students at

ETBU are from a Baptist background; such background holds that evolution contradicts the Bible and therefore compromises their faith (Ladine, 2009). To address these questions, three hundred eleven students in general education courses at ETBU used a Likert scale to respond to five questions on the survey that investigated their current understanding of science in general and evolution in particular. Participants showed a "fair understanding that science includes only naturalistic explanations" (Ladine, 2009). However, a "greater number of science courses and maturity level of the student" (Ladine, 2009) resulted in "significant differences in the understanding of science" (Ladine, 2009). There was, however, "a general assertion that God should be included in the definition of science" (Ladine, 2009) by almost two-thirds of participants, indicating a fundamental misunderstanding of the nature of science. Participants responded that they would be most comfortable with being approached in the classroom about evolution through the presentation of the science supporting evolution, and being shown how creationism and intelligent design are not science (Ladine, 2009). Almost one-third of participants responded that the professor should accept creationism and intelligent design as science and teach them as such (Ladine, 2009). There was a weak correlation between the definition of science and the definition of evolution with the approach to teaching evolution, indicating "that an improved understanding of the nature of science should improve the acceptance of evolution" (Ladine, 2009). As with the last study, one potential problem with this study is that there was no reliability or validity testing noted with respect to the survey instrument. Additionally, it would have been interesting to see ETBU compared with a state school in order to see differences between a religious university and a state university in the same region.

All of these studies had one thing in common: not one description of the influence of religion in views of college students went into more detail than general comments about their religious views. None of these studies sought to delve more deeply into the views of the students; e.g., attempt to characterize these religious influences. Additionally, none of these studies tried to find a common framework for describing the views of all students, whether they did or did not accept evolution.

Global Warming

Before proceeding any further, it is necessary to distinguish what is meant by "global warming." Global warming is an increase in global surface temperatures, attributed to the trapping of infrared energy in the atmosphere by an increase in greenhouse gases, such as CO_2 (National Academy of Sciences, 2008). The term "climate change" is becoming preferred usage for describing the results of greenhouse gas accumulation, as that term "helps convey that there are changes in addition to rising temperatures" (National Academy of Sciences, 2008). However, as this emphasis on the term "climate change" is a recent one, "climate change" and "global warming" are used interchangeably in this study.

A March 11, 2010 report by Gallup reported that the public "over the last two years has become less worried about the threat of global warming, less convinced that its effects are already happening, and more likely to believe that scientists themselves are uncertain about its occurrence" (Newport, 2010). A total of 35% say that the effects of global warming either will never happen (19%) or will not happen in their lifetimes (16%); the 19% is more than double the number who held that view in 1997 (Newport, 2010). An April 2010 CBS News/New York Times poll found that 24% of Americans

thought that global warming "won't have a serious impact," up from 19% in March 2009 (PollingReport.com, 2010). The conflict between the scientific conception of global warming and beliefs is not a religious one; rather, it is a political one (McCright, A., & Dunlap, R., 2000). Results from a 2009 Gallup poll state that "Since 1997, Republicans have grown increasingly likely to believe media coverage of global warming is exaggerated, and that trend continues in the 2009 survey; however, this year marks a relatively sharp increase among independents as well. In just the past year, Republican doubters grew from 59% to 66%, and independents from 33% to 44%, while the rate among Democrats remained close to 20%" (Saad, 2009). A September 2009 FoxNews/Opinion Dynamics Poll showed a sharp divide among political parties in response to the question "Do you believe that global warming exists?"; 83% of Democrats and 46% of Republicans responded "yes," while 13% of Democrats and 51% of Republicans responded "no" (PollingReport.com, 2010). Figure 2 displays a continuum of positions with respect to global warming drawn from an analysis of the conservative movement's counterclaims against scientific evidence pointing towards anthropogenic global warming (McCright, A., & Dunlap, R., 2000). The descriptors at either end of the continuum, as well as the specific wording along the continuum, are original. The positions along this continuum may also reflect different levels of acceptance of the epistemic authority of the scientific community (Demeritt, 2001).

Views and attitudes of college students regarding global warming/climate change in science education literature

In 2004, Papadimitriou stated that "research has shown that misconceptions and misunderstandings about many environmental issues, climate change included, are not

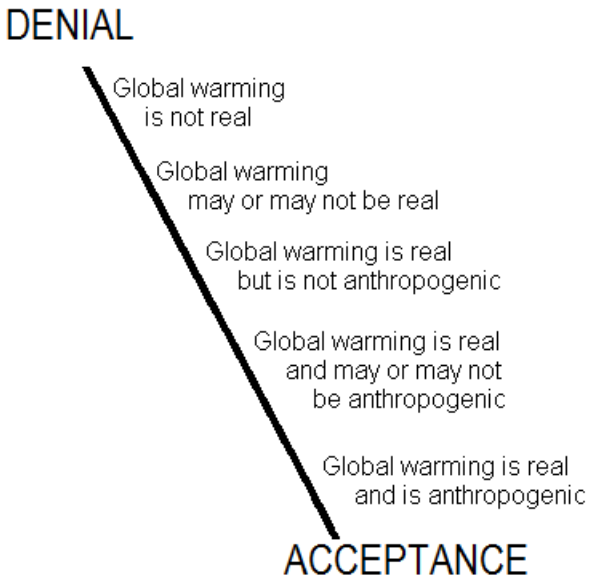

Figure 2. Anthropogenic global warming position continuum.

only held by pupils but by teachers as well." Therefore, 172 Greek first-year preservice elementary teachers were surveyed to discover: a) their beliefs concerning the occurrence of climate change and the evidence they use to justify their beliefs; b) their ideas about causes of climate change; c) Their ideas about actions to be taken to slow down climate change. A five-question open-ended questionnaire was employed, consisting of the following items: a) there has been lately a debate concerning climate change. Do you personally believe that climate change is underway? If you do, please explain how you got to know about it.; b) In your opinion which are the causes of climate change?; c) What do you think can be done for slowing down climate change?; d) Please describe briefly the mechanism through which greenhouse effect takes place by specific reference to the individual compounds that are responsible for it.; e) Please describe briefly the mechanism through which ozone layer depletion takes place by mentioning the individual compounds that are responsible for it. All participants agreed that climate change was underway. However, participants confused weather with climate. They related climate

change to air pollution, to environmental pollution in general, and to acid rain. They also related the climate change to ozone layer depletion. This misconception probably is a consequence of another misconception identified, which concerns the confusion between greenhouse effect and ozone layer depletion. A problematic conclusion of this study was that the students "incorrectly" identified air pollution as an agent of climate change; CO_2 emissions are definitely a major agent of anthropogenic climate change. The researchers did not define precisely what they meant by air pollution, making this point difficult to understand.

In 2003, Spellman, Field, and Sinclair, concerned with a "movement towards more discussion-based science rather than hard-nosed absolute correctness of science" (Spellman, Field, & Sinclair, 2003), attempted to assess the scientific literacy of UK higher education students with respect to the greenhouse effect/global warming and ozone depletion. In order to accomplish this, a total of 400 respondents were sampled from students registering for courses in the Faculty of Applied Science and the Faculty of Arts and Social Science at University College Northampton. The survey was a 3 point Likert scale consisting of 10 statements related to global warming and the greenhouse effect and 10 statements related to ozone depletion, drawn from an earlier American study. The rounded mean total score was 15.2 out of a possible 20, with the modal score 20/20 and the median score 17/20 (Spellman *et al*, 2003). The mean score represented significantly higher achievement than that of the respondents in the earlier American study (12.7/20). Three possible conclusions were drawn from this: 1) the samples were drawn from very different populations in terms of personal characteristics; the earlier study was sampled from students on a general environmental science course at the

University of Wisconsin. According to the researchers, "there are unlikely to be considerable differences in age and gender but differences would exist in prior schooling" (Spellman *et al*, 2003); 2). Since 1995, there may have been a general worldwide improvement in the knowledge of global environmental change; and 3) British higher education students may be more scientifically literate than their American counterparts.

Neither of these studies attempts to discern much beyond the most rudimentary consideration of students' views; what the students think is researched, but how they have come to these views – the "why" – has been given no consideration at all.

Theoretical lens distinguishing knowledge and belief

Reliabilism

The consideration of knowledge in Western philosophy began in Plato's *The Theaetetus*, in which Plato, writing a dialogue between Socrates and Theaetetus, a young mathematician, discussed knowledge (Dyde, 1899). During the dialogue, Socrates and Theaetetus discussed three definitions of knowledge which Theaetetus proposed in order to answer Socrates' question: 1) knowledge is perception; 2) knowledge is true judgment; and 3) knowledge is true judgment with an account (Dyde, 1899), otherwise known as "justified true belief" (Audi, 1998). In the dialogue, Socrates provided arguments against the first two definitions, but did not provide a convincing argument against the third, so *The Theaetetus* ended without giving an official definition of knowledge.

Despite this ambiguity, philosophers have based a line of study, epistemology, on knowledge as justified true belief:

> And since epistemology is the "theory of knowledge," it would seem most naturally to have knowledge as its principal focus. But that is not entirely

> accurate. The theory of knowledge is an attempt to answer the question, "How do you know?", but this is a question about *how* [italics in text] one knows, and not about knowing per se. In asking how a person knows something we are typically asking for her grounds for believing it. We want to know what *justifies* [italics in text] her in holding her belief. Thus epistemology has traditionally focused on epistemic justification more than on knowledge. (Pollock, 1986) [p. 11]

Does this mean that knowledge, if defined as justified true belief, is a subset of belief, rendering any distinction from belief impracticable? As justification is an essential requirement to produce knowledge, and knowledge may be a result of belief with the addition of justification, then knowledge is no longer necessarily a type of belief. An analogy from science may be used to illustrate this. When intense heat and pressure are applied to coal, diamond may be formed. However, despite this, diamond is not considered a form of coal.

Before proceeding with further consideration of knowledge, it is important to discuss how philosophy defines belief. Modern philosophers generally use the term "belief" to refer to the "attitude we have, roughly, whenever we take something to be the case or regard it as true" (Schwitzgebel, 2006). It should be stated for clarification that the term "belief," in the context of philosophy, does not imply uncertainty or extended reflection about the matter in question, as it sometimes does in other contexts such as everyday use. Most contemporary philosophers characterize belief as a "propositional attitude" (Schwitzgebel, 2006). Propositions are generally understood to be "whatever it is that sentences express" (Schwitzgebel, 2006). For example, two sentences that carry the same meaning (e.g., "Thank you" in English and "Kamsamnida" in Korean) express the same proposition. Two sentences that have different meanings express different propositions. Therefore, a propositional attitude – and hence, a belief – is "the mental

state of having some attitude, stance, take, or opinion about a proposition or about the potential state of affairs in which that proposition is true" (Schwitzgebel, 2006).

Much of epistemology revolves around questions about when and how beliefs are justified or qualify as knowledge. The various applications, branches, and philosophical positions regarding epistemology are far too numerous and elaborate to discuss in detail here. With that said, modern epistemology is concerned with how one distinguishes between belief and knowledge (Audi 1998, Dancy, 1985; Pollock, 1986); e.g., what form the epistemic justification takes.

As with epistemology itself, epistemic justification is divided into diverse viewpoints and theories (Audi 1998, Dancy, 1985; Pollock, 1986). One of these theories is of interest when considering science: reliabilism. Reliabilism "attempts to analyze epistemic justification… by appealing to the reliability of cognitive processes" (Pollock, 1986). The basic idea behind what Pollack (1986) calls process reliabilism is that a belief is "justified only if it is produced by a reliable cognitive process." In other words, processes like perception, deduction, or induction would be reliable, while imagination would not. Leplin (2007) gives additional conditions of reliabilism:

A. A belief is epistemically justified if it is reliably produced or sustained and no incompatible belief is epistemically justified.

B. A person is epistemically justified in believing a proposition that he has good reason to believe is epistemically justified. [p.34]

Reference to a source of appropriate epistemic authority might also be considered reliable (Audi, 1998); epistemology can admit that trust plays a role in the origins of someone's knowledge (Hertwig, 1991). Epistemic authority is based on the principle of testimony: If A knows that B knows p, then A knows p (Hertwig, 1991). In fact,

Hertwig (1991) claims that in special cases in science, reference to epistemic authority may be epistemically superior to any belief based completely on direct empirical evidence whenever the relevant evidence becomes too extensive or too complex for any one person to gather it all. In such cases, one can have sufficient evidence only through testimony (Hertwig, 1991).

If Pollack's description of process reliabilism is combined with Leplin's, Audi's, and Hertwig's assertions, reliabilism then carries the following conditions:

A. A belief is epistemically justified if it is reliably produced or sustained by a reliable cognitive process and no incompatible belief or process is epistemically justified.

B. A belief is epistemically justified if it is derived from an epistemic authority that is known to have produced knowledge in a fashion fulfilling condition A.

With reliabilism as a framework for epistemic justification, justifying a claim as knowledge, rather than belief, is dependent on the cognitive processes and authorities presented as evidence.

Scientific community

There are many definitions of community; they are far too numerous and elaborate to discuss in detail here. With that stated, however, the scientific community seems to fit particularly well into the notion of Etienne Wenger's community of practice. According to Wenger (2004), "communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavor." Wenger states that three characteristics are crucial:

> Domain: A community of practice is not merely a club of friends or a network of connections between people. It has an identity defined by a shared domain of interest. Membership therefore implies a commitment to

> the domain, and therefore a shared competence that distinguishes members from other people.
>
> Community: In pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other.
>
> Practice: A community of practice is not merely a community of interest--people who like certain kinds of movies, for instance. Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared practice. [pp. 1-2]

The shared domain in the scientific community is the construction of new scientific knowledge, with the shared competence distinguishing members from other people being academic degrees and contributions to peer-reviewed publications (there are a few exceptions to the degree requirement; a good example is the amateur astronomer, but it should be noted that even the amateur astronomer's discoveries must be reviewed by the professional community in order to gain credence as scientific knowledge). Scientists certainly engage in joint activities and discussions, from informal interactions with other scientists to professional conferences and publications. Scientists also share resources; it is not uncommon, for instance, for one genetics laboratory to obtain a transgenic line from another, and it is certainly common for scientists and laboratories to share research protocols and procedures. Therefore, the scientific community is the community of practice associated with a specific discipline or subdiscipline of science. These communities of practice, then, determine what comprises science and scientific knowledge, and therefore, epistemologically, would serve as arbiters of reliability – functionally serving as arbiters of knowledge and belief within the context of science.

Knowledge and belief in science education

"What does it mean to know? To believe? Where does knowledge end and belief begin? Can one legitimately distinguish between these two constructs? What are the implications of such distinctions? Questions such as these are at the very heart of science education teaching and research." [pp. 325-326] (Southerland, Sinatra, & Matthews, 2001). These epistemological questions are central to controversial issues in science education such as evolution/religion and the status of cultural or "indigenous knowledge" (Southerland *et al*, 2001). According to this 2001 review, a wide variation existed in the use of the constructs "knowledge" and "belief," indicating a general state of confusion and lack of consensus regarding their treatment within science education (Southerland *et al*, 2001).

A subsequent reading of the science education journals *Science Education* and *Journal of Research In Science Teaching* from 2004 to 2007 yielded 25 research papers (Table 2) that used the term "knowledge" in the title and text in such varied fashions as content knowledge, environmental knowledge, everyday knowledge, indigenous knowledge, intuitive knowledge, knowledge structures, pedagogical content knowledge, practical knowledge, prior knowledge of students, scientific knowledge, shared knowledge, and teacher knowledge. None of these 25 papers provided any sort of epistemological distinction of knowledge from belief, and in some cases, the use of the term "knowledge" would not appear to parallel "knowledge" in the philosophical sense; e.g., justified true belief. Further, many of the papers did not specifically define the type of knowledge that they discussed (Table 2); instead, any meaning of knowledge was either implicit in the papers and had to be drawn from context, or was discussed in

varying degrees of detail, but not defined. It should be noted that in some cases, the authors clearly felt that the term was too generalized or detailed to be confined to a specific definition.

A similar search yielded seven research papers (Table 3) that used the term "belief" in title and text in such varied fashion as epistemological beliefs, self-efficacy beliefs, student beliefs and teacher beliefs. None of these seven papers attempted any sort of distinction of belief from knowledge.

There is clearly still no consensus position in science education that differentiates between knowledge and belief. However, the division between scientific knowledge and belief in the context of the science classroom should be readily apparent, given the previous discussions of reliabilism and the scientific community: scientific knowledge is that knowledge originating from processes and people deemed reliable by the scientific community of practice, while sources not deemed reliable by the scientific community of practice constitute belief.

Scientists themselves agree with this view. Wong and Hodson (2009), in a study conducted with 14 "well-established scientists from different parts of the world, working in experimental or theoretical research, in both traditional fields such as astrophysics and rapidly growing research fields such as molecular biology," (Wong & Hodson, 2009) stated that:

> A key aspect of the social dimension of scientific practice concerns the validation and acceptance/rejection procedures for scientific discoveries. Knowledge claims have to be argued according to the "rules of the game" laid down by the community of scientists and have to be expressed in a language and form *determined by the community* [italics for emphasis]; an individual scientist's confidence in the significance of her/his work is insufficient to establish it as part of the body of knowledge; *it must*

Table 2. Knowledge types, authors, and definitions.

Knowledge Type	Author(s)	Definition
Content	Sadler & Fowler, 2006	No specific definition
Environmental	Sirmo, Sirmo, & Stamou, 2007	No specific definition
Everyday	Santos & Bizzo, 2005	a set of "folk" or "lay" ideas, assertions or explanations that make sense in day-by-day life
Indigenous	Riggs, 2005	knowledge that emerges from and resides within precolonial (i.e. indigenous) peoples, to the best extent that that status may be determined, and which is almost always concerned with the balance of humans and human activities within the interwoven functions of the natural environment and natural surroundings
	Chinn, 2008	No specific definition
Intuitive	Sherin, 2006	No specific definition
Knowledge structures	Bischoff, 2005	No specific definition
Pedagogical content	De Jong, Van Driel, & Verloop, 2005	teachers' ''own special form of professional understanding'' … that is, as a form of teachers' (professional) practical knowledge
Practical	Eick & Dias, 2005	the tacit know-how to make quick and appropriate professional decisions in the "heat" of practice
	Jones & Eick, 2007	a set of skills, conceptions, and beliefs that develop within a teacher's own classroom
Prior, of students	Anderson & Nashon, 2007	No specific definition
	Cook, 2006	No specific definition
	Cook, Wiebe, & Carter, 2008	No specific definition
	Otero, 2008	knowledge developed from formal learning situations and self-taught knowledge drawn from students' experiences
	Rivet & Krajcik, 2008	No specific definition
	Gijlers & de Jong, 2005	No specific definition
Scientific	von Aufschnaiter, Erduran, Osborne, & Simon, 2008	No specific definition
	Svarovsky & Shaffer, 2007	No specific definition
	Nahum, Mamlok-Naaman, Hofstein, & Krajcik, 2007	No specific definition
Shared	Munby, Taylor, Chin, & Hutchinson, 2007	No specific definition
Teacher	Lee, Lewis, Adamson, Maerten-Rivera, & Secada, 2008	No specific definition
	Arzi & White, 2008	No specific definition
	Avraamidou & Zembal-Saul, 2005	No specific definition
	Mulholland & Wallace, 2005	No specific definition
Traditional ecological	Van Eijck & Roth, 2007	experience acquired over thousands of years of direct human contact with the environment

Table 4. Belief types, authors, and definitions.

Belief Type	Author(s)	Definition
Epistemological	Kang & Wallace, 2005	beliefs about the nature of knowledge and ways of knowing
Self-efficacy	Zeldin, Britner, & Pajares, 2008 Britner & Pajares, 2006	people's judgments of their capabilities to produce designated levels of performance
Student	Nakhleh, Samarapungavan, & Saglam, 2005	No specific definition
Teacher	Irez, 2006	No specific definition
	Lee, Luykx, Buxton, & Shaver, 2006	No specific definition
	Brown & Melear, 2006	inferences made by an observer about underlying states of expectancy

> *withstand critical scrutiny by the community by whatever means the community decides is appropriate* [italics for emphasis]. (p 20)

Additionally, "there was wide agreement among the scientists that peer review safeguards the quality of publications and underpins the reliability of data and the validity of knowledge claims" (Wong & Hodson, 2009). It is not unreasonable to assume, then, that the further that a source is separated from the peer review process, the less reliable and/or valid the knowledge claim is. Therefore, knowledge claims in written or media sources that have directly undergone peer review would be the most reliable, while other sources would be considered less reliable, based on their relative amount of dependence on or reference to the sources that have directly undergone peer review. Individuals who have participated in the peer review process, whether by contributing literature or refereeing it, would be the most reliable, while other sources would be considered less reliable, based on their relative amount of dependence on or reference to the individuals that have participated in the peer review process. This relates directly to one of the research questions in this study; one of the research questions asks, "How well do the students' sources align with the appropriate epistemic authorities?" The appropriate epistemic authorities have been established, but this question necessitates an explanation of what "aligned" means in the context of this study. For purposes of this study, a participant's justifications for their views were considered more aligned with the appropriate epistemic authority as they approached the actual scientific community of practice; e.g., peer-reviewed research. Table 4 contains a scale of alignment.

Table 4. Rating scale for epistemic authority justification.

Rating	Explanation
Very well-aligned	This rating was given to any participant who specified an epistemic authority that was a part of the actual scientific community of practice. For example, if a participant stated that his or her source for evolution would be a scientist specifically involved in peer-reviewed evolution research, or use knowledge derived from a scientist specifically involved in peer-reviewed evolution research, he or she would receive a rating of very well-aligned.
Well-aligned	This rating was given to any participant who specified an epistemic authority that was related to the actual scientific community of practice. For example, if a participant stated that his or her source for evolution would be a biologist, or use knowledge derived from a biologist, he or she would receive a rating of well-aligned.
Somewhat poorly aligned	This rating was given to any participant who specified an epistemic authority that was scientific, but not necessarily related to the specific community of practice. For example, if a participant stated that his or her source for evolution would be a scientist, or use knowledge derived from a scientist, but did not specify which field, he or she would receive a rating of somewhat poorly aligned. Another example might be a science teacher; although the teacher may have received instruction from a source directly involved in research, unless the teacher is part of the scientific research community, this authority would receive a rating of somewhat poorly aligned.
Poorly aligned	This rating was given to any participant who specified an epistemic authority that was not scientific. For example, if a participant stated that his or her source for evolution would be a religious figure, he or she would receive a rating of poorly aligned. This rating was also given to any participant who could not provide any detail beyond vague generalizations about their sources due to either lack of information or interest in the topic.

CHAPTER 3

METHODOLOGY

In this chapter, descriptions of epistemology and theoretical perspective will be provided, outlining theoretical positions that provide a framework for this study in more detail. Social constructivism, a theoretical framework for education, is briefly discussed. Descriptions of data collection methods, questionnaire development, and data analysis methods, including construction of a theoretical lens for differentiating between knowledge and belief, will also be provided.

Rationale, Role of the Researcher, Epistemology, and Theoretical Perspective

Rationale for the Study

Even if researchers generally disagreed with the proposed categorization of scientific knowledge and belief, this study could be useful in its emphasis on how students' conceptions are constructed and the potential relationship between their particular sources of epistemic authority and their responses to questions about controversial science topics; in a constructivist discipline, how prior knowledge has been constructed should be of interest. Whether the prior knowledge is described as naïve conceptions, misconceptions, or alternative conceptions, a goal of science teaching is to effect conceptual change in students to reflect the view of a particular concept that is held by the scientific community. Therefore, there *is* a "correct" answer, and how a student constructs this answer is an important consideration. This study goes beyond participants' responses, to how they have come to construct these responses.

Role of the Researcher

I am a late entry to science education. My background has been in the natural sciences, with undergraduate and graduate degrees in biology, as well as the completion of all course requirements for the PhD program in genetics at the University of Georgia. Upon discovering through a teaching assistantship both a love for and demonstrated excellence in teaching, I decided to transfer to the science education PhD program. I have a rich heritage of teaching in my family; my father, all of his four siblings and their spouses, his father, his father's three siblings, and their father were all teachers. I have and will be a fourth-generation teacher and will be a third-generation college instructor.

I believe that science education stands at somewhat of a crossroads. In some respects, I think that social activism has become a much more important consideration in some circles of science education than the conceptions of science or the methodology of science as practiced by the scientific community; in fact, I have heard "Western science" and "white male science" used as pejoratives to describe the scientific community. While these pejoratives may very well be interesting social commentary, I believe it is the first duty of science educators to help students gain an understanding of science as practiced by the scientific community. This has been an understood rationale for the inclusion of science in public education since the Committee of Ten elucidated it in 1894 (National Education Association, 1894). I believe that an emphasis on changing the scientific community to match one's personal view of social justice and the desire to include virtually all viewpoints as legitimate science – a philosophy promulgated by Karl Feyerabend (Feyerabend, 1975) and present in the assumptions of some science education researchers (e.g., as in Roth, 2008) – may result in a discipline that is almost

foreign to scientists. I fear that this emphasis increases the possibility that scientists may consider science education research as irrelevant to science. If that possibility becomes reality, I do not think that our society would take science education research seriously and the entire discipline would be marginalized, with loss of both prestige and funding. My background and beliefs are why I have decided to take the strong stance that the scientific community should be the arbiter of scientific conceptions and the epistemic justification supporting those conceptions.

Epistemology

According to Matthews (2002), "Constructivism is undoubtedly a major theoretical influence in contemporary science and mathematics education. Some would say it is *the* [italics in text] major influence." Constructivism, at its most basic, is the idea that learners construct their knowledge, and are not a *tabula rasa* upon which knowledge can be written (Tobin & Tippins, 1993; O'Connor, 1998). Knowledge construction involves the ongoing assembly of an internal mental structure, adding to preexisting pieces that were themselves constructed. This structure is the basis for the learner's adaptation to experience, giving rise to a construction that is either added to or altered. Absent more elaboration, this is what von Glasersfeld would call "trivial constructivism" (von Glasersfeld, 1993).

Social constructivism centers its focus on the study of constructing knowledge through language; e.g., social interactions. There are three basic assumptions of social constructivism (Staver, 1998): 1) As language is the means by which humans communicate, and the coordinated endeavors of at least two individuals are required to attain a meaning understood by each and all, social interdependence is the foundational

influence in attaining meaning in language; 2) the meaning of language is dependent on the context of the social interdependence, as the referents for our language lie in the historical and sociological shared components of our society – and consequently, local agreements about connections between language and referents cannot necessarily be generalized; 3) the function served by language is primarily communal, and it is paramount in continuing relationships among individuals in communities. Staver also outlined three foundations/assertions of social constructivism (Staver, 1998). The first assertion is that knowledge is actively built up from within, both by each individual member of a community and by a community itself, via the interactions between individuals in the community (Staver, 1998). Whether an individual's knowledge becomes acknowledged as common (e.g., general/societal/community) knowledge by his or her community is dependent on the strength of the connection between what the individual knows and what the community has already agreed to consider as knowledge (Staver, 1998). The second assertion is that social interactions between and among individuals in a variety of community, societal, and cultural settings are central to the building of knowledge by individuals, as well as the building of knowledge by communities, societies, and cultures (Staver, 1998). Communication via language is the means of this social interaction (Staver, 1998). The third assertion is that "the character of cognition and a language which is employed to express cognition is functional and adaptive" (Staver, 1998). The fourth assertion is that "the purpose of cognition and language is to bring coherency to an individual's world of experience and a community's knowledge base, respectively" (Staver, 1998). These assertions encompass the theoretical perspective.

Theoretical Perspective

The theoretical perspective of the author is symbolic interactionism. Herbert Blumer (1969) coined the term "symbolic interactionism" and outlined three basic premises of the perspective:

1. Human beings act toward things on the basis of the meanings they ascribe to those things

2. The meaning of such things is derived from, or arises out of, the social interaction that one has with others and the society.

3. These meanings are handled in, and modified through, an interpretive process used by the person in dealing with the things he/she encounters [p. 2]

This is a particularly apt theoretical perspective for the author, as it is applicable throughout this entire study. It is congruent with the theoretical framework of this study and of learning in science education, which is social constructivism, itself entirely dependent on all of Blumer's premises. It directly applies to Woolgar's second tenet of the revised received view of science (Woolgar, 1996):

> It follows that scientific knowledge is determined not by the "actual character of the physical world" but instead by the social relations, beliefs, and value systems that pertain within scientific communities. The apposite slogan in social studies of science is that "what counts as successful scientific knowledge is a social construct". However, note that this is not the same as claiming that scientific knowledge is merely a *social* [italics in text] construct. "Social construct" is here intended in a purely technical sense that connotes no assessment of the veracity or truth of the relevant scientific knowledge. [p. 19]

It also applies to the scientific community; the idea of a community of practice would be nonsensical without meaning, social interaction, and interpretive process. Therefore, symbolic interactionism provides a useful theoretical perspective for this study.

Methods

This research project was a two-tiered study (IRB # 2008-10817-0), preceded by an initial pilot study that used a questionnaire to discern basic views of participants, followed by interviewee selection from categories that emerged from the questionnaire responses.

Study setting

The setting for this study was a large public university in the Southeastern United States. The undergraduate enrollment as of 2009-2010 was 25,204; graduate and professional, 8,456; other, 1,604; total enrollment, 33,660. Students are enrolled in 15 undergraduate, graduate and professional schools and colleges, which offer 22 baccalaureate degrees in 140 major fields; 29 masters degrees in 123 fields; 20 educational specialists degrees; 3 doctoral degrees in 84 areas; and professional degrees in law, pharmacy, public health and veterinary medicine; and 122 study-abroad and exchange programs. Published ethnic demographics are as follows: 86.2% Caucasian, 5.4% Black non-Hispanic, 5.3% Asian or Pacific Islander, 1.0% Non-resident alien, 0.2% American Indian or Alaskan Native (Education-portal.com, 2010).

Questionnaire construction

The questionnaire used in this study is Appendix A (page a). Responses from open-ended questionnaires represent "the most elementary form of qualitative inquiry" (Patton 2002). According to Patton (2002), "The purpose of gathering responses to open-ended questions is to enable the researcher to understand and capture the points of view of other people without predetermining those points of view through prior selection of questionnaire categories. Direct quotations are a basic source of raw data in qualitative

inquiry, revealing respondents' depth of emotion, the ways they have organized their world, their thoughts about what is happening, their experiences, and their basic perceptions." Therefore, a goal of the questionnaire was to elicit an emotional response from students based on their views of evolution and global warming.

According to Caswell (2004), editorial cartoons "are rhetorical devices, persuasive communication analogous to print editorials and op-ed columns that are intended to influence readers" and "trigger responses from outrage to delight." El Refaie (2003) states that, for readers of political cartoons, "visual metaphors must always be studied within their socio-political context" and that these readers are likely to bring "their own experiences and assumptions" to the "process of interpreting visual metaphors" (El Refaie, 2003). For these reasons, political cartoons concerning evolution and global warming were chosen as a means of evoking reactions from participants indicative of their views.

Cartoon analysis.

The specific cartoons were chosen on a subjective basis by the author; the intent was to choose cartoons that would evoke an emotional response but not offend the religious views of the participants. A basic analysis of each cartoon in the questionnaire follows, with the cartoons being presented in the same order as in the questionnaire. An additional cartoon serving as an example of a rejected cartoon will follow these.

Figure 3 shows an antievolution cartoon. An antievolution cartoon was chosen to balance out the pro-evolution cartoons and give a nonbiased appearance to the questionnaire. Students who are antievolution may feel that the presentation of evolution presents a direct challenge to their beliefs (Pennock, 1999); therefore, the intent behind

including at least one antievolution cartoon was to make antievolution participants more comfortable and more willing to participate further in the study.

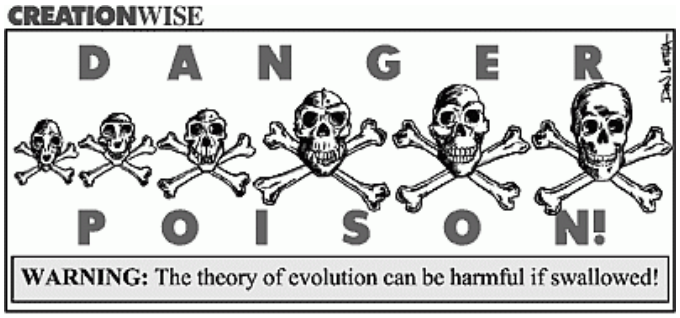

Figure 3. Antievolution cartoon. Retrieved April 14, 2008, from http://www.answersingenesis.org/CreationWise/CW_Pages/CWpoisonEvolution.asp

The central theme in this cartoon is that evolution is equivalent to poison. This theme is carried out in both text and image. The skull and crossbones is an international symbol indicating toxicity (United Nations, 2009). The series of skulls is reminiscent of a progression of hominin skulls from earlier, extinct species to *Homo sapiens*; the skull on the far right represents a modern human skull, while to the left of that skull, there are fair approximations of, respectively, *Homo neanderthalensis*, *Australopithecus boisei*, *Australopithecus afarensis*, and *Sahelanthropus tchadensis*. The skull on the far left does not approximate the appearance of any discovered hominin. This series of skull representations in conjunction with the crossbones most likely intends to conflate some of the most convincing pieces of evidence for hominin evolution – skulls – with poison. Additionally, this cartoon, by presenting hominin evolution in a series, represents evolution as a linear process, a common misconception about evolution (Branch, 2007).

Figure 4 shows a cartoon referencing climate change. The images of Santa Claus, the elves, the reindeer, and the striped pole represent the North Pole. With the elves, Santa, and the reindeer floating on floes, and a heavily emphasized sun in the upper right

Figure 4. Global warming cartoon. Retrieved April 15, 2008, from http://politicalcartoons.com/cartoon/1e45504d-2f2d-4e4c-a238-19715390a8f.html

corner, the clear implication is that there is open water at the North Pole caused by higher temperatures. The elf is telling Santa Claus that "the jury's still out on climate change," while a skeptical expression appears to be on Santa Claus's face. This, most likely, is a rhetorical device intended to criticize the idea that climate change is not occurring, and therefore, the cartoon is most likely a criticism of that position. Because of this criticism, a position that is more commonly associated with the political left (Mooney, 2005), this cartoon was placed in this spot to provide a political balance on the first page with the antievolution cartoon, as an antievolution stance is more commonly associated with the political right (Mooney, 2005). Further, it was felt that the presence of Santa Claus, an "integral part of American Christmas rituals" (Belk, 2004), in a humorous fashion in this cartoon would provoke a response.

Figure 5 shows a cartoon referencing both science and creationism. The first panel, titled "The Scientific Method," has two figures. The figure on the left appears to be a Caucasian male in a laboratory coat; this specific description is the most common representation of scientists in popular culture (Finson, 2002). The image of the figure as scientist is further enhanced by the microscope, skull, blackboard, pens in the pocket

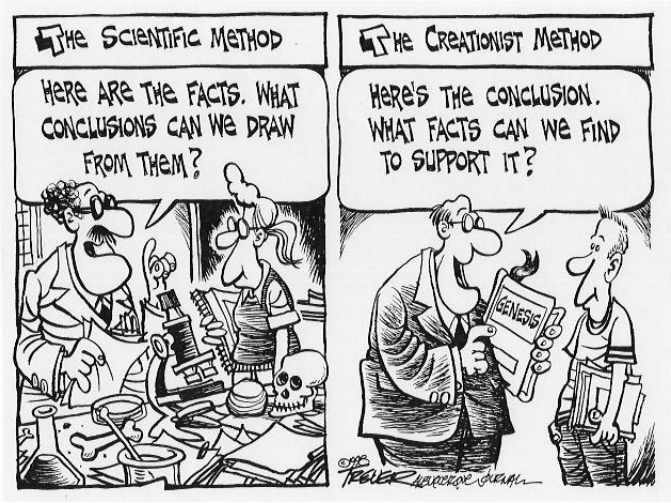

Figure 5. Anti-creationist cartoon. Retrieved April 14, 2008 from http://pharyngula.org/images/the_creationist_method.jpg.

protector, beaker with stir bar, petri dish, and Erlenmeyer flask. Further, there are papers and folders on what appears to be a lab bench. This complexity in surroundings most likely implies a complex viewpoint. The figure on the right, presumably a student, is wearing glasses, an image associated with intelligence (Terry & Krantz, 1993), implying that the two figures are in an intellectual setting, and that the figure on the right is a good student. The right panel, titled "The Creationist Method," also shows two figures. The figure on the left is in a suit, and is holding a copy of Genesis. The absence of a lab coat, in contrast with the figure in the left panel, is most likely an implication that the figure in the right panel is not a scientist, and therefore has no scientific authority or validity. None of the other images associated with scientists appear, furthering this implication. In contrast with the panel on the left, the two figures are shown without a background. This simplicity most likely implies that the figures on the right are also simplistic. The text of both of the speakers is very similar. This similarity is most likely intended to draw the reader's attention to the words "facts" and "conclusions," emphasizing what is most likely a critique of the creationist point of view. Additionally, the implied representation

of the figure on the right as simplistic and nonscientific is most likely intended to devalue the creationist point of view. This cartoon was placed in this order because it contrasted with the antievolution stance of the first evolution cartoon. Additionally, the strongly implied criticism of creationism was intended to elicit a correspondingly strong favorable or negative reaction from participants who held, respectively, an evolutionist or creationist view.

Figure 6 shows a cartoon referencing global warming. There are two figures in this cartoon. The figure at the bottom right is a Caucasian male, sitting in a lounge chair, reading a newspaper. The figure is saying "Global warming… polar ice caps melting… it's all a big hoax." There are a number of possible symbolic references with this figure. First, the figure's gender and race are a demographic most commonly associated with the political right (Mooney, 2005). This most likely implies that the figure is a political conservative, a political position associated with denying the veracity of anthropogenic global warming (Mooney, 2005). Additionally, there is the possibility that the figure is intended to resemble Archie Bunker, a figure in American pop culture that in the context

Figure 6. Global warming cartoon. Retrieved April 15, 2008, from http://www.politicalcartoons.com/cartoon/16315d41-f836-4ca1-90fd-d488016ed982.html

of the show was represented as both emphatically conservative and somewhat ignorant (Berk, 1977). This would most likely imply that the figure has strong views that are either ignorant or inaccurate. The figure is several feet underwater; the implication in the cartoon is that global warming has melted ice caps, leading to elevated sea levels and placing the figure, unaware of his circumstances, in a dangerous position. This most likely implies that this figure is oblivious to obvious occurrences, further undermining his position that global warming and its consequences are a hoax. Additionally, the figure is unprepared for the consequences of his viewpoint. The second figure, on the upper left, is Al Gore, a prominent advocate of the position that global warming is both real and is anthropogenic. Gore is in a rowboat on top of the water. There are a number of possible symbolic references with this figure. First, Gore is in a rowboat, not a motorboat, implying that he is not contributing to global warming. Second, Gore is rowing the boat in short sleeves. This may imply that Gore, carrying out manual labor in casual clothes, is both hardworking and egalitarian, characteristics that carry positive associations in American culture (Lockhart, 2001). Third, Gore is on the top of the water, implying that he was well-prepared for the situation, and the elevated position may imply that Gore's viewpoint was "on top." The symbolic inferences that may drawn from each figure most likely imply that this cartoon is a critique of the position that global warming is not occurring, and further, that advocates of that position are ill-prepared and unintelligent. This strongly implied criticism of the position that global warming is not occurring was intended to elicit a correspondingly strong favorable or negative reaction from participants who, respectively, disagreed or agreed with that position.

Figure 7 shows a cartoon referencing intelligent design. The primary figure in the cartoon is a Caucasian male in a jacket with a bowtie, holding a pointer. This is not a particularly common representation of an educator; however, as the figure is teaching a

Figure 7. Anti-intelligent-design cartoon. Retrieved from www.goalsforamericans.org/gallery/v/cartoons/.

lesson, it is clear that this figure is an instructor. The white coat may or may not be a lab coat, but resembles one, implying that this instructor is a science teacher. The two items represented with the figure, the framed picture and the structure to the right of the figure, are also important. The framed picture has a hand coming out of the clouds, with its index finger touching a pseudopod of an amoeba, the fin of a fish, and the index fingers of a chimpanzee (identifiable as such because of the lack of a tail) and a human. This is clearly a parody of Michaelangelo's *The Creation of Adam*, which depicts God touching Adam's finger in the moment of creation. This parody, in which there are multiple creation events, is particularly applicable to intelligent design, which posits multiple interventions by a "designer" to explain the complexity of biological processes and diversity of life (Scott, 2004). The second item has a frame which would ordinarily hold a globe, but holds a flat square which has latitude, longitude, continents, and oceans, with

a sailing ship sailing off of the edge. The ship assists with the depiction of the square as a flat earth rather than a map. The text of the cartoon refers to intelligent design, and the instructor is moving on to "intelligent geography." The use of the concocted phrase "intelligent geography" is most likely intended to juxtapose intelligent design with the belief that the earth is flat, a belief regarded as a metaphor of extreme ignorance (Nilsen, 1986). It is therefore most likely that this cartoon equates intelligent design with extreme ignorance (whether the ignorance is intentional or unintentional is not immediately clear). This strongly implied criticism of intelligent design was intended to elicit a correspondingly strong favorable or negative reaction from participants who, respectively, disagreed or agreed with intelligent design. This cartoon was also included as an attempt to distinguish between students who favored intelligent design and students who favored a young earth creationist position.

Figure 8 shows a cartoon referencing global warming. There are three dominant images in this cartoon. On the right, a chicken with what appears to be a frantic

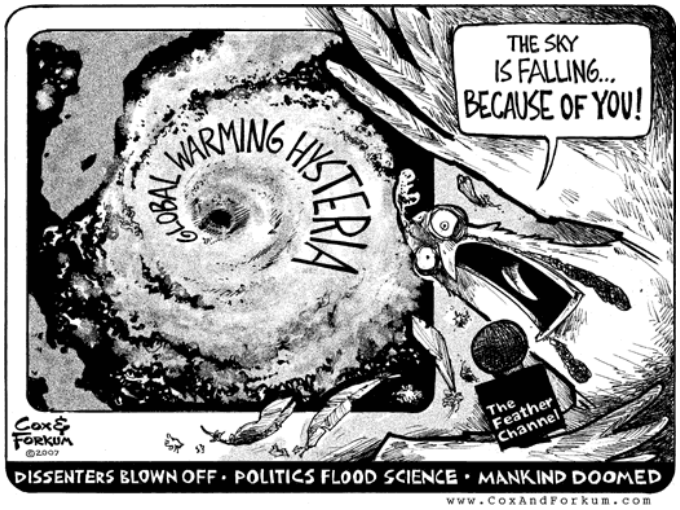

Figure 8. Cartoon debunking anthropogenic global warming. Retrieved April 16, 2008 from http://www.coxandforkum.com/archives/001031.html

expression is screaming, “the sky is falling… because of you!” This is most likely a reference to Chicken Little, a character in a cultural fable, with the phrase “the sky is falling” serving as a common American idiom indicating excessive panic over a mistaken belief that disaster is imminent. The figure is also holding a microphone; this prop, along with the position of the figure beside what appears to be a weather map, most likely implies that the chicken is a weatherman. This implication is furthered with the text on the microphone – “The Feather Channel.” The font of this text very closely mirrors the appearance of the icon for the Weather Channel. The second image appears to be a weather map; the map shows the state of Florida with a massive hurricane approaching the east coast. The words “global warming hysteria” appear on the hurricane, spiraled in such a fashion to indicate that this is a label for the hurricane. This, most likely, is an implication that global warming “hysteria” is the actual disaster, as opposed to the consequences of global warming being a disaster. This implication is reinforced in the third image. The third image is a “news crawl,” similar to that found in cable news channels. It is composed of three segments of text: “dissenters blown off”; “politics flood science”; and “mankind doomed.” The third segment reinforces the “hysteria” theme promulgated by the chicken and the hurricane. “Dissenters blown off” and “politics flood science” most likely are implications that global warming is a phenomenon promoted by a monolithic scientific community with a political agenda, a common claim of the American political right about global warming (Mooney, 2005). This strongly implied criticism of the concept of anthropogenic global warming was intended to elicit a correspondingly strong favorable or negative reaction from participants who, respectively, disagreed or agreed with the concept of anthropogenic

global warming. This cartoon was also included as an attempt to elicit responses from participants who were not particularly prompted to respond to the previous cartoons that held the opposite position with respect to anthropogenic global warming.

Rejected cartoon.

The cartoon in Figure 9 was deemed too offensive to use in the questionnaire for three primary reasons: 1) the depiction of creationism as a wolf; as part of the "wolf in sheep's clothing" motif, potential participants might have read this as an accusation of their faith as a false prophet, as in Matthew 7, 15-16; 2) the depiction of the Religious Right as a monkey, which belittles its proponents by turning one of its primary misconceptions of evolution (e.g., "men came from monkeys") back on it; and 3) the presence of the Bible in the cartoon, which might have equated to blasphemy to some participants. The specificity of the images could have registered as deep enough an insult to potential participants to remove any interest in taking further part in the study.

Figure 9. Rejected anti-creationist cartoon. Retrieved April 15, 2008 from http://www.answersingenesis.org/docs2006/images/cartoonist_carnival.gif

Pilot study

A pilot study was carried out in which questionnaires and consent forms (see appendix B) were given to two laboratory sections of the university's nonmajors biology course. Students were informed that participation was entirely voluntary and that no penalty would be administered for not taking the questionnaire. Students were given directions by the researcher that reinforced the directions at the top of the questionnaire. All participants who filled out a questionnaire were invited to interview. Nine students accepted. At the interview, students read Facebook group titles and descriptions and were asked if they would join the groups in order to distinguish their views on global warming and evolution. This was followed by an unstructured interview intended to establish basic information about their beliefs and the authorities they relied upon to form those beliefs. The results of the pilot study are in the data chapter.

A number of changes were made following this pilot. First, the Facebook group question was eliminated; two of the nine students were not involved with Facebook. This forced an explanation of exactly what Facebook was, which disrupted the flow of the interview. Further, there was an unexpected reaction of the participants to the Facebook group descriptions. After having had success prompting responses with on the questionnaire with provocative cartoons, the assumption was that similarly colorful Facebook group descriptions would also spark lengthy responses. However, what was not anticipated was the importance that Facebook users place on their group selection. Because Facebook is a social networking site, profiles serve to project the user's desired public identity (Ginger, 2008). Therefore, the participants focused on their dislike of the language of the group descriptions. When participants were asked if they would join

those groups, intending to ascertain what they thought of the group description's content, participants responded based on what wished to project of themselves, rather than their actual views of evolution and global warming.

Another problem encountered was the lack of uniformity between interviews because of the unstructured format. Therefore, a list of questions for semi-structured interviewing was constructed, based on the research questions (see appendix C, g-h).

Main study

Questionnaire distribution

Questionnaires and consent forms were given to 19 laboratory sections of a nonmajors biology course, one section of an elementary science methods course, and one fraternity chapter. Students from the nonmajors biology course were chosen because the nonmajors biology course may be taken to satisfy a general life sciences requirement; therefore, these students represented a broad spectrum of majors at the University. Personal experience confirmed this; the primary researcher served as a teaching assistant for this course for three semesters. During the selection process, not all desired categories of students (see Figure 19 for category details) assented to interview. Therefore, one section of an elementary science methods course and one fraternity chapter were asked to participate (selection was convenience sampling). Students were informed that participation was entirely voluntary and that no penalty would be administered for not taking the questionnaire. Students were given directions by the researcher that reinforced the directions at the top of the questionnaire. Of distributed questionnaires, 490 were returned, with 456 consent forms that gave permission to contact the participants for an interview.

Interviewee selection

Interviewee selection occurred in three phases. First, inductive coding (description of coding method follows later in this chapter and more detailed description of results appears in Chapter 4) was carried out on 44 questionnaires from respondents who indicated that they did not wish to be interviewed. Second, major themes with respect to expressed views of evolution and global warming resulting from this analysis were resolved into categories. The results and representation of some data is in the next chapter. These categories were then resolved into a 3x3 grid as an end product of the analysis, which is in the next chapter. Third, deductive analysis was carried out on the rest of the questionnaires using the major themes as codes. The specific method used is a adaptation from a synthesis of two different deductive thematic analysis approaches based on Fereday & Muir-Cochrane (2006) and Dayer, Stinchfield, & Manfredo (2007). There are four steps to this analytic method, which is specific to this project: 1) coding questionnaires; 2) generating evolution and global warming position themes from codes and categories; 3) assigning major themes and/or secondary themes to the 3x3 grid; 4) using each assigned theme as deductive codes for the rest of the questionnaires. Specific examples of the data used for the codes, as well as the codes themselves, will be given in the data analysis section. Students from each position on the grid were invited via email (the text of which is in Appendix E, page j) to schedule an interview via website (the text of which is in Appendix E, page k). Genbook, an online scheduling site, was used to organize interviews and prevent overlapping times. After several rounds of invitations, 14 participants, with at least one representative of each position in the grid, assented to interview.

Interviews

According to Patton (2002), "we interview people to find out from them those things we cannot directly observe." We cannot observe feelings, thoughts, intentions, or how people make meaning of the world around them. The purpose of interviewing is "to allow us to enter into the other person's perspective. Qualitative interviewing begins with the assumption that the perspective of others is meaningful, knowable, and able to be made explicit" (Patton, 2002). This study used the semi-structured interview approach, a term which may be used interchangeably with the general interview guide approach (Coll & Chapman, 2000), in which "topics and issues to be covered are specified in advance, in outline form; interviewer decides sequence and wording of questions in the course of the interview" (Patton, 2002). This makes data collection "somewhat systematic for each respondent" (Patton, 2002), and addresses the weaknesses of the unstructured interview format listed by Patton (2002), which were encountered in the pilot study: "Different information collected from different people with different questions. Less systematic and comprehensive if certain questions do not arise naturally. Data organization and analysis can be quite difficult" (Patton, 2002).

Questionnaire evaluation

As this was the initial use of the questionnaire, each of the participants was asked to indicate an evolution or global warming position on lists drawn from each of the two continua from Chapter 2. The lists are in Appendix D.

Data Analysis

Grounded theory research is qualitative research in which theory is developed, or induced from data, rather than preceding them (Lincoln & Guba, 1985). The theoretical

assumptions for grounded theory are drawn from both Herbert Blumer's symbolic interactionism and from Dewey's pragmatism (Corbin & Strauss, 1990; Charmaz, 2006). Grounded theory, in its assumptions that a) phenomena are dynamic, not static, changing in response to evolving conditions; and b) nondeterminism – that is, that actors (e.g., participants) have the ability to effect control of their destinies in response to these evolving conditions, attempts to elucidate the conditions (e.g., context), the actors' responses to them, and the consequences of these actions (Corbin & Strauss, 1990).

The overarching aim of grounded theory stands in opposition to the primary goal serving as the foundation of scientific or quantitative research. Rather than using data in theory confirmation, grounded theory research seeks to generate theory from the data themselves (Charmaz, 2006). Grounded theory emerged in the 1960s, as the tradition of qualitative research was waning (Charmaz, 2006). Glaser & Strauss generated the initial methodological components of grounded theory in *The Discovery of Grounded Theory* (Glaser & Strauss, 1967), quoted directly from Charmaz (2006):

- Simultaneous involvement in data collection and analysis
- Constructing analytic codes and categories from data, not from preconceived logically deduced hypotheses
- Using the constant comparative method, which involves making comparisons during each stage of the analysis
- Advancing theory development during each step of data collection and analysis
- Memo-writing to elaborate categories, specify their properties, define relationships between categories, and identify gaps
- Sampling aimed toward theory construction, not for population representativeness
- Conducting the literature review *after* [italics in text] developing an independent analysis

If, however, one wishes to conduct analysis and interpretation, but not generate theory, the difference between methods and methodology must first be discussed.

Qualitative research is conducted by undertaking specific activities such as administering and analyzing questionnaires, interviews, focus groups, participant observation, examining a wide array of documents, and so forth (Patton, 2002). These basic activities may be referred to as research methods or techniques; e.g. "well-defined sequences of operations that if carried out proficiently yield predictable results (Mingers, 2001). A methodology, however, is a particular combination of methods which occurs many times in practice (Mingers, 2001).

Therefore, although theory generation is intrinsic to grounded theory, the methods used in grounded theory are separable from its methodology when theory generation is not an objective. Being careful to distinguish grounded theory from the procedures used for coding in grounded theory prevents one from having to "fully subscribe to the theoretical commitments of a 'full-fat' grounded theory, which requires analysis to be directed towards theory development" (Braun & Clarke, 2006). The methods used in grounded theory, then, may be referred to simply as inductive thematic analysis.

Inductive thematic analysis methods.

There are many ways to approach inductive analysis methods (Charmaz, 2006). In the absence of a cut-and-dried, "right" approach, an approach has been chosen because it comes from a paper that is specifically concerned with thematic inductive analysis, as opposed to grounded theory. The inductive analysis method used in this paper is adapted from Braun and Clarke (2006), which called for demarcation and identification of inductive thematic analysis, separating analysis into six phases. The first phase involves the researcher familiarizing him/herself with and immersing him/herself in the collected data. This can involve repeatedly reading data in an active way; e.g., searching for

meanings, patterns, etc. Braun and Clarke (2006) recommend that the researcher read through the entire data set at least once before coding begins, with the idea that patterns can be identified and ideas shaped as one reads though the different data. During this phase, Braun and Clarke (2006) also recommend that data be marked for subsequent analytical phases. If verbal (e.g., audio and video) data are part of the data set, they have to be transcribed in order to undergo thematic analysis (Braun & Clarke, 2006). In this study, a transcriptionist was hired to transcribe the interviews. It must be noted that there are different levels of transcription detail (e.g., codes used to mark inflections and speech patterns), but that thematic analysis does not require the same level of detail as, for instance, discourse analysis (Braun & Clarke, 2006). However, the minimum level of detail in a transcript requires "a rigorous and thorough 'orthographic' transcript – a 'verbatim' account of all verbal (and sometimes nonverbal – e.g., coughs) utterances (Braun & Clarke, 2006). Each transcript was read while listening to a recording of the interview; this served the dual purposes of checking the transcript for accuracy and familiarization with the data.

The second phase involves generating initial codes and begins once the researcher has familiarized him/herself with the data, and has "generated an initial list of ideas about what is in the data and what is interesting about them" (Braun & Clarke, 2006). According to Braun & Clarke (2006), codes "identify a feature of the data (semantic content or latent) that appears interesting to the analyst." Terms such as codes, categories, and themes are used in many different ways in qualitative research literature, many times interchangeably (DeSantis, L., & Ugarriza, D., 2000). This lack of uniform meaning for these terms in the literature necessitates a specific definition of them for

purposes of this study. In this study, a "code" is defined as a subjectively derived distillation of written or transcribed verbal data that can be expressed within a single phrase; "phrase" is used in the sense of a noun phrase; e.g., a noun and all its modifiers and any syntactic element, such as pronouns operating within the capacity of a noun's function as the subject of a verb, or the object of a verb or preposition (Merriam-Webster, 2010). In this study, a category is defined as a subjectively derived commonality between two or more codes that can be expressed within a single phrase. In this study, a theme is defined as a subjectively derived category, or commonality between two or more categories, that specifically addresses a research question and can be expressed within a single phrase. After a set of themes is generated, there is a possibility that some themes considered relevant to research questions have subjectively perceived commonalities that are also relevant to the research questions. Such commonalities, if they can be expressed in a single phrase, are referred to as "superthemes" in the context of this study.

Likewise, after a set of themes is generated, some themes may be considered relevant to research questions, but can be subjectively considered as a) conceptually dependent upon; or b) a subset of other themes. These themes, if they can be expressed in a single phrase, are referred to as "secondary themes" in the context of this study. Some secondary themes may be conceptually dependent upon or a subset of other secondary themes; these themes will be referred to as tertiary themes. Any further iteration will be referred to as a quaternary theme, etc. Examples drawn from the pilot study are in Table 5.

The third phase begins when all data have been initially coded, and a comprehensive list of different codes has been generated across the data set (Braun &

Table 5. Thematic map elements, examples, and explanations.

Map element	Example and explanation
Supertheme	Primacy of personal beliefs [this was placed as a supertheme because the themes reconciliation of evolution and religion, validity of global warming, and epistemic authority with respect to science were all subordinate to the participants' personal beliefs]
Theme	Reconciliation of evolution and religion
Secondary theme	Validity of evolution [this was placed as a secondary theme because to the participants, the validity of evolution was dependent on both participants' merging of evolution and religion]
Tertiary themes	Characteristics of evidence [this was placed as a tertiary theme to the secondary theme "description of science" because the characteristics of evidence were dependent on the participants' description of science.

Clarke, 2006). This phase steps back and, so to speak, distinguishes the forest (as opposed to the trees). This phase was altered in this study; codes were sorted into categories. The categories were then examined as to relevancy to the research questions for potential identification as themes. According to Braun & Clarke (2006), it is essential to "think about the relationship between codes, between themes, and between different levels of themes." This phase ended with a collection of candidate themes and secondary themes. Themes and any associated superthemes or secondary themes were organized into a thematic map. A key to the thematic maps used in this study is in Table 6. The fourth phase involved refinement of themes and their map (Braun & Clarke, 2006). Themes may be eliminated if there are not enough data to support them, if the data within them are too diverse, or if they are too similar to other themes (Braun & Clarke, 2006). Other themes may need to be divided into more than one separate theme (Braun & Clarke, 2006). This phase involved two levels of reviewing and refining themes. The first involved reviewing at the level of the coded data extracts; e.g., reviewing the categorized data for coherent patterns (Braun & Clarke, 2006). The second level was

Table 6. Thematic map elements, graphic representations, and descriptions.

Map element	Graphic representation	Description
Supertheme		A subjectively derived commonality between two or more themes, that specifically addresses a research question and can be expressed within a single phrase. Superthemes will be on the same horizontal level within the map.
Theme		A subjectively derived category, or commonality between two or more categories, that specifically addresses a research question and can be expressed within a single phrase. Themes will be on the same horizontal level within the map and below the superthemes, unless space requirements force otherwise, but will always be above their secondary and tertiary themes.
Secondary theme		A theme that is subjectively considered as a) conceptually dependent upon; or b) a subset of other themes. Secondary themes will be on the same horizontal level within the map and below the themes, unless space requirements force otherwise, but will always be above their tertiary themes.
Tertiary themes		A theme that is subjectively considered as a) conceptually dependent upon; or b) a subset of other secondary themes. Tertiary themes will be on the same horizontal level within the map and below their secondary themes.
Connector		If vertical or diagonal, represents a hierarchical relationship (e.g., a theme contained within a supertheme). If horizontal, represents an interrelationship with another theme/secondary theme/supertheme. Any interrelationships will be labeled by text on the line.

analogous, with themes being examined with respect to the entire data set (Braun & Clarke, 2006). This phase involved rereading the entire data set to see if the themes were relevant to it, while coding any additional data that may have been missed in the second stage (Braun & Clarke, 2006).

The fifth phase was essentially involved with assigning specific roles to each theme; in other words, the themes were specifically delineated and the relevance of each theme to the data was spelled out (Braun & Clarke, 2006). It is here, as well, where any additional sub-themes or superthemes were induced. The sixth phase from Braun and Clarke (2006) involved producing the report.

CHAPTER 4

RESULTS

Pilot study results

Two interview transcripts were selected for an initial data analysis. Allison (pseudonym) is a Caucasian female who would be categorized as a "non-traditional student" by the University; e.g., a student in her 30s who has come back to school to pursue another degree. Grace is a Korean-American, whose parents were immigrants. Grace has lived in the United States since she was two. She falls into the age range that the University would consider typical. Grace's interview was transcribed using a traditional method, while Allison's interview was transcribed using voice recognition software.

Initial codes were annotated in the transcripts by using the "comment" function in Microsoft Word. An example of this line-by-line coding is displayed in Figure 10.

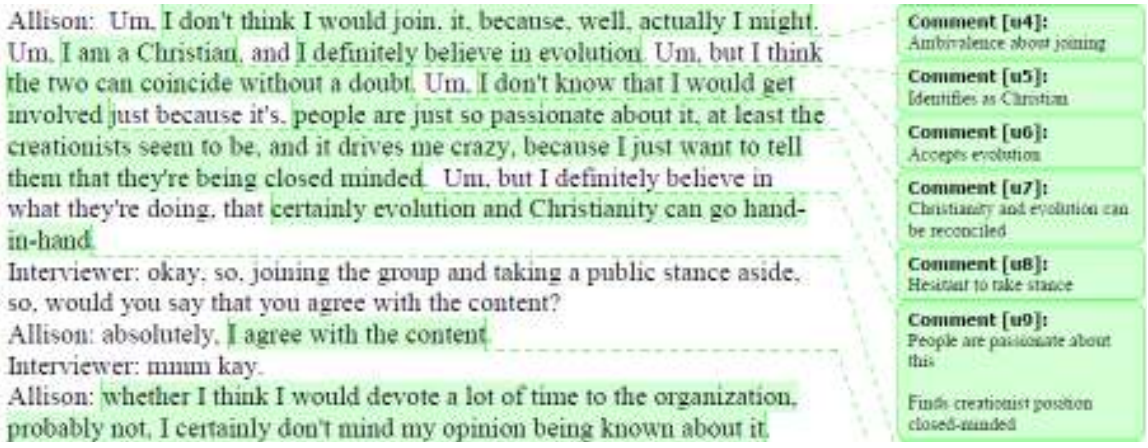

Figure 10. Example of line-by-line coding, pilot study.

After line-by-line coding, and the removal of identical codes, 93 codes emerged from Allison's transcript, while 56 codes emerged from Grace's transcript. Codes within

interviews were then checked for similarity and combined. During this step, additional codes were also discarded as extraneous (e.g., codes that did not apply to research questions). Examples of extraneous codes are found in Table 7, while similar codes are in Table 8.

Table 7. Three examples of extraneous codes, pilot study.

Example 1	Expresses interest in Facebook
Example 2	People judge outspoken individuals
Example 3	Facebook groups establish identity

Table 8. Three examples of similar codes, pilot study.

Example 1	Evidence is important Evidence is valuable
Example 2	Evolution is pleasing Evolution is positive
Example 3	Global warming is caused at least in part by humans Humans have a role in global warming

Following this step, Grace's transcript contained 43 codes, while Allison's transcript contained 89. Data were then merged, with identical and similar codes being merged. This resulted in a total of 109 codes. These codes were then assigned to categories and are listed in Figure 11. Codes were then refined by reducing them to smaller words/phrases. Some were ranked as subcategories, and some were eliminated. Table 5 represents the refined codes. From the refined codes, 6 major themes were drawn, with 3 sub-themes. A synopsis of each follows.

Theme 1: Epistemic authorities with respect to science

There are multiple sources of epistemic authority in science. Among these are: experts, who are established by credentials. In this case, credentials aren't just degrees; credentials have to do with where an expert works. In other words, name recognition is a major part of the deal – a scientist who works at an Ivy League university is taken a great deal more seriously than one working at a small state university. Groups of scientists or a consensus of scientists are considered an authority. Books, especially textbooks, are also an authority, but their authority depends entirely on their authors, and this is where credentials enter the picture again. Teachers and university professors are also considered epistemic authorities. Media – magazines and TV – also serve as epistemic authorities, although the Internet is not considered an epistemic authority because website authors may not have legitimate credentials, or worse, may intend to deceive.

Secondary theme 1: Different levels of authority.

A consensus of scientists carries the most authority. Scientists are considered the next highest epistemic authority, with teachers and professors following them, and media following teachers and professors. Credentials, however, may disrupt this hierarchy; one scientist from an Ivy League university, for instance, may outrank several scientists from lesser-known colleges.

Theme 2: Primacy of personal beliefs

Beliefs, interpreted internally, are considered more important than evidence, others' expertise, science, or religious dogma/assertions. In other words, if a scientist makes an assertion (for example, Richard Dawkins asserting that there is no God) that is counter to personal beliefs, then the assertion is rejected in favor of the belief. Somewhat

Epistemic authority positions - Authority takes precedence when emotional issue is not involved - Beliefs are more important than evidence - Books as authority when written by experts - Consensus has authority - Consensus takes precedence when reputation is equal - Credentials are important - Expertise is important - Expertise is valid - Media is epistemic authority - News media as epistemic authority - Peers were influential when younger - Prefers teachers to books as authorities – Academic reputation affects authority - Academic reputation takes precedence over consensus - Scientists are epistemic authorities in science - Scientists are a greater scientific authority than teachers - Teachers (school) are an epistemic authority - The internet is not an epistemic authority - University professors are epistemic authority
Epistemic positions - Aligns information with instincts - Personal beliefs are more important than evidence - Personal beliefs are more important than expertise - Personal beliefs are more important than science - Personal beliefs are more important than religious dogma - Personal beliefs take precedence over media articles - Relies on internal interpretations - Lacks confidence to interpret raw data
Descriptions of Evidence - Concrete things - facts/evidence - are in textbooks - Convincing arguments contain facts - Data may be faulty - Evidence can be made to fit beliefs - Evidence is important - Evidence more important than argument - Evidence more important than expertise - Evidence more important than opinion - Evidence needed for theory - Facts are important in establishing position - Fossils are evidence of evolution - Hard evidence is evidentiary support - No one source is correct - Opinion not a valid information source - Opinion not based on facts - Philosophy and science are different - Seeing data is believing - Textbooks a valid information source (evidence)
Evolution history - Evolution was presented as fact
Evolution positions - Accepts evolution - Agrees with intelligent design - Annoyed with antievolution position - Disagrees with literalist position - Disparages literalist position - Evolution is not accidental - Evolution is not random - Evolution is pleasing - Evolution is tentative - Evolution is valid - Finds creationist position closed-minded - No struggle with position on evolution
Evolution/Creation reconciliation - Being/power involved with some type of creation - Both creation and evolution should be discussed - Christianity and evolution are separated - Christianity and evolution can be reconciled - Creator involved in evolution - Evolution a directed process - Genesis and natural history can be reconciled - God designed evolution - Natural selection is directed - Natural selection is related to a "higher power" -Science confirms religion
Global warming positions - Accepts global warming - Denying global warming means one has ulterior motives - global warming can be slowed - global warming cannot be stopped - global warming caused at least in part by humans - global warming is an interesting topic - global warming is an urgent problem - global warming is in part a natural process - In favor of slowing global warming - Position on global warming cause has changed - Would like to act against global warming
Intelligent design positions - There is truth to intelligent design - Intelligent design can "repackage" Christianity - Intelligent design is not literally true
Religious background - Christian upbringing - Christianity was not forced - Emotional trauma sparked need for beliefs - Religion presented as fact at summer camp - Trauma sparked independence about beliefs - Formed religious positions independently
Religious positions - Does not reject Bible - Genesis is not a literal account - God is real - Identifies as Christian - Is Christian - The Bible is a story - There has been creation - Summer church camp is not a religious authority - Peers at camp not religious authorities
Science descriptions - Science is cognitive, spirituality is emotional - Science is not fully dependable - Science is tentative - Theories generated by humans aren't completely reliable - Science cannot explain everything

Figure 11. Initial categories and codes, pilot study.

surprisingly, if a religious assertion is claimed and it conflicts with the participant's personal beliefs, the assertion is also rejected in favor of the belief. The interpretation process has not been investigated further, but one of the participants stated that she went "with her gut."

Theme 3: Characteristics of evidence

This was initially considered as a secondary theme to epistemic authority; however, evidence was mentioned in more contexts than only with respect to epistemic authority. Therefore, it could not be considered a secondary theme to epistemic authority. Evidence is a valid information source, and is comprised of facts. Although, as with all other sources of information, it is subordinate to beliefs, it is needed for theory and is more important than expertise. Even though evidence (e.g., data) can be faulty, evidence is also considered more important than opinion. Opinion is not considered valid because it, unlike evidence, is not based on facts. Physical evidence – for instance, fossils – is considered the strongest or most valid evidence to these participants.

Theme 4: Validity of evolution

Both participants specifically stated that evolution is a valid concept, and stated the opposing view (e.g., disbelief in evolution) is not valid. One of the participants disparaged anti-evolution beliefs, calling them annoying and closed-minded. Although evolution has a reputation as a controversial subject, neither participant struggled in accepting it. Furthermore, one found it aesthetically pleasing. Evolution was characterized as not accidental and nonrandom. This characterization makes for a very blurry boundary with the next theme.

Theme 5: Reconciliation of evolution and religion

Both participants asserted that a creator or God is involved in evolution, either directing or designing it. Natural selection, the mechanism by which evolution proceeds, was also related to a "higher power." Because of this, intelligent design – the idea that God actively intervenes in evolution – was considered a truth by both participants as a philosophy, but neither considered it a literal truth, and in fact, considered it a "repackaging" of a literalist interpretation of the Bible. Both participants mentioned reconciling Genesis or parts of Genesis with natural history, and stated that science confirms their religion. This segues neatly into the next secondary theme.

Secondary theme 2: Christian background of the participants

Both participants asserted that they were Christian, and expressed specific religious positions with respect to reconciling their religious beliefs with evolution. First, neither rejected the Bible completely as truth, but both regarded it as a story that may be interpreted in other fashions than literally. Genesis, specifically, was mentioned as not being a literal account of how the universe, etc. was formed. This was grouped as a secondary theme to reconciliation of evolution and religion, because the participants' religious views and background were a part of this reconciliation. Their opposition to a Biblically literalist viewpoint was a crucial component in enabling them to reconcile evolution and religion.

Secondary theme 3: Description of science.

As with the prior secondary theme, this is not immediately obvious. However, it is quite similar in some ways to the previous secondary theme. Science was considered a tentative, imperfect human endeavor by the participants, and was described as not fully

dependable. Theories were specifically mentioned as not completely reliable. Both participants either stated or implied that science cannot explain everything. The recognition of science as potentially flawed also aided in reconciling evolution and religion, as the participants viewed neither their religion nor science as absolute or literal truth.

Theme 6: The validity of global warming

Global warming was recognized by both participants as a valid concept and to be a consequence of both human actions and a natural cycle. Because they considered this dual causality in global warming, both participants specifically asserted that global warming could be slowed by the cessation of harmful human activities but could not be completely stopped. An initial thematic map is represented in Figure 12. The initial thematic map was examined for restructuring of themes, resulting in three ideas for altering the map, listed below Figure 12.

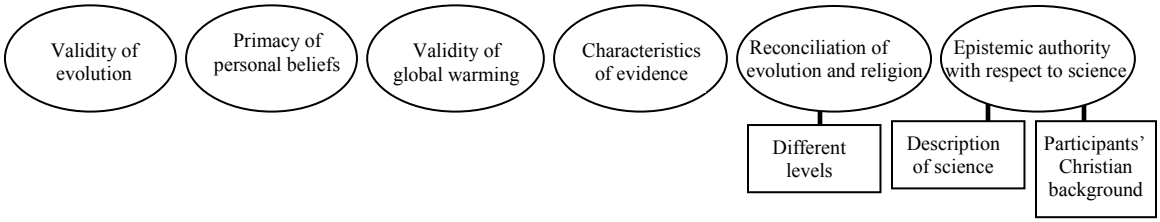

Figure 12. Initial thematic map of major themes and secondary themes, pilot study.

1. Characteristics of evidence are really a part of the description of science. Participants referred to evidence as meeting scientific standards – e.g., naturalistic evidence. Therefore, evidence was placed as a subcategory to description of science.

2. Reconciliation of evolution and religion requires both a stance on religion and a positive stance on evolution. Validity of evolution was placed as a secondary theme to reconciliation.
3. As both recognition of epistemic authorities and reconciliation of evolution and religion are mediated through the lens of personal beliefs, "personal beliefs" was placed as a top-level theme – a supertheme.

The resultant thematic map is represented in Figure 13. Table 9 displays the supertheme, the major themes, and the major secondary themes in context in the raw data.

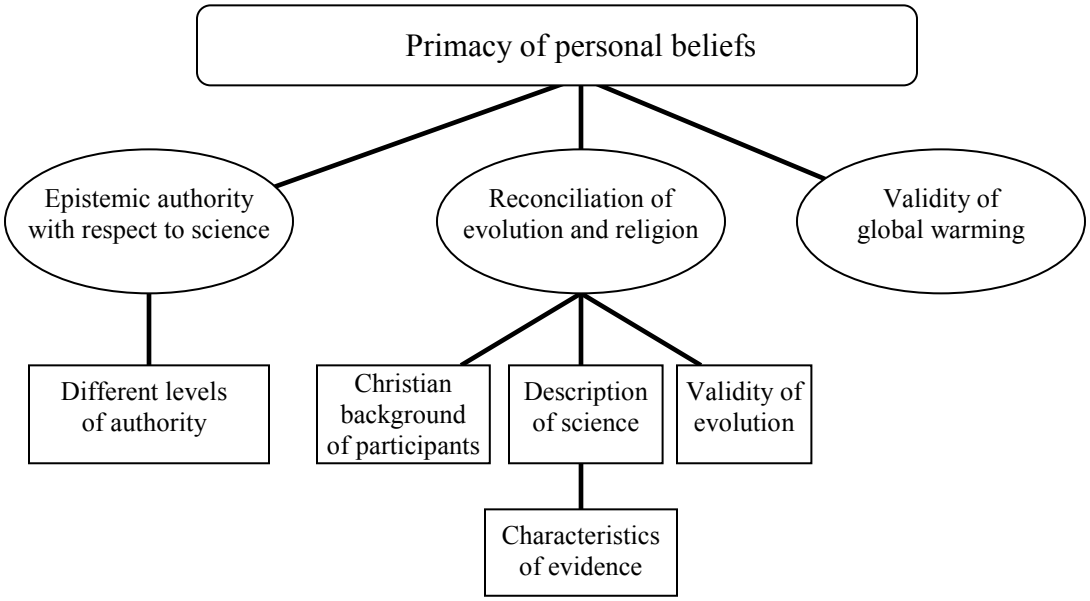

Figure 13. Revised thematic map of major themes and secondary themes, pilot study.

Inductive analysis results from questionnaires

Phase 1

Transcripts were organized into responses to the individual cartoons, resulting in six sets of 20 responses each. The resulting transcripts were reread twice. For sake of clarity, subsequent phases were carried out on the evolution and global warming cartoons

Table 9. Supertheme, major themes, and secondary themes in context in the raw data, pilot study.

Theme	Data
Primacy of personal beliefs	Interviewer: okay, so credentials and credibility and evidence are things that are important to you? Allison: in a situation like that, yeah. Interviewer: okay, can you tell me a situation in which they wouldn't be? Allison: when you get down to the absolute nitty-gritty of what I believe. That, that a world renowned biochemists can beat it into my brain that there is no higher power, but, there is.
Epistemic authority with respect to science	Interviewer: Okay. So, for legitimizing an argument for you, then, expertise is something that you want to call on? Grace: Yes, um, yeah, because I mean there's no, one human being can't possibly learn everything in this world. We have to take that leap of faith and trust in others to, I guess, do their share.
Different levels of authority	Interviewer: Mmm kay. Which one would you consider more of an expert? Grace: On the topic of evolution? Interviewer: Mmm hmm. Grace: Obviously the evolutionary biologist, I would think, because that is their field.
Reconciliation of evolution and religion	Allison: …it drives me crazy, because I just want to tell them that they're being closed minded. Um, but I definitely believe in what they're doing, that certainly evolution and Christianity can go hand-in-hand.
Christian background of participants	Allison: …Um, I don't think I would join, it, because, well, actually I might. Um, I am a Christian, and I definitely believe in evolution.
Description of science	Allison: …Um, the reason why I probably wouldn't take it as a, an absolute definite is that science, to me, is an evolving process.
Characteristics of evidence	Allison: …they can give me hard evidence. I mean, there's so much, it's such a wealth of knowledge that continues to grow, it's not all there, but it's just hard to deny that we have all these fossils and that we have all of these records, it's just, to me, it's just hard to deny that.
Validity of evolution	Grace: …Um, no, I would not join this Facebook group, because, um, the attitude would be fine, but I believe in, um, I do, I believe the validity of evolution but I also believe that, um, science is not so clear-cut that we can just all depend so heavily on evolution.
Validity of global warming	Grace: Uh, I would also join this group because I believe with the weather right now that global warming is, uh, just increasing to be a big problem. So.

separately. Phases 2-5 of analysis of the evolution cartoons will be discussed, followed by phases 2-5 of analysis of the global warming cartoons.

Evolution cartoons, Phase 2

The second phase involved generating initial codes from the data. The initial codes were annotated by using the "comment" function in Microsoft Word. A short example of this line-by-line coding is displayed in Figure 14. Codes within cartoons were then checked for similarity and combined. Examples of similar codes are in Table 10. Following this step, codes across cartoons were combined, duplicate codes were eliminated, and similar codes were combined.

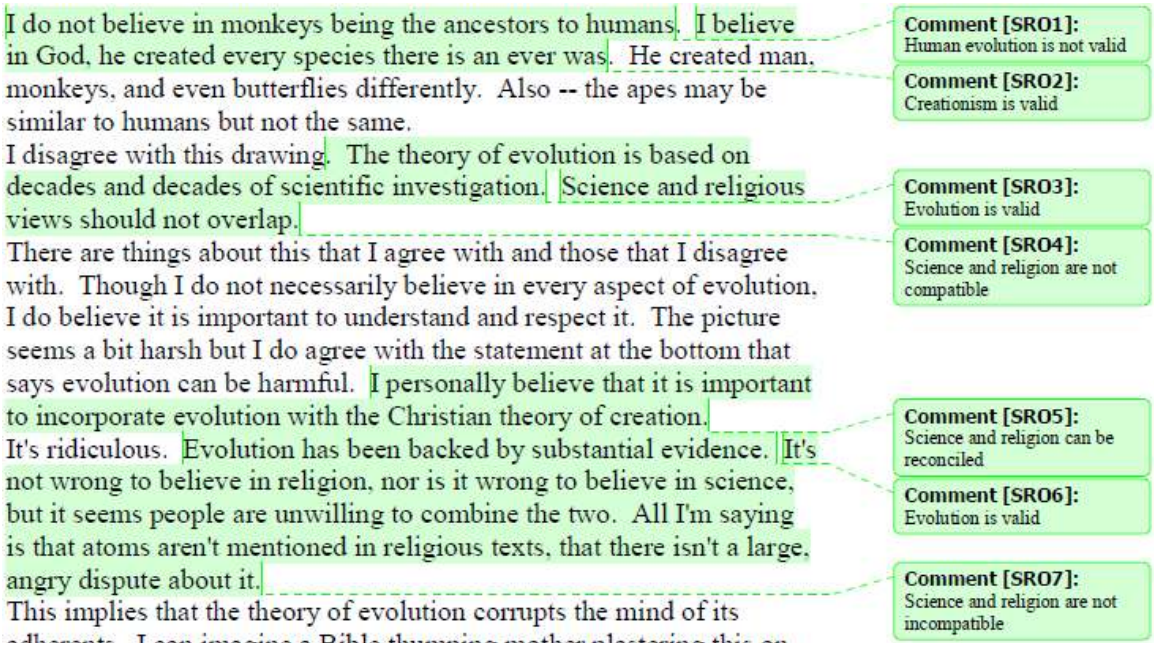

Figure 14. Example of line-by-line coding, evolution cartoons.

Evolution categories and codes.

Six initial categories with 17 codes emerged. The initial codes and categories are listed in Figure 15. Further refinement of these codes was not felt necessary before moving to Phase 3.

Table 10. Three examples of similar codes, evolution cartoons.

Example 1	Disagrees with evolution Does not believe in evolution.
Example 2	Science and religion are not incompatible. Science and religion can be reconciled.
Example 3	Human evolution is not valid. Humans did not evolve.

Support for creationism/religion - the Bible is literal truth - believes in creationism - Evidence exists for creation - Intelligent design is valid
Support for evolution/science - Human evolution is valid - Evolution is valid
Opposition to creationism - Does not believe in creationism
Opposition to evolution - Human evolution is not valid - Science is biased - Evolution is not valid
Reconcilation between creation and religion – Evolution and religion are not incompatible - Human evolution and religion are compatible - Evolution is a creation theory - Science and religion can be reconciled
Opposition to reconciliation - Christianity and evolution are not compatible - Evolution and religion are not compatible - Science and religion are not compatible

Figure 15. Initial inductive categories and codes for evolution cartoons.

Evolution cartoons, Phases 3 and 4

These phases were combined, as the data analysis was confined to twenty questionnaire transcripts and not the entire data set. This made the reexamination across the entire data set problematic. From the codes, 2 major themes were drawn, with 3 sub-themes:

Theme 1. Incompatibility between science/evolution and religion.

This theme was actually demonstrated with two viewpoints, discussed in secondary themes. Essentially, the participants to whom this theme applies either could not or were not willing to reconcile evolution and/or science with creationism.

Secondary theme 1: Creationism/religion is valid and evolution/science is not. This viewpoint supported religion as valid or truthful, while treating evolution, and by extension science, as either entirely invalid or subordinate to religious beliefs when in conflict. This theme is relevant to evolution/creation literature, as it is actually quite well elucidated in several of the positions along Eugenie Scott's (Scott 2004) creation/ evolution continuum; Flat Earthers, geocentrists, Old Earth creationists, gap creationists, day-age creationists, and progressive creationists are characterized by Scott as viewing religion as incompatible with evolution because of the emphasis that each of these groups places on Biblical literalism.

Secondary theme 2: Evolution/science is valid and creationism/religion is not. This viewpoint supported evolution as valid or truthful, while treating creationism, and by extension religion, as invalid. This theme is relevant to evolution/creation literature, as it is well elucidated in one of the positions along Scott's creation/evolution continuum (Scott, 2004); naturalistic evolutionists are characterized by Scott as viewing religion and the supernatural as invalid concepts.

Theme 2. Reconciliation between science/evolution and religion.

This theme was actually demonstrated when participants, viewing both their religion and science/evolution as valid, attempted a reconciliation of the two. This theme is relevant to evolution/creation literature, as it is located in intelligent design creationists, evolutionary creationists, and theistic evolutionists along Eugenie Scott's continuum (Scott, 2004). Figure 16 is a map of the themes and secondary themes.

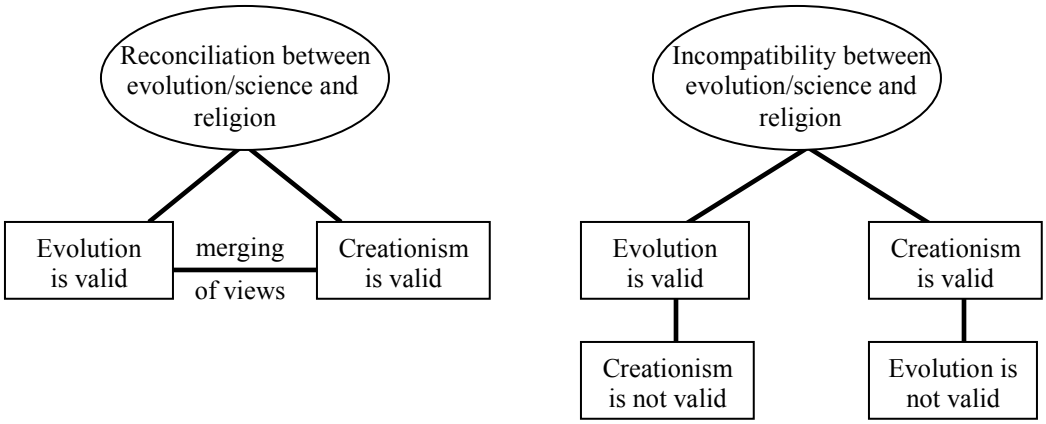

Figure 16. Map of themes and secondary themes from evolution cartoons.

One aspect of this figure that that may cause confusion is the connection between "evolution is valid" and "creationism is valid." In two questionnaires, participants indicated that one reinforced the other; e.g., evolution was evidence of creation, or evolution was a type of creation.

Evolution cartoons, Phase 5

This phase involves placing the themes in the context of the raw data. Table 11 displays the major themes and the major secondary themes in context in the raw data. Themes and secondary themes are highlighted.

Evolution cartoons, Phase 6

In this phase, the major themes and secondary themes were folded into three categories for the 3 x 3 grid: 1) rejects evolution; 2) accepts evolution and attempts to merge with religion; 3) accepts evolution without attempting to merge with religion.

Global warming cartoons, Phase 2

An example of line-by-line coding for global warming cartoons is in Figure 17.

Table 11. Major themes and secondary themes in context in the raw data, evolution cartoons.

Theme	Secondary theme	Data
Incompatibility between science/evolution and religion	Creationism/religion is valid and evolution/ science is not	[referring to cartoon 1] Scary, but true. My view on evolution is that man did not form from a fish out of water. We were not apes that turned into man. This picture is exactly right. Takes away from creationism. Evolution = poison.
Incompatibility between science/evolution and religion	Evolution/science is valid and creationism/ religion is not	[referring to cartoon 3] This cracks me up. I find creationism hard to swallow, so I would have to agree with what this cartoon is saying. Comparing it to the old beliefs about geography was very effective.
Reconciliation between science/evolution and religion		[referring to cartoon 2] Evolution has been proven time and time again. Research tells us that evolution has occurred in humans and other creatures. To not accept this theory should not be an attack on a person's religious belief, I believe there is a way to accept the theory of evolution while still being religious.

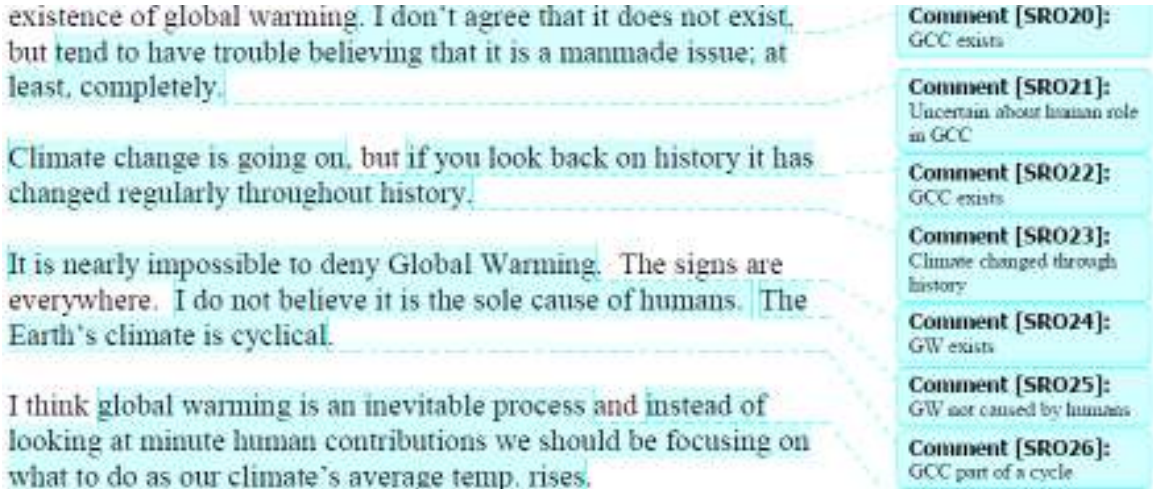

Figure 17. Example of line-by-line coding, global warming cartoons.

Codes within cartoons were then checked for similarity and combined. Examples of similar codes are in Table 12. Following this step, codes across cartoons were combined, duplicate codes were eliminated, and similar codes were combined.

Table 12. Three examples of similar codes, global warming cartoons.

Example 1	Global warming is a result of human actions. Global warming is anthropogenic.
Example 2	Global warming is occurring. Global warming is real.
Example 3	Global warming is a natural cycle. Global warming is cyclical.

Global warming categories and codes

Five initial categories with 16 codes emerged. The initial codes and categories are listed in Figure 18.

Global warming is discounted - global warming is not important - global warming does not exist - global warming is exaggerated
Global warming exists and is anthropogenic - global warming is anthropogenic - human overconsumption causes global warming - global warming can be affected by humans - global warming can be fixed - man-made global warming will have consequences - global warming is a massive human problem
Global warming exists but is not anthropogenic - global warming is a natural cycle - global warming is inevitable - global warming caused by God
Uncertainty about human role in global warming - global warming may be partially natural - global warming may or may not be caused by humans
Uncertainty about global warming - global warming may or may not exist - don't know much about global warming

Figure 18. Initial inductive categories and codes for global warming cartoons.

Further refinement of these codes was not felt necessary before moving to Phase 3.

Global warming cartoons, Phases 3 and 4

These phases were combined, as the data analysis was confined to twenty questionnaire transcripts and not the entire data set. This made the reexamination across the entire data set problematic. From the codes, 3 major themes were drawn, with 3 sub-themes:

Theme 1. Anthropogenic global warming is occurring.

This viewpoint supported global warming as a currently occurring phenomenon caused by human activity. This theme is relevant to global warming literature, as it is elucidated in a number of papers examining views of primary or college students. Additionally, this viewpoint is associated with the political left in general and specifically Democrats (Mooney, 2005).

Theme 2. Anthropogenic global warming is not occurring/is minimal.

Secondary theme 1: Global warming is not occurring.

This theme amounted to a simple denial that global warming is not occurring or an assertion that either global warming or its effects are exaggerated or overblown. This may correspond with an upsurge in literature from conservative think tanks asserting that global warming has virtually ceased over the past few years (Legates, 2006; Taylor, 2007; Marsh, 2002; Murray, 2008; Anderson & McCormick, 2007, Michaels, 2009) and predictions that effects will be minimal (Legates, 2006; Taylor, 2007; Marsh, 2002; Murray, 2008; Anderson & McCormick, 2007, Michaels, 2009).

Secondary theme 2: Global warming is occurring but is not anthropogenic.

This viewpoint supported global warming as a currently occurring phenomenon, but one that is not caused by human activity. There were two entirely different aspects to

this viewpoint. In one, participants wrote that global warming is a naturally occurring cycle, and that human activity has little to nothing to do with the climate change. This is a position that has been encouraged by the political right (Legates, 2006; Taylor, 2007; Marsh, 2002; Murray, 2008; Anderson & McCormick, 2007).

Theme 3. Uncertainty about global warming.

This theme has two different secondary themes, both of which involve uncertainty with respect to global warming.

Secondary theme 1: Global warming may or may not be occurring.

Unlike the previous theme that denied that global warming was occurring, this secondary theme neither confirmed nor denied the validity of global warming. Instead, the respondents stated that they did not know if global warming was occurring, for one of two general reasons: 1) they did not know enough about the topic to make a decision; or 2) they could not decide between conflicting sources.

Secondary theme 2: Global warming is occurring but may or may not be anthropogenic.

This secondary theme did confirmed the validity of global warming; however, the respondents stated that they did not know if global warming was anthropogenic, for one of two same general reasons as the previous secondary theme: 1) they did not know enough about the topic to make a decision; or 2) they could not decide between conflicting sources. A thematic map for the global warming cartoons is in Figure 19.

Global warming cartoons, Phase 5

This phase involves placing the themes in the context of the raw data. Table 13 displays the major themes and the major secondary themes in context in the raw data.

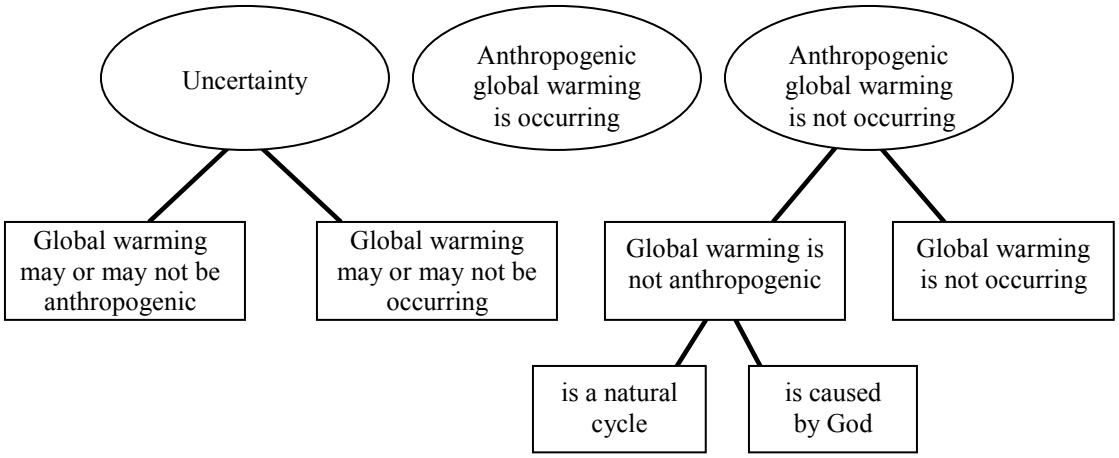

Figure 19. Map of themes and secondary themes from global warming cartoons.

Table 13. Major themes and secondary themes in context in the raw data, global warming cartoons.

Theme	Secondary theme	Data
Anthropogenic global warming is occurring		I mostly believe it is mankind's fault for causing global warming mostly due to laziness. The laziness of man has caused increases in technology which leads to the current state today.
Anthropogenic global warming is not occurring	Global warming is not occurring	Global warming is ridiculous. I do not believe it exists. However, even if it did, it is being blown way out of proportion. My God will end the world and take his followers out.
Anthropogenic global warming is not occurring	Global warming is not anthropogenic	It is nearly impossible to deny Global Warming. The signs are everywhere. I do not believe it is the sole cause of humans. The Earth's climate is cyclical.
Uncertainty	Global warming may or may not be happening	This cartoon means global warming is real, and it's taking people forever to still "decide" that it's real. I'm still unsure whether or not I think global warming is happening, but I think it's a little overdone (like with the polar bears on isolated caps of ice to draw sympathy for these poor animals.
Uncertainty	Global warming may or may not be anthropogenic	It appears that it is poking fun at those who argue against the existence of global warming. I don't agree that it does not exist, but tend to have trouble believing that it is a manmade issue; at least, completely.

Global warming cartoons, Phase 6

In this phase, the major themes and secondary themes were folded into three headings for the 3 x 3 grid: 1) anthropogenic global warming is occurring; 2) uncertainty, either in reality of global warming or humans' role in global warming; 3) anthropogenic global warming is not occurring. The grid is below in Figure 20. The grid merges global warming and evolution positions; the top left corner, for instance, would be position 1, assigned to a participant who rejected evolution and stated that anthropogenic global warming is occurring.

	Rejects evolution	Accepts evolution and attempts merging with religion	Accepts evolution without attempting merging with religion
Anthropogenic global warming is occurring			
Uncertainty, either in reality of GW or humans' role in GW			
Anthropogenic global warming is not occurring			

Figure 20. 3x3 grid used to classify respondents for interview selection.

Results of deductive coding.

Using the grid headings, 446 questionnaires were coded and assigned to their different positions on the grid. The results of the coding follow in Table 14. Out of the 446 questionnaires, 150 could not be assigned to a position on the grid. In 60 of these questionnaires, the respondents analyzed the cartoons and expressed what they thought the cartoons were communicating, but did not express whether they agreed or disagreed

with the cartoons. In 28 questionnaires, the respondents could be assigned an evolution position, but could not be assigned a global warming position, either because what they wrote could not be interpreted or because they left cartoons blank. In 28 questionnaires, the respondents could be assigned a global warming position, but could not be assigned an evolution position, either because what they wrote could not be interpreted or because they left cartoons blank. In 34 questionnaires, the respondents could not be assigned either a global warming position or an evolution position, either because what they wrote could not be interpreted or because they left cartoons blank. Figure 21 displays the

Table 14. Numbers of questionnaires at each position.

Category	Evolution / Global Warming Views	% (number)
1	Rejects evolution / Accepts anthropogenic global warming	9.6 (43)
2	Attempts merging with religion / Accepts anthropogenic global warming	8.3 (37)
3	Accepts evolution without merging / Accepts anthropogenic global warming	17.3 (77)
4	Rejects evolution / Uncertainty about global warming	2.9 (13)
5	Attempts merging with religion / Uncertainty about global warming	4.3 (19)
6	Accepts evolution without merging / Uncertainty about global warming	2.7 (12)
7	Rejects evolution / Rejects anthropogenic global warming	11.0 (47)
8	Attempts merging with religion / Rejects anthropogenic global warming	6.1 (27)
9	Accepts evolution without merging / Rejects anthropogenic global warming	4.3 (19)
1/U	Rejects evolution / Could not be distinguished	7.6 (17)
2/U	Attempts merging with religion / Could not be distinguished	3.8 (7)
3/U	Accepts evolution without merging / Could not be distinguished	1.6 (4)
U/1	Could not be distinguished / Accepts anthropogenic global warming	0.9 (18)
U/2	Could not be distinguished / Uncertainty about global warming	4.0 (4)
U/3	Could not be distinguished / Rejects anthropogenic global warming	0.9 (6)
U/U	Could not be distinguished / Could not be distinguished	1.3 (34)
A	Attempted analysis of the cartoons; did not express own views	13.5 (60)

numbers and percentages of respondents who could be assigned a specific position on the grid. Please note that these percentages are drawn from the 296 questionnaires that could be assigned a position on the grid; in Table 14, percentages were drawn from all

participants who consented to further participation in the study beyond filling out the questionnaire, including those who could not be assigned a position on the grid.

Of the 324 respondents who had an evolution position that could be distinguished, 37.7% (122) rejected evolution entirely; 27.8% (90) accepted evolution and attempted to merge it in some fashion with religion, whether by intelligent design, evolutionary creationism, or theistic evolution; and 34.6% (112) accepted evolution without attempting to merge it with religion. Of the 324 respondents who had a global warming position that could be distinguished, 54.0% (175) accepted anthropogenic global warming; 14.8% (48)

	Rejects evolution	Accepts evolution and attempts merging with religion	Accepts evolution without attempting merging with religion
Anthropogenic global warming is occurring	43 (14.5%)	37 (12.5%)	77 (26%)
Uncertainty, either in reality of GW or humans' role in GW	13 (4.4%)	19 (6.4%)	12 (4.1%)
Anthropogenic global warming is not occurring	49 (16.6%)	27 (9.1%)	19 (6.4%)

Figure 21. Number and percentages of assigned positions on the 3x3 grid.

expressed uncertainty, either in the reality of global warming, or in humans' role in global warming; and 31.2% (101) rejected anthropogenic global warming, either by expressing a belief that global warming is not occurring, or that it is occurring but is a natural cycle and is not affected by human activity.

Interviewee contact

Potential interviewees were chosen from each of the nine positions on the grid, and contacted via email. Attempts were made to obtain at least two participants per position on the grid, and two separate invitations were sent to each participant. Eventually, 14 participants agreed to two interviews; one with respect to their position on evolution, and one with respect to their position on global warming. Their pseudonyms (pseudonyms were chosen by participants at the outset of the initial interview), as well as abbreviations (RE = rejects evolution; M = merges evolution with religion; AE = accepts evolution; AGW = anthropogenic global warming; U = uncertainty; NA = not anthropogenic) are shown on the grid in Figure 22.

	Rejects evolution	Accepts evolution and attempts merging with religion	Accepts evolution without attempting merging with religion
Anthropogenic global warming is occurring	Jane Hazel RE-AGW	Rick Theresa M-AGW	Genevieve Karen AE-AGW
Uncertainty, either in reality of GW or humans' role in GW	Kate RE-U	Carly M-U	Roy AE-U
Anthropogenic global warming is not occurring	Sally RE-NA	Bryan Rachel Fred M-NA	Herbert AE-NA

Figure 22. Interviewees on 3x3 grid with abbreviations for those positions.

Interview summaries

For ease of reading, some words and phrases such as "like" and "you know," as well as utterances such as "um" which do not affect meaning have been omitted from quotes. Additionally, some words have been substituted for clarity and enclosed in

brackets. For instance: "So like I think you would have to like bring like a combination 'cause I feel like one side is, like, completely like creation doesn't exist and then one side is like completely like, evolution doesn't exist" would be written as "So I think you would have to bring a combination because I feel like one side [asserts that] creation doesn't exist and then one side [asserts that] evolution doesn't exist." Additionally, ellipses have been inserted into the responses for brevity's sake when the participants' responses included extraneous information to an excessive degree. For example, in response to the question "Can you describe a book that you would consider to be to be more reliable for your purposes?", the participant replied:

> Well, you know, with "An Inconvenient Truth," we watched that in my whole environmental class, and it was – I actually missed the first half of the class because I was sick, but, I caught the second half and I caught the overall gist of it, but one that I would trust? Just give me the facts without telling me that I should go out there and fix the world. I understand that by telling your readers, 'You can change the world one reader at a time,' by them taking that into their apartment, and fixing like, they don't recycle there, so they can recycle and then that's four people that are doing good things; these four go out and tell more and it all comes down from this one book and the authors. So I can see why bias is important in that, but, in my personal views, I don't want to know all that. I want you to give me the facts. I will make my own decisions about whether I want to recycle or not.
>
> This would be trimmed to:
>
> Well… one that I would trust? Just give me the facts without telling me that I should go out there and fix the world… I can see why bias is important in that, but, in my personal views, I don't want to know all that. I want you to give me the facts. I will make my own decisions about whether I want to recycle or not.

Bryan

"Bryan", Description

Bryan was a 21-year-old male upperclassman, self-identified as Caucasian, his religion as Catholic, and politically as Republican at the time of the interview.

Bryan, Questionnaire

Bryan's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 15 shows the quotes used to assign Bryan to position M-NA.

Table 15. Selected supporting quotes placing Bryan at M-NA.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution and attempts merging with religion	I'm not too sure on this one like if they are saying God didn't create humans so he didn't create the earth as well. Me personally I think evolution and the big bang are just answers to HOW stuff happened not why.
Anthropogenic global warming is not occurring	Climate change is not all human caused. I think it is more a natural cycle.

Questionnaire effectiveness and views

On the evolution pre-interview position list (Appendix D, page i), Bryan indicated that his evolution position was "I believe that God set up the rules of the universe at the beginning and let it go, resulting in evolution. God created the universe but allowed random chance in evolution." This corresponded well with position M; by choosing this option, Bryan accepted evolution and merged it with his religion. Additionally, in his interview, Bryan stated, "I mean I'm religious, I'm Catholic actually. So I mean I'm not strict, real strict, but I think that it's got to play a role somewhere in there because I don't think that space in general could have been created, had just always been there more or less." Bryan also stated in his interview that "I don't think it's completely set like it's in

the Bible. So I think you would have to bring a combination 'cause I feel like one side [asserts that] 'creation doesn't exist' and then one side [asserts that] 'evolution doesn't exist.' So I think you'd have to mold the two." Both of these statements indicated that Bryan accepted evolution but attempted to merge it with his religious views; therefore, the questionnaire appeared to accurately place Bryan in M.

On the global warming pre-interview position list (Appendix D, page j), Bryan indicated that his global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This did not correspond with NA as neatly as evolution code M, as Bryan felt that humans have contributed to global warming but are not necessarily the cause. However, the assignation to NA is defensible; one of the global warming positions that Bryan did not choose is that humans are primarily responsible for global warming. Additionally, Bryan stated in his interview that "I think people have more like a pretty minor role in it [global warming] but they do have like an effect on it obviously. But like I feel like they have a much more minor role and it's more like just Mother Nature, like the natural cycle of how, you know." In Bryan's case, the questionnaire appeared to place his global warming position as NA accurately.

Sources of epistemic authority re: evolution

Bryan initially expressed distrust in "government-backed" sources. When questioned further, Bryan defined "government-backed" sources as "anything that has to report to the government" and "the government is giving them money and they have some kind of like control over it." However, Bryan stated that grant-funded scientists were not necessarily untrustworthy: "grants could be a little different because I feel that

they give you a little bit more room, leniency with that as opposed to being more under full government control." Bryan stated that he would not take scientists at their word: "I think more than anything, you'd have to really look into their information, and look it over. Does it make sense? Do you think it's a little bit far stretched?" He expressed further reservations:

> I also think that I trust them on, I guess, more of the smaller scale and I think that the big bang theory, yeah, that's a little far off but it's still possible. But none of them have gone out and been able to explain how just space in general, where anything has been created, like that, so starting off you can't really, I consider them credible from only a certain point, I guess.

This "certain point" was time:

> Yeah, chronologically so I think that somehow the world got created, so that would be the religious part which is not logical, it can't be proven. But then I think that whenever, whatever it was, space and matter, got like spun into whatever, its web, but all of that stuff like the big bang could have happened. And, evolution from then on.

Although Bryan answered affirmatively when asked if the evidence posed for conclusions would determine their veracity, he did not state how he would examine the evidence, and in fact, did not claim that he had ever examined any evidence.

Bryan did express trust in other sources: "I've been watching the History Channel and they have where the earth used to be and where the all the river systems and oceans used to be. You can see they can prove that, so that's accurate. I can completely understand what they are saying." Later in the interview, Bryan mentioned taking classes to learn about evolution, and elaborated that the sources within those classes that he trusted for accurate information were "the books, just the books and the teachers. Definitely the teachers… I feel like they had a pretty good idea about what they were talking about..."

As in his questionnaire results, Bryan incorporated religion into his views of evolution. He stated that moderate religious figures would be an information source because "I don't know how it's explained, nothing coming from something, I mean something coming from nothing." However, when specifically asked if scientists were a primary source and religious figures were a secondary source, Bryan indicated that religious figures would be a secondary source. Further, he stated that if the Catholic Church took the position that evolution was absolutely not true, that it would not affect his views much. In the latter part of the interview, Bryan indicated that he would value

> a religious scientist that was pretty respected in the scientific community, I would give him like particular accolades I guess… I think that he would have to explain, because if you're going to say that God created everything, then he had to kind of put some spin on something, do something. So you have to almost [have] a philosophy of 'if He didn't create it in seven days, but He might have like just created space and then let it go.' But then, how much interference does He actually have if He exists? Is He still changing things or is He leaving things to go? So somebody who maybe could distinguish between that and if there is a God that created it, what effects does He have on the planet right now?

It is difficult to name specific epistemic authorities with Bryan. Certainly, religion played a role, as Bryan denied a scientific explanation of origins and accepted a sort of creation story, although he made it clear that he was neither a Biblical literalist nor a "strict" Catholic. However, it is not clear whether this is because he wanted to retain some sort of belief in the face of scientific knowledge, or whether his misconception about the big bang theory resulted in his finding an answer to origins from elsewhere, turning to religion by default. The Catholic Church was not a strong epistemic authority for Bryan, as he stated that his views would not automatically change with the Church's views. Additionally, he specifically stated that he would trust scientific sources over religious sources with respect to evolution. Bryan seemed to not completely trust either

scientific or religious sources, though, as he stated that further personal research into evolution would come from websites that did not show bias: "find one that was not necessarily biased toward either side. Somebody who was not looking to prove one side or the other and obviously not sponsored by one side or the other." However, he did seem to implicitly trust the resources in his science classes; e.g., the professors and course materials. Perhaps the most important authority was his personal set of beliefs that resulted in the assignation of origins to a creator:

> Bryan: I think that somehow the world got created, so that would be the religious part which is not logical, it can't be proven so…
> Interviewer: So how did you initially decide that moderate religious figures would be accurate sources?
> Bryan: Well, because I don't know how it's explained, nothing coming from something. I mean something coming from nothing.

Belief/knowledge with respect to evolution

Bryan's knowledge about evolution indicated a limited dependence on epistemic authorities, as reflected in his interview statements. Bryan clearly did not remember a lot of specifics about evolution from his classes, but retained a few general ideas. One of these ideas was that scientists are fairly convincing with their arguments because they can provide specific, physical data to back their claims. Another idea was that scientists cannot explain origins; this came from a misconception that the Big Bang "came from nothing." It was fairly clear that Bryan implicitly trusted both the professors and the materials in his classes. One would think that by extension, Bryan would implicitly trust scientists, but he stated that he would have to examine evidence from scientists in order to trust their claims. Bryan also mentioned the History Channel; he found the programs that he had seen to be convincing. Essentially, Bryan's views on evolution were fairly vague, but amounted to Deism; ascribing origins to God, with the caveat that God has not

interfered with the universe in any fashion from that point forward. This belief overrode any other information that Bryan encountered. Given that Bryan constructed his position on origins from religion – a source far removed from the peer review process – and otherwise accepted evolution based on knowledge gained from professors and textbooks closely tied to the peer review process, Bryan's position on evolution could be described as a mix of belief and knowledge – belief with respect to origins, and knowledge with respect to other information.

Characteristics of evolution knowledge sources related to perception of authority

Scientists were considered a valid information source for evolution by Bryan for one primary reason: they can provide evidence to back their claims:

> Interviewer: So what is it about scientists that generates trust for you?
> Bryan: actual evidence… not necessarily theories but more like actual, real facts that can be proved and explained, more or less.
> Interviewer: Ok. So would you say validity, repeatability?
> Bryan: Yeah.
> Interviewer: What [is it] about scientists [that] make them useful for your position on evolution?
> Bryan: They can explain how things have changed over time and how one thing has gotten from here to here. And give examples of it and show exactly how it happened for the most part.

Moderate religious figures were also considered an information source secondary to scientists:

> Interviewer: Ok. And what sources within religion would you pay attention to?
> Bryan: Uh. Probably a pretty liberal [source]. I don't believe [creation is] set like it's in the Bible. So I think you would have to bring a combination because I feel one side [asserts that] creation doesn't exist and then one side [asserts that] evolution doesn't exist. So I think you'd have to mold the two.

Again, this largely stemmed from a misconception on Bryan's part about the big bang theory, and it did seem that the characteristic of religious sources that made them

important to Bryan was that these sources were part of a more religious past; essentially, the characteristic that made religious sources important was that they were religious, the value of which most likely was an artifact of his upbringing.

Justification of epistemic authorities used in evolution position construction

Bryan's description of scientists was limited to a general idea that scientists provide physical evidence, and are competent. As he did not specify any sources beyond "scientists," Bryan's justification was rated as somewhat poorly aligned.

Characteristics of student related to perception of evolution authority sources

The characteristics that can be most related to Bryan's perception of evolution authority sources are his educational and religious backgrounds. His educational background has exposed him to sources that he trusted for scientific knowledge, but at the same time, his religious background served to delimit that trust. The following quote demonstrates both the trust found in his education and the limits to that trust imposed by his religion:

> Interviewer: You talk about taking classes. And what sources did you rely on for your knowledge for those classes in the biology classes?
> Bryan: The books, just the books and the teachers. Definitely the teachers.
> Interviewer: Ok you think they had a pretty good handle on what they were talking about?
> Bryan: I feel like they had a pretty good idea about what they were talking about, but a lot of them are convinced that the big bang theory explains everything but to me that doesn't really explain anything.

Bryan trusted the instructors in his college biology courses, but, because of his religious perspective on origins, apparently would not regard his teachers as a strong epistemic authority.

Sources of epistemic authority re: global warming

As with his evolution interview, Bryan expressed distrust in a specific group almost immediately:

> Interviewer: Bryan, what sources would you trust for accurate information on global warming?
> Bryan: I think that would definitely have to be a pretty extensive scientific research group that is also not necessarily environmentalists.
> Interviewer: Ok. And why not?
> Bryan: Because I think environmentalists are kind of biased towards the effect that we as humans might have and maybe are a little too interested in correlating our effect on the whole ecosystem.

Bryan went on to name astronomy and chemistry as disciplines that he thought should contribute to a scientific research group. His rationale for this came from a distrust of environmentalists:

> Yea, yea. And assign, I think that if something is bad happening, they might not be able to look at a more broad picture, but they are trying to figure out [that] something's changing [because] we must be doing it. And therefore it's our fault. As opposed to not looking at it possibly being a natural cycle or combination of the two.

He confirmed this perceived bias in another exchange:

> Interviewer: So you would want to bring in multiple scientific perspectives?
> Bryan: Uh huh
> Interviewer: And can you tell me why you'd want to cast the net that broadly?
> Bryan: Because I think otherwise, people are so into their area of science that they can't look to the broader picture and figure out this is a possibility, but there are also multiple other possibilities out there.
> Interviewer: Not being able to see the forest for the trees?
> Bryan: Yea.

Bryan then stated that a consensus of scientists from different fields was important:

Interviewer: …when it comes to global warming would you have more of a tendency to trust a really large consortium if it's multidisciplinary or perhaps a book that's been published other than a smaller report?

Bryan: Probably a larger report put together by, not just one scientist from each section but maybe multiple scientists from each section, and even from different areas just so that none of them really have too much of a bias. [Scientists who] are willing to come together; otherwise, they won't be able to come to a consensus.

Interviewer: Ok so is this consensus the thing that's important for you?

Bryan: Yeah.

When Bryan referred to evolution sources, he mentioned the importance of the scientist having gone to "a good school"; however, this was not as important with respect to global warming:

Interviewer: …let's say that you've got a consortium made up from smaller research institutions who are maybe less well known, and opposing them you've got a smaller research group of a few individual scientists from Ivy League schools. Which one are you going to tend to take more seriously in that case?

Bryan: I would probably have to look into the information and see what seems more logical, like what makes more sense.

Here, Bryan did not consider a "good school" necessarily more important; instead, he wanted to examine the results of the research and see which results made more sense to him. However, he then mentioned an intermediary:

Interviewer: How would you determine what was more logical?

Bryan: Probably just try and have somebody either read whatever the report is or just – you know, it's probably pretty scientific – so maybe just have somebody explain it in more layman's terms, one compared to the other.

When asked for more detail, it became clear that Bryan did not have a clear idea whom he would trust, but he did not mention a scientist:

Interviewer: Who would you trust to be able to explain these things in more layman's terms to you if it were overly technical?

Bryan: Pretty much anybody that understood what they were talking about and could effectively convey what's going on.

Interviewer: So would you want someone who could make connections between you and the information and then step out of the picture?

Bryan: I would want somebody to basically take the facts of whatever was going on and then explain them to me. I don't need to know the chemical formula for something. But if you tell me what is going on, like there's these things, these things are breaking apart, whatever, and transferring to this, I could understand that, definitely.

Bryan wanted someone to "translate" the science to him. He, apparently, did not trust a scientist to communicate directly with him; rather, he wanted someone else who understood the material to condense it to a comprehensible form, but did not mention specifics of the "interpreter." When asked where he would turn to find out more specifics about global warming, he replied:

Interviewer: So let's say you wanted to find out more about global warming as a subject. Where would you go?

Bryan: Probably, maybe, to the library. And then I would probably check out one of the newer geological books. I feel like there's a lot of new information coming out, [with respect to] formation of the planet. It's like the planet's life cycle, almost. And then maybe an astronomy book, maybe just to check out what effect, obviously the sun has to have something to do with warming and cooling.

It is difficult to name specific epistemic authorities with Bryan. He spent a significant portion of the interview speaking about what or who he did not trust. However, it may be possible to form a more generalized picture, based on his statements about environmentalists. Almost immediately, Bryan mentioned environmentalists as individuals who could not be trusted. The reason for this lack of trust was that he felt that environmentalists had blown human contributions to global warming out of proportion:

Interviewer: So would you say it's fair that you would consider a scientific source as accurate if they have what you feel is a lack of bias, if they are multidisciplinary, and if they present a report that is conservative with its implications?

Bryan: Yes. Yeah, yeah, definitely.

Interviewer: Ok, so all those are all in line with –

Bryan: Conservative is like a good way to put it. Don't go out of control. I feel like a lot of people just throw things out there. [Things that] are possible but not really that likely.
Interviewer: So it's overreaching then it turns you off from sources?
Bryan: Yeah, I feel like a lot of things are just like way too extreme. [Things that] are off to one side or probably biased, put it that way.

Further, when asked about topics that he found scientists useful for, Bryan said:

Just having a better idea of where the planet's going, like what is a reasonable thing to ask of people, even as far as like taxes go and stuff like that and what is environmentalists being environmentalists.

This mistrust of environmentalists most likely came from his political affiliation; according to Mooney (2005), Republicans are sharply critical of environmentalists. Therefore, it is not unreasonable to posit that Bryan's political views were his strongest epistemic authority; he mistrusted sources based on his pre-existing bias against them conferred by his political leanings, and looked for sources that would confirm his view that global warming is a natural occurrence.

Belief/knowledge with respect to global warming

It was fairly clear, as with evolution, that Bryan implicitly trusted both the professors and the materials in his classes. Again, one would think that by extension, Bryan would implicitly trust scientists, but he stated that he would have to have someone other than scientists interpret their claims. It appeared that Bryan was somewhat overwhelmed by the technical aspects of reports on global warming. This may have contributed to his mistrust. Essentially, Bryan's views on global warming were fairly vague, but there was a belief that environmentalists are making exaggerated claims about global warming. This belief overrode any other information that Bryan encountered. Bryan constructed his position from what appears to be an argument from incredulity;

e.g., that humans could not possibly affect climate to the extent that "environmentalists" claim, and seeks references to confirm his position rather than inform it:

> …accurate would be understanding, taking into account not only our effect, but also all of the, there's been a lot of historic or geological evidence recently that shows the different planetary changes, so I think that [I would] bring somebody in there that has a great knowledge of that. That would make a lot more sense to me, instead of just [concluding] our temperature is rising because we're using too much fossil fuel.

Given this construction, Bryan's position on evolution could be described more as belief than knowledge.

Characteristics of global warming belief sources related to perception of authority

The primary characteristic of belief sources related to perception of authority, for Bryan, followed one main characteristic: they confirmed his contention that global warming is a natural cycle with minimal human influence. In other words, the authority of scientific knowledge was minimal for Bryan; he would probably simply disregard sources that conflicted with his beliefs. Bryan stated that he would seek out geology books and astronomy books to confirm his position that influences other than human ones would affect climate.

Justification of epistemic authorities used in global warming position construction

Bryan relied on a position built from a disbelief that humans could effect climate change, and his description of information sources was essentially limited to those which would confirm a pre-existing set of beliefs. Although he did not specifically mention his politics as an authority, he disparaged environmentalists, insistently claimed that climate change is a naturally occurring cycle, and considered sources that incorporated economics as more helpful:

Interviewer: So would you say its fair to say that these that the sources that you trust for information on global warming assist you with considering economic implications of what we need to do to address whatever role we may have in it?
Bryan: Yes, definitely.
Interviewer: Ok.
Bryan: I feel like uh global warming a pretty big governmental issue. I'm a housing major, so it definitely has a lot to do with where you can build [and] what you can [build].
Interviewer: And perhaps how you can build?
Bryan: Yea how I mean all of the above, pretty much the whole building industry. I feel like it affects the whole economy pretty intensely. Carbon taxes.

These, again, were views that arise from a political stance. Bryan did not have the same ideas that scientists have about science: "science is universal (i.e., its validity is independent of the context in which it is generated) because evaluation of knowledge claims in science uses objective, rational and impersonal criteria rather than criteria based on personal, national or *political* [italics mine] interests" (Wong and Hodson, 2009). As Bryan's position arose from, essentially, an argument from incredulity, Bryan's justification was poorly aligned with scientific authorities.

Characteristics of student related to perception of global warming authority sources

The characteristics that can be most related to Bryan's perception of global warming authority sources are his educational and political backgrounds. His educational background has exposed him to sources that he trusted somewhat for scientific knowledge, but at the same time, as with religion and evolution, his political background served to delimit that trust.

Epistemic commonalities between evolution and global warming sources

The commonalities between Bryan's authority with respect to evolution and global warming are clear: Bryan placed primacy on his personal beliefs. He was not

willing to consider evolution without reference to a creator of some sort, and he was reluctant to consider sources that did not confirm beliefs engendered by his politics. Although Bryan was willing to trust teachers, scientists, and textbooks to an extent, that extent was delimited by either his religious or political beliefs.

Carly

"Carly", Description

Carly was a 19-year-old female underclassman, self-identified as Caucasian, her religion as Catholic, and did not self-identify her political identity at the time of the interview.

Carly, Questionnaire

Carly's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 16 shows the quotes used to assign Carly to position M-U in the grid.

Table 16. Selected supporting quotes placing Carly at position M-U.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution and attempts merging with religion	This sort of rubs me the wrong way. Not because evolution is wrong, but because it makes evolution seem like a crazy idea, without even the slightest chance of credibility. I don't know how much I believe in evolution, but I know it should at least be considered an option.
Uncertainty, either in reality of global warming or humans' role in it	Ha ha. Democrats blaming the population for global warming. I mean it's true that it's our fault to a certain extent, but the earth also goes through heating and cooling cycles. Who is to say this isn't one of them? I thought this one was funny. Whether people want to admit it or not, global warming is a reality. I believe the extent of which it occurs is the real controversy.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Carly had trouble choosing an exact position. She indicated that her evolution position was a combination of these statements:

> I believe that there are two separate creation events described in Genesis, and that these creation events are separated by a vast expanse of time. Creation confirms an ancient age of the earth, but one of the creation events was still the six 24 hour days.
>
> I believe that the earth is ancient, but complex molecular machinery and complex structures, such as the eye, were a result of specific creation events; e.g., "design." I can accept microevolution, but mutation and natural selection are not adequate to explain macroevolution, such as evolution of reptiles from fish.
>
> I believe that God uses evolution for creation and has specifically directed evolution's pathway.
>
> I believe in evolution, and also believe in God. I think God played a role in evolution, but was so subtle that we can't detect that role.

Despite the multiple choices, these positions still corresponded well with the assigned evolution code; these options allowed Carly to accept evolution and merge it with her religion. Additionally, in her interview, Carly stated, "I was just raised to believe that God created everything so that's like a foundation it's kind of hard to knock those ideas out but I do believe that that's where it all originated." Carly also stated in her interview that "I think like the Bible gives me background and shows how things came from before to now. And I think science helps describe it better, like more description with natural selection and stuff." Both of these statements indicated that Carly accepted evolution but attempted to merge it with her religious views; therefore, the questionnaire appeared to accurately place Carly at position M.

On the global warming pre-interview position list, Carly indicated that her global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This does not correspond with M-U as neatly as the evolution code, as Carly felt that humans have contributed to global warming but are not necessarily the cause. However, the assignation to position U is defensible; the second of Carly's quotes indicated uncertainty as to the extent of global warming. In Carly's case, the responses on the questionnaire placed her at position U accurately.

Sources of epistemic authority re: evolution

Carly initially stated that sources she would trust would be a cross between the Bible and science. When asked if the Bible provided a general framework and natural selection filled the framework, Carly replied, "Definitely." She considered the Bible an accurate source on evolution because

> I was just raised to believe that God created everything so that's like a foundation. It's kind of hard to knock those ideas out, but I do believe that that's where it all originated. How accurate it is, is kind of hard to tell because we always have to take that leap of faith to believe in stuff like that. But it just makes sense to me.

She did not begin to question a literal account of the Bible until recently:

> I don't know, I never even thought to question it until last year. And I don't know, my Mom, I would like ask her how things can mesh. She goes "well in the Bible God created the earth in like six days or whatever, and took the seventh day to rest." And in Sunday school we'd learn on the first day God created heaven and earth or whatever. And so it's just always been, that's what happened, I've never thought about it. And then I [thought] evolution does have good ideas. But I don't know if I can necessarily believe that.

Carly was, at the time of the interview, struggling to define a clear authority with respect to evolution:

> I have to trust that what the Bible says is true, and I want to believe it, that it's accurate, but there are things out there pointing [out] that it's not so. That makes me only believe in a certain extent of evolution because I do have my religious background and I want to believe that's right, so that's what I believe is right. I may be wrong. I hope not.

However, she did state that she thought that the "extent of evolution" – meaning the complexity of evolution – was not necessary with a creator. She felt, though, that microevolution was hard to deny:

> Interviewer: Ok. And what about the idea of microevolution? I want to go into that a little just a little bit – the idea that one species can gradually give rise to two species. Are you ok with that concept?
>
> Carly: Yea I mean if you look at like the genetics of it, it would be kind of hard to deny. It's just I don't believe it on the grand scale. I believe we are close to apes, but I find it hard to believe that we actually are from apes.

She also stated that:

> I don't think my views on anything are fully formed because I am only 19 so I don't know anything. And I think you can study as long as you want but I don't think you are going to know everything about everything. So I think there's always room to learn more.

As Carly self-identified as Catholic, she was asked about the influence of the Pope on her views:

> Interviewer: You mentioned you have a Catholic background. And what I was curious about was if you found a specific statement on evolution from the Pope or from an official statement from the Catholic from high up in the hierarchy of the Catholic church would that make a difference in how you form your views?
> Carly: If the statement were made now?
> Interviewer: If there were an official statement
> Carly: But was it a current official statement or was it made way back?
> Interviewer: Oh a current official statement, not like something from the 1500's.
> Carly: Would [the] statement be more accepting of evolution or it would be condemning it more?
> Interviewer: Either way.

> Carly: If it was more accepting of it I'd kind of [think] that makes me feel less guilty about like challenging the Bible or whatever. But I already believe in microevolution, so I don't think just because, this is going to sound bad, the Pope says that, I should believe it. But I do think that the Pope is usually a good barometer.

Here, it was made clear that Carly thought of the Pope as a generalized epistemic authority, but not one specific to evolution.

Carly did not initially mention scientists when asked what people she would use as a reference for evolution; she mentioned her father. She also mentioned that she would use "a reputable source" on the internet – reputable source being "certified by people who have actually studied evolution and have studied genetics who have room to talk, instead of people who are just on Wikipedia where you can get on and write any kind of article you want." She did not mention textbooks, but mentioned the Encyclopedia Britannica as a source for finding out more information.

Carly's main authority with respect to evolution was her religious belief. Although she was introduced to evolution recently and found the idea of microevolution valid, her views on evolution are still delimited by her belief system. She was only willing to accept evolution after she had accommodated it to her belief system; therefore, her personal beliefs were her greatest authority. Within the framework of that belief system, though, it was clear that Carly accepted the information that she heard in class. This implies that her professors and course materials were somewhat of an authority that she accepted until they came into conflict with her religious views. Carly's epistemic authorities would have to be characterized as religion, the Bible, the Pope, professors, and textbooks.

Belief/knowledge with respect to evolution

Scientific epistemic authorities made contributions to Carly's knowledge about evolution; however, as her framework for evolution views was her religion, Carly's overall views of evolution would have to be considered beliefs rather than knowledge.

Characteristics of evolution belief sources related to perception of authority

The characteristics of Carly's sources that related to the perception of their authority were that they were associated with her beliefs. Carly stated that she was raised Catholic and did not question it; therefore, her religion, the Bible, and the Pope, as parts of that belief system, were viewed as epistemic authorities. When she stated that a reputable website would be written by "people who have studied evolution," expertise and experience in the field were the characteristics that defined authorities, albeit weak ones, for Carly.

Justification of epistemic authorities used in evolution position construction

Given that Carly considered a religious text and beliefs as legitimate authorities with respect to a scientific concept, Carly's justification of the sources of epistemic authority was rated as poorly aligned. She understood that expertise and experience in evolution research was an appropriate authority, but those were clearly subsumed by her religious beliefs, as any conflict between the two was generally won by religion. Carly was also unaware of the official position of her main source; she stated a belief that the Catholic Church did not believe in evolution. This is incorrect, as the Catholic Church's official position is that evolution and religion are not incompatible (Catholic Church, 2004).

Characteristics of student related to perception of evolution authority sources

Carly's upbringing in the Catholic Church was clearly related to her perception of religion and the Bible as her authority. This most likely sprang from the upbringing by her parents; parents are themselves a very strong and generalized epistemic authority to young children (Raviv, Bar-Tal, Raviv, & Houminer, 1991). Her experiences as a student contributed to her acceptance of microevolution.

Sources of epistemic authority re: global warming

Carly initially stated that she would trust "scholarly articles found on the internet or reference books" as a source for accurate information on global warming. She described "scholarly" as an article "written by experts in the field." When asked how she would determine what an expert was in this particular case, she replied:

> I would say someone whose life has been devoted to [the] environment. I don't know what the proper major would be, but my geography professor knew a lot about it, so I don't think geography is the right word but somebody in that kind of field.

When asked what type of reference book would be appropriate, Carly said, "I don't know, just one found in the library. Encyclopedia Britannica, I think that's online. I don't know, I can't think of any specific ones." After leading Carly through a series of questions where she defined global warming as the greenhouse effect, she stated that she would find atmospheric scientists to be an appropriate source of information:

> Because I feel like that's what they are studying, the atmosphere, and I believe global warming is mainly atmospheric because it deals with the ozone stuff. So I think they would know better than like math majors and people like that. Because that's what they are actually interested in, in their study.

Carly felt that she could find reliable sources of information at a university more so than in the media, specifically because she felt that a university is a less biased environment than the media:

> Interviewer: Aside from atmospheric scientists, would you consider somebody an accurate source who put a lot of study into it? Or is it holding the major or holding the degree that's important to you?
> Carly: I would say studying also is, a person [who] does a lot of studying on the subject matter would be good, but it just depends on where they get their information. Because if they are just getting it from the news, and the news, I believe, is biased. If you're studying at a university, the university, I believe, has no personal gain in whether you believe global warming is manmade or it's an environmental factor. So I think they are just going to present you with the facts that have been discovered.
> Interviewer: You said that the university has doesn't necessarily have a personal gain in whether you actually believe something or not, right?
> Carly: I don't believe it does, no.
> Interviewer: Ok. So can you quickly define what you mean by bias for me?
>
> Carly: Some news stations are more inclined to believe it's like manmade [and are] Democratic. But I don't know, I'm not too political. And then Republicans [claim] it's a natural effect and blah, blah, blah. So I think more Democratic sources are going to be telling you how its our fault and more Republican sources are going to tell you how it's nothing to worry about. It just depends on where you get your information because they are going to want to only present the facts that support what they believe. So that's how you end up getting a biased opinion, no matter even if you are not intending to.
>
> Interviewer: Ok. And so is this what you feel, a relative sort of lack of bias, is this what generates trust for a source for you?
>
> Carly: Yea. Because I feel sources [are] really trustworthy if [they don't] have any invested interest in the matter, [they say] this is what's going on in the world.

Carly did not have much more specific detail about the sources she would find reliable for information on global warming. She stated that she would take more classes if she wanted to find out more about global warming, and also said that she would advise

someone else to do the same. This carried the implication that she found university professors and/or their classroom materials to be a valid source of information. She also stated that the scientific method was inherently biased, in that questions may be asked in such a fashion as to lead to a desired conclusion, but thought that scientists offset that bias by making their experiments as "neutral and unbiased one way or the other as possible."

Carly's epistemic authorities with respect to global warming were atmospheric scientists, or other researchers who specifically study global warming. She felt that they would be appropriate sources of information, so long as she felt that the scientists did not have an agenda to prove or disprove humanity's role in global warming. She also seemed to view her professors and course materials as authorities, as she stated that she would advise someone else to take classes in order to increase their knowledge of global warming. She was also cognizant of the limitations of specialists in science. Therefore, Carly's authorities with respect to global warming would appear to be atmospheric scientists or other scientists studying global warming, professors, and course materials.

Belief/knowledge with respect to global warming

As her views of global warming were influenced by scientific sources, specifically those engaged in research related to global warming, Carly's views of global warming would have to be considered knowledge rather than belief.

Characteristics of global warming knowledge sources related to perception of authority

The characteristics of Carly's sources that related to the perception of their authority were that they had expertise and experience in a scientific field relevant to global warming.

Justification of epistemic authorities used in global warming position construction

Given that Carly considered not only scientists, but required a field relevant to the study of global warming, Carly's justification of the sources of epistemic authority was rated as very well-aligned. She understood that expertise and experience in global warming research was an appropriate authority, and also understood that scientists in other fields would not necessarily result in expertise with respect to global warming.

Characteristics of student related to perception of global warming authority sources

Carly's emphasis on her college education – she did dual enrollment her senior year of high school in order to attend college early – most likely had a favorable effect on her view of university scientists. Although from tone of voice during certain statements in the interview, Carly appeared to be a Republican, she did not adopt a hard-line conservative political stance with respect to global warming. This was a contrast with Bryan, whose political position influenced his views of global warming.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did exist in Carly's positions on evolution and global warming. She did seem to trust her professors implicitly, and did seem to trust course materials as well. However, Carly's religious views impinged on her acceptance of evolution, and weakened the epistemic authority of scientists, professors, and course

materials with respect to evolution, while global warming remained free of this religious challenge to her views.

Fred

"Fred", Description

Fred was a 19-year-old male underclassman, self-identified as Caucasian, and did not state either his religious or political identity at the time of the interview.

Fred, Questionnaire

Fred's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 17 shows the quotes used to assign Fred to position M-NA in the grid.

Table 17. Selected supporting quotes placing Fred at position M-NA.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution and attempts merging with religion	I think evolution is a realism & may lead to further questioning of God due to curiosity. I think some people need God to be moral. I believe we are all connected to each other & the earth & a higher power is guiding us through coincidence.
Anthropogenic global warming is not occurring	I think global warming is happening but it is natural due to the earth's cycle around the sun. We are closer now. Learned it in Geology.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Fred's position was that "I believe that evolution occurred, and that the evolution of species can be explained without assigning a role to God in any fashion." Fred had been placed at position M mainly

because of the second response shown in Table 17. However, there were many positions on the pre-interview position list that represented a merging of evolution with religious reflect his views, and in his case, the questionnaire did not accurately place his evolution position. Therefore, Fred was reassigned to position AE-NA.

On the global warming pre-interview position list, Fred indicated that his global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This corresponded more closely with U than the evolution code, as Fred felt that humans have contributed to global warming but they are not necessarily the cause. The assignation to position NA is defensible; one of the global warming positions that Fred did not choose is that humans are primarily responsible for global warming. In Fred's case, the questionnaire appeared to place his global warming position as NA accurately.

Sources of epistemic authority re: evolution

Fred initially stated that sources he would trust would be "someone who is highly educated. I suppose a book that's been reviewed by many highly educated people." When asked what he meant by "highly educated," Fred said:

> I guess the person I talk to about this stuff is one of my [high school] professors who graduated from Yale and I consider him highly educated. So definitely graduated college and someone who has a unique interest in the subject… not from a religious standpoint.

He further elaborated that he would want credentials from someone whom he would consult for information about evolution:

> Interviewer: …if you were to consult somebody in terms of information on evolution, is it important to you that they have a certain type of degree or that they work in certain field?
> Fred: Yeah.
> Interviewer: can you go into –

Fred: someone who's studied biology to an exhausting extent. I guess someone who knows how to reason within reason.

When asked what other sources he would use if he was interested in adding to his understanding of evolution, Fred said:

I think my [university] biology teacher seems to be very knowledgeable on the subject, even though we haven't [covered evolution] – we've been building up to it – but he certainly knows his stuff. I'd probably check out the library online database. I would, if I were really, really wanting to talk to different people about evolution, maybe get their biased opinions on whatever, then I would ask him who's another good person to talk to or who's someone that completely does not agree with you about anything. And I could talk to that person. I mean it really just depends on what it is I'm curious about. I'd probably [go to] my [university] anthropology teacher; we discuss that quite a bit, evolution.

When Fred was asked how he would distinguish between different sites on the online database, he replied:

Fred: I wouldn't limit myself. I would expose myself to as many sources of information as possible, in order to get a good understanding, or something that's pretty important.
Interviewer: Okay, so a variety of sources expressing a variety of viewpoints.
Fred: Sure. I would look at them all. It would take time, but.
Interviewer: Can you think of a decision making process that you go through to say 'this is valid, this is not valid'? What about those sources that tend to be convincing –
Fred: Extreme views. By looking at everything, I would eventually figure out the lefts, the rights, and the middles. I would probably end up blending things from here and here and eventually arrive at my own conclusion even though it wouldn't be a conclusion because it would still be susceptible to change.

When asked how he would advise someone without a lot of knowledge about evolution to get information, Fred replied:

I would honestly say take a class. The only way you can really be exposed to that kind of subject matter is through someone whose field is that exact thing.

Although there was a clear desire to appear open-minded – whether to himself or to the interviewer cannot be distinguished – as evinced by stating that he would look into extreme views, the common current in Fred's statements was expertise in the field. He considered his high school teacher an important influence in his thinking, and spoke about his teacher's education at Yale; in fact, he said, "I just feel like studying his tush off at Yale has helped that process along as far as him being credible." Fred was not only impressed by the degree his high school teacher gained, but the prestige of the setting in which the teacher gained it. Fred would also direct others to individuals with expertise – in order to learn more about the topic. It is important to separate the topic from the controversy here; Fred wished to address the controversy by consulting a wide range of opinions, but when it came to the topic, Fred would direct others to classes taught by "someone whose field is that exact thing." This is a clear indication that Fred considered individuals with degrees and/or careers in evolution to be the authorities with respect to evolution.

Fred's high school teacher's influence was not just limited to evolution:

> Interviewer: So what other sources what other topics besides evolution did you find this professor useful for?
> Fred: I guess the higher power topic – bioethics, different ways of looking at thing, such as utilitarianism, Kantianism, rights-based, just different ways of arguing things. Life in general.

In Fred's case, his biology and anthropology professor were domain-specific authorities and his high school teacher was a more generalized authority, and as this professor was the first individual who came to mind when asked about sources for evolution, a strong one. Additionally, Fred considered individuals who disagree with those sources as less than reliable (italics added for emphasis):

> …if I were really, really wanting to talk to different people about evolution, maybe get their biased opinions on whatever, then I would ask [my biology teacher] … who's someone that completely does not agree with [my biology teacher] about anything. And I could talk to that person.

Belief/knowledge with respect to evolution

Both generalized and domain-specific epistemic authorities made contributions to Fred's knowledge about evolution. These authorities had specific credentials applicable to evolution. His high school professor had a degree in biology from Yale, and the professors were faculty at the Tier I research institution that Fred attended and therefore necessarily were part of the publishing academic community. As the latter sources were part of the peer review process, and the former received training in a research university, Fred's authorities would almost certainly be considered knowledge rather than belief sources.

Characteristics of evolution knowledge sources related to perception of authority

As previously stated, expertise in biology was the characteristic that defined authorities with respect to evolution for Fred.

Justification of epistemic authorities used in evolution position construction

Given that Fred considered individuals with expertise and experience in biology to be legitimate authorities with respect to a biological science concept, but did not specify research specifically in evolution, Fred's justification of the sources of epistemic authority was rated as somewhat well-aligned. He understood that expertise and experience in biology was an appropriate authority, and assumed bias in those who disagreed with those authorities.

Characteristics of student related to perception of evolution authority sources

Fred's educational experiences were clearly related to his perception of his instructors as his authority; the teacher whom he encountered in high school was an important influence. Beyond this, it was difficult to assign Fred's perceptions of authorities to any other characteristics; Fred did not mention religion, political affiliation, or his upbringing; rather, he focused specifically on his education in assigning authority.

Sources of epistemic authority re: global warming

Fred immediately mentioned a variety of potential sources for information on global warming that he had encountered:

> I guess what I hear the most is [from] the scientific community [by] being in geology class [and] being in natural resource conversation class. Those are the places I'm most exposed to information on global warming. It's certainly in the movies, it's in the media, but as far as what I think about global warming it's going to be more looking at information that's been collected. I know there's a some kind of panel, I can't remember, [the] U.S. government did a bunch of graphs and collected a bunch of data about different emissions and different things and compared it and put it up against the population - that was [in] geology class [where] I was exposed to this.

After a brief exchange that established "the panel" as the IPCC, Fred stated that

> I think that they're definitely collecting credible information… When you look at that kind of data it's [firsthand]. You can figure out how they collected their data, or if they did something wrong, or the processes that they used to go from a to b. But when the [IPCC does] some kind of study like that, I think that like it's pretty legitimate. There are a lot of highly educated people, I would think, working on that kind of research.

Fred was then asked to distinguish between the sources he mentioned:

> Interviewer: You did mention, actually, a variety of sources. You mentioned media and movies and the IPCC. If given a choice between those three with different positions, which one of those would you trust for accurate information?

Fred: Definitely that panel.
Interviewer: So the IPCC, then.
Fred: Sure.

Fred was asked to elaborate further about accuracy of sources:

Interviewer: So the next question I would generally ask would be, why would you consider these sources accurate, but you talked about collecting credible information, how the data are collected, and working on research. Are those aspects the things that generate trust for you in terms of the IPCC or is there additional – ?
Fred: I would look at their graphs and maybe compare them to someone else's graphs, and I would think that would be very strong correlations between the two. But I'm definitely someone who likes to check up on my information, whether it's asking the teacher after class, 'when was that graph generated?' and she [says] '1991' [and I say] 'It's 2009.'
Interviewer: So current as well as accurate – ?
Fred: Current. You need the current data and you need to compare to past data just to see the change. Because that's what warming is, a change.

Fred then mentioned expertise, and defined it through a series of questions and answers:

Fred: I want someone who knows what they're doing to be out there in the field collecting the data that we're going to eventually be making probably pretty big decisions off of.
Interviewer: Tell me how you know that somebody knows what they are doing.
Fred: …someone who's been in the field for awhile, someone who's an expert and that type of thing.
Interviewer: Define expert for me.
Fred: Experience.
Interviewer: Experience doing what?
Fred: Collecting data. Someone who's been in the field awhile and has previously collected data on maybe similar topics.
Interviewer: What about publications?
Fred: Right, but what about them?
Interviewer: A lot of people can collect data but not all the data is going to get published. So you talked about peer evaluation and you've talked about data collection and the peers evaluate how the data are collected. So is somebody having a publication record [an] important consideration for you?
Fred: Yeah, I would think someone who has been in the field a while and is an expert has published things in the past.

As the "scientific community" had been mentioned, Fred was asked about the importance of consensus in the scientific community:

> Interviewer: Is [a] consensus position of importance to you? Does that guide you in making a decision?
> Fred: It's important. You could probably say that if the majority, say 90% of the people in the scientific population, is all saying no, this is not happening, then I would probably take you for your word.
> Interviewer: ok.
> Fred: But yeah, I think there's probably a general consensus that global warming is occurring and anthropogenic factors are increasing the rate [at] which everything [is] occurring.

Fred, when asked, did indicate that his sources for global warming were not generalized authorities:

> Fred: The IPCC… their purpose is collecting research on this particular topic, so I don't look to them for anything other than global warming, no.

When asked what sources he would consider using to adding to his understanding of global warming, Fred replied:

> I would go to my professors who introduced me to these sources to begin with. I would ask them. Once again, I'm going to say the library, because I feel [that] there's probably a pretty good history [in] their collection, books about the topic, because I'm really gung ho about getting to know as much as I can about it. I can remember my geology teacher in the past saying that a particular orbit that the earth is going in, every, I don't know, it's thousands, couple of thousand years, shifts a little bit closer to the sun and we're in that period. So yes, naturally the planet is warming because we are in that period, but humans are definitely doing a lot to increase the rate [at] which the global warming is occurring.

One point to be made is that, despite his acknowledgment of the IPCC as experts, Fred appeared to trust his professors more than the IPCC; it appeared that Fred's professors assigned natural cycles more of a role than anthropogenic factors, and this was reflected in Fred's views. One possible reason for this is that Fred trusts people with

whom he has direct contact to a greater extent than people with whom he has none, but this is purely speculative.

Belief/knowledge with respect to global warming

Domain-specific epistemic authorities made contributions to Fred's knowledge about evolution. These authorities had specific credentials applicable to global warming, but Fred specifically stated that he would not consider them an authority on other topics. Fred's professors in his geology class and natural resource conversation class were faculty at the Tier I research institution that Fred attended, and therefore necessarily were part of the publishing academic community. The IPCC was, of course, part of the publishing academic community. As these sources were heavily involved in the peer review process, Fred's authorities would almost certainly be considered knowledge rather than belief sources.

Characteristics of global warming knowledge sources related to perception of authority

As previously stated, expertise in global warming research was the characteristic that defined authorities with respect to global warming for Fred.

Justification of epistemic authorities used in global warming position construction

Given that Fred considered individuals with expertise and experience in global warming to be legitimate authorities with respect to a geological science concept, Fred's justification of the sources of epistemic authority was very well-aligned. He understood that expertise and experience in global warming research was an appropriate authority.

Characteristics of student related to perception of global warming authority sources

Fred's educational experiences were clearly related to his perception of his instructors as his authority. Beyond this, as with his perceptions of evolution authorities, it is difficult to assign Fred's perceptions of authorities to any other characteristics; once again, Fred did not mention religion, political affiliation, or his upbringing; rather, he focused specifically on his education in assigning authority.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did exist in Fred's positions on evolution and global warming. He did seem to trust his professors implicitly. The epistemic authority of scientists and professors was very strong with respect to both evolution and global warming. Additionally, Fred did not consider either religious or political figures as authorities. Fred was more specific in his requirements for global warming authorities than evolution; this may have been influenced by how much he valued his high school bioethics teacher – an individual not involved in peer-reviewed research – as an authority with respect to evolution.

Genevieve

"Genevieve", Description

Genevieve was a 20-year-old female underclassman, self-identified as Caucasian, and did not state either her religious or political identity at the time of the interview.

Genevieve, Questionnaire

Genevieve's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 18 shows the quotes used to assign Genevieve to position AE-AGW in the grid.

Table 18. Selected supporting quotes placing Genevieve at position AE-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution without attempting merging with religion	Sorry to put this so bluntly but, religion is not a fact and will never be a fact. It can't be proven or tested, which is a vital part of the scientific theory: SUPERSTITION cannot prove anything.
Anthropogenic global warming is occurring	Global warming is definitely happening but skeptics don't "believe" that it is human made, it's just a natural change in the Earth's climate.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Genevieve's position was that "I believe in evolution, and also believe in God. I think God played a role in evolution, but was so subtle that we can't detect that role." Genevieve had been placed at position AE mainly because she referred to religion as "superstition," as seen in Table 18. Notes taken before the interview indicated that Genevieve asked if that option allowed for completely naturalistic explanations of evolution; e.g., if that statement would allow her to express a belief that God exists but that belief did not interfere in any fashion with evolutionary theory. Because this was a separation of her belief from her views of science, rather than a merging of her beliefs with science, Genevieve was correctly placed in position AE by her responses on the questionnaire.

On the global warming pre-interview position list, Genevieve indicated that her global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This did not appear to correspond as closely with AGW as her questionnaire response; however, at the very beginning of the interview, Genevieve stated that "I think it it's naturally a very little bit and humans have accelerated it a lot. It's mostly humans, but there is some sort of

natural causes going on." In Genevieve's case, the questionnaire appeared to place her global warming position as AGW accurately, as she considered humans the main source of global warming.

Sources of epistemic authority re: evolution

Genevieve initially stated that sources she would trust would be "textbooks and researchers and scientific journals, anything scientifically proven [with] good resources." When asked what she meant by "scientifically proven," Genevieve engaged in an exchange demonstrating that she saw peer review as trustworthy:

> Genevieve: Well, nothing can be proven. Anything that has good resources and a good background check.
> Interviewer: And what would you define as a good background check?
> Genevieve: A peer reviewed journal would be a good example. Anything that has more than one person approving it.
> Interviewer: So why would you consider any of these sources accurate?
> Genevieve: I guess because these are people that have studied it and they might have different views, but if they all agree on it, then there is at least something that they all agree with. So I guess I just believe that because a group of people [are] saying this is what they believe and they've done this amount of research to prove it.

This trust was also mentioned when she defined accurate in the context of the interview:

> Interviewer: Well, I asked earlier what sources you would trust for accurate information on evolution, so I wanted to backtrack a little bit and ask you in that context how you would define accurate.
> Genevieve: I guess [the] same thing. Accurate would be how well their research and explanation go with what other people in the scientific community say, and to be accurate, I think you have to have sufficient evidence to back it up.

She then went on to define the scientific community:

> Interviewer:So who would you consider to be the scientific community?
> Genevieve: People who research this.

Interviewer:And research what?
Genevieve: Evolution and the theories of evolution and anything that has to do with it.
Interviewer: How about somebody like a theoretical physicist, who most people would [identify as] part of the scientific community? Would you consider them to be an accurate source of information regarding evolution?
Genevieve: No.
Interviewer:Tell me why not.
Genevieve: Because they do not work with evolution. They don't work directly with it. They could have good opinions, but they wouldn't exactly be the most accurate source. Just because there are people more closely connected with it than they would [be].

Genevieve then identified the characteristics of an evolution researcher:

Interviewer: So basically we're back to pretty much the community of scientists that work or do research on evolution. So what about them make them useful for your position on evolution?
Genevieve: Well they've been to lots of school, they've done a lot of research. They, I don't know, they just seem like they are more educated on the subject matter.
Interviewer: And do you have sort of a threshold of education that you would consider to be high enough for somebody to be part of the scientific community? Let me rephrase that. I'm asking what level it takes for you to really say this person's an authority on evolution, is it a bachelor's, a master's, a PhD, or [does] somebody actually have to be actively doing research?
Genevieve: I think somebody has to actively being doing research. Because science is an ever changing subject matter, so if somebody has their doctorate from 30 years ago on evolution, they could be totally off [with respect to] the modern stuff.
Interviewer: So does this mean that you would not consider Darwin an expert on evolution?
Genevieve: No not really. He started it, but I think it's the same thing as saying Benjamin Franklin is an expert on electricity.

When asked if she considered the community of evolution researchers to be useful for any other topics besides evolution, Genevieve replied:

Yeah, of course. The more that they understand about where, especially humans, what they evolved from, I think that could play an important role in medicine and understanding [the] human genome and stuff like that.

Genevieve also considered biology teachers as legitimate sources with respect to evolution:

> Interviewer: So we've talked about the main source that you consider Useful, which is the scientific community that's directly involved with evolution research. What other sources do you think you'd consider useful for adding to your understanding of evolution?
> Genevieve: I guess biology teachers, because they've done a lot. They've obviously, most of them have formed their own opinions from these researchers, and they're kind of a good intermediate so you don't have to go read a bunch of stuff. And they can just read it for you. And you can make your opinion from them.

It is important to note here that Genevieve considered biology teachers to be legitimate sources on the presumption that they had formed their own opinions from the primary authorities; she obviously considered teachers a secondary authority. Genevieve also trusted literature produced by evolution researchers, and was careful to emphasize that textbooks and popular science books should carry the imprimatur of the scientific community, although she did insert a caveat:

> Interviewer: Ok. So the literature that evolutionary biologist produce is, of course, primary literature in scientific journals. Would you consider that to be the absolute top source on evolutionary theory?
> Genevieve: Yes.
> Interviewer: So [would you consider] textbooks that are made from those journals [to be] also a good source?
> Genevieve: Yes.
> Interviewer: But if you saw something that called itself a textbook, how would you consider that textbook, what would make that textbook a legitimate source for you?
> Genevieve: I guess it would [be] who published it and who wrote it, and if they are qualified scientists.
> Interviewer: And again with qualified scientists, we're back. So I'm wondering where you kind of draw the line between something that is – how do you personally tell something you consider to be a good source versus something that's not? Let's say you run into a textbook, or a popular science book, or you see somebody on television talking about these things. What are the kinds of things you look for to say, 'I'm going to buy what this book or this person is saying'?

Genevieve: If they said something that I already agreed with then I would probably be more inclined to listen to what they had to say, and probably even change my opinion with what they said in that segment.

In addition to defining what she considered as an authority, Genevieve also mentioned what she did not consider to be a legitimate source on evolution: religion.

Genevieve: I think my very first reason I believe in evolution is because I'm sort of rebellious, because I had to go to Catholic school for 12 years. And I got told creationism was correct, but I didn't really believe that, because, I don't know, the Bible can be kind of weird. I don't really think Noah had an ark and stuff like that. And then also like they [scientists] give you facts and you can see it today, especially as far as with people, with DNA compared to primates' DNA and you can see exactly, I think it's chromosome 4 that had whatever effect [it] had. You know what I'm talking about?
Interviewer: Yes, I do.
Genevieve: So I mean there's definite examples, very concrete evidence.

[later in interview]

Interviewer: I'd like to talk a little bit more about what you said earlier in the interview, that part of the thing that got you started with your particular views was having gone to a Catholic school and hearing about creationism and the Bible. I'd like to hear you talk a little bit more about that. What were the kinds of things that made you say 'I'm not really sure I buy into this and I'm going to look somewhere else for answers when it comes to things like diversity of species and so forth'?
Genevieve: Well, I believe in the Bible. I believe in God and I believe that there is some connection between God and the Bible, but I don't really think that Catholics are supposed to be taught that the stories in the Bible actually happened. And I kind of think that the stories are supposed to be fables, and so from that I kind of think that Genesis was sort of a fable. And really crazy things happened in the Bible that aren't really probable, but I was also taught that things like with stories in the Bible happened, but not exactly like the way that they made it sound. For example, when Moses like split the Red Sea, it could have been a typhoon or something like that, some sort of storm that made it look like it was split, stuff like that. I think that natural occurrences could have caused these stories, so that's why I kind of think Genesis was a [fable] instead of God actually created the world in 7 days and took a rest and that kind of thing.

Interviewer: Well, at a certain point, you've talked about uncertainty with some of the stories in the Bible, and so when you started looking for other answers, what was it about science that appealed to you to have an answer for that?
Genevieve: Well, science can prove, they can say we think this, and this is why. And I guess I'm just one of those people that needs a reason to believe things.
Interviewer: So you would say evidence and reasoning is important to you.
Genevieve: Yes.

Genevieve defined her authorities as the scientific community, and within that community, researchers specifically concerned with evolution. Any other source – journals, textbooks, or biology teachers – had authority only if their claims originated with the scientific community. Genevieve also did not consider religion an authority at all; even in early experiences with religion, she did not treat it as literal truth.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Genevieve's knowledge of evolution could be considered fairly domain-specific, but strong. These authorities were useful to Genevieve for a very limited range of subjects related to biology, but were strong enough authorities for them to influence how Genevieve viewed other sources (e.g., biology teachers and textbooks). Within that range, Genevieve had very specific requirements of them: they must be actively involved in current peer-reviewed research on evolution. As these sources would most likely be what the scientific community would consider the authoritative sources on evolution, Genevieve's sources mostly constituted knowledge, rather than belief. However, one caveat should be noted: Genevieve stated that if a source said something that she agreed with, she could be persuaded to change her mind on another subtopic by that source. This demonstrated a confidence in her own judgment; therefore, there was the potential for encountering

sources that "felt right" by making connections with prior knowledge, but made claims that were not originated by the scientific community.

Characteristics of evolution knowledge sources related to perception of authority

As previously stated, active involvement in current peer-reviewed research on evolution, or claims originating from current peer-reviewed research on evolution, were the characteristics that defined authorities with respect to evolution for Genevieve. Again, the lone exception to this would be a source not necessarily originated from the scientific community that was appealed because of its connections with prior knowledge.

Justification of epistemic authorities used in evolution position construction

Given that Genevieve considered individuals be actively involved in current peer-reviewed research on evolution to be legitimate authorities with respect to a biological science concept, Genevieve's justification of the sources of epistemic authority was very well-aligned. She understood that active involvement in current peer-reviewed research on evolution was an appropriate authority, and rejected claims by who disagreed with those authorities. Even her lone caveat was somewhat reasonable; a source would have to make claims that agreed with prior knowledge for her to accept it on face value.

Characteristics of student related to perception of evolution authority sources

Genevieve's educational experiences were clearly related to her perception of evolutionary biologists as her authority. A teacher whom she encountered in high school was an important influence:

> Interviewer: [What was] that first experience where you said, 'ok this is science and well this makes sense to me'? I'd like to hear about some of your early experiences like that.
> Genevieve: We all had science classes all through grade school, but those were kind of just memorizing facts, I guess, and when we really

started actively learning wasn't until my sophomore year of high school.

Interviewer: And what was it about that sophomore science class that makes you focus on that?

Genevieve: I think it was my teacher. She was kind of crazy. She really put things into very vivid terms that made you just think about them.

Interviewer: Can you give me an example?

Genevieve: Let's see, instead of just showing us pictures, she made us make a DNA model out of noodles. And just kind of hands-on things like that, and she would give examples that we could grasp… she would give real life examples that made it easier to understand what she was talking about.

Interviewer: And so tell me, in this class did you see science – you mentioned earlier that science classes had been sort of content and memorizing and that kind of thing – did you first start to see science as a process in this class?

Genevieve: Yes.

Interviewer: How important was that in forming your views of the legitimacy of science?

Genevieve: It was pretty important because it taught me that science isn't just like a bunch of facts like history is. You have to be really open-minded and be prepared to accept change if it becomes available.

Beyond this, it was difficult to assign Genevieve's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

When asked what characteristics generated that trust for her, Genevieve engaged in a dialogue that described them:

Interviewer: What is it about these people that generates the trust for you? Is it the degrees, or is the fact they are doing active research?

Genevieve: The degrees are a lot of it, because actually, active research is most of it. But the degrees are a lot of it, because I wouldn't want somebody who just kind of knows what they are doing, doing the research because they would never really get adequate information. People who have degrees know what they are looking for and know what they do to the research and what they find and they know how to interpret it.

Interviewer: So you feel like if somebody's got a degree then they've had perhaps training that puts them in a position to, I don't want to put

words in your mouth, but would you feel that this gives them training that puts them in a position to conduct accurate research?

Genevieve: Yes.

Interviewer: Ok. So of the two, what would you consider to be more important, having the degrees or actually being involved in the research? Would you consider somebody with newly minted PhD, or somebody who's got a PhD and hasn't done a lot of research, or somebody who has a bachelor's degree but is doing active research within a particular lab?

Genevieve: I would say somebody who has a bachelor's degree and they are doing active research. If they at least know a good deal on the topic and they are doing active research, then that's good enough for me because they obviously know the most modern stuff that has to do with the topic, whereas somebody who has the PhD and hasn't really been active in it may not know the contemporary findings in the topic.

Interviewer: Would you want somebody with the bachelor's degree to be involved with somebody else who has a higher degree and is actively doing research, or would that not matter to you?

Genevieve: Somebody that had a higher degree, that would probably be better. I would like that better.

Interviewer: And can you tell me what you mean by active research?

Genevieve: Research that is going on like right now, like recent research that is constantly going and has been done within the last year.

Interviewer: Ok. Would you consider somebody who is publishing too, would you consider that a necessary component?

Genevieve: Yes. Because no one can read their information if it's not published.

She then confirmed that being part of a scientific consensus was important, even more so than educational credentials:

Interviewer: Ok. So you would say it would be better to be part of a consensus than not?

Genevieve: Yes.

Interviewer: Let's say that somebody is part of a group that's working at a university like [southeastern state university] or somebody is from Stanford, would that make a difference in how much you trusted the results?

Genevieve: Yes.

Interviewer: In what fashion?

Genevieve: I would trust Stanford. Have you ever been to [southeastern state university]?

Interviewer: No, I haven't.

Genevieve: You wouldn't trust [southeastern state university], either.

Interviewer: Ok. Let's try something different, let's say, [more highly rated southeastern state university].

Genevieve: Stanford. Because Stanford is obviously funded better. And they work harder and the people that go there are generally smarter, I guess. I mean that's probably not true but seriously, the people that go there are smarter, and I mean not just me but the general public would probably believe that to be true, that people from Stanford are smarter and do better research than people from [more highly rated southeastern state university]. Anybody else around here, anyway, would say that.

Interviewer: Ok. Let's set a scenario up, then. Let's say that several groups of scientists from universities on the level of [southeastern state universities], so forth and so on have reached some kind of a consensus with research, and one group from Stanford disagrees with them and goes in a completely different direction. At that point, who do you trust? The lone group from Stanford, or the larger consensus group from universities that you might not consider to be as highly rated?

Genevieve: I would trust the larger group even if it is Stanford. Maybe they just have a small research group, and maybe they just brainwashed each other.

Interviewer: Ok. So you think that there could be one person who is off, who could be extremely influential at one place, and that would be sort of counteractive in a consensus?

Genevieve: Yes.

Genevieve then commented on the usefulness of a consensus:

Interviewer: What characteristics of the source that you've named, a consensus of scientists, what about this makes it useful to your position on global warming?

Genevieve: Well if they are all a consensus, I guess I would agree with them and then I'd have all this proof to back up why I agree with them. And then people [who disagree with me] can hear, this is why I agree, you don't have to, but look at all this research.

Interviewer: So tell me what you mean by proof.

Genevieve: The results of the research that they've done, the journals they've published, and the result they got from the research would be like a proof.

Interviewer: Would it be fair to say that you use proof and evidence interchangeably?

Genevieve: Yes.

She was then asked for a description of her information sources using a different approach:

Interviewer: If you going to try to convince somebody else of your position how would you go about doing it?

Genevieve: I would show them journal articles and textbooks with my position, with evidence of my position to them, and then I would probably show them An Inconvenient Truth by Al Gore because that's very good.

Interviewer: What criteria would you use for choosing the articles and textbooks?

Genevieve: I'd need some kind of proof [so] that somebody's going to go with my opinion. Or not.

Interviewer: And if this person you're talking to says, 'Well, that's just more of the same. So they say the same thing as you. Tell me why I should believe what they are saying.

Genevieve: Because they can give you examples, and they give you examples, and they can show you the research that they've done. And it's more proof or evidence than you just [saying] 'this is what I think.' They can actually give you evidence as to why they think that.

Interviewer: Do you think it would be fair to say, then, if you were going to try to convince somebody of your position, that you would go out and find evidence-based documents or sources that came from sources that you particularly trusted?

Genevieve: Yes.

Interviewer: so tell me about An Inconvenient Truth and Al Gore. What about that makes you trust it?

Genevieve: Well first of all it agrees with what I think, and second of all, it really has a lot of good examples in it and I think that they are trying to prove to somebody that global warming was happening. You would show them that movie because it showed really sad little animals, which a lot of people should be concerned about. It gives a lot of good points. I think people would start to realize that really is going to happen and it would make people more concerned to look further into the topic.

Interviewer: How would you respond if somebody said, 'An Inconvenient Truth, that's Al Gore and that's politically motivated'?

Genevieve: It is politically motivated to some extent, but I think that if you do research and look at some other journal articles, that a lot of them also agree with what he says in An Inconvenient Truth, and he also cites some researchers and stuff.

When asked if she would consider these sources as authorities for information other than strictly global warming, Genevieve responded that she would:

Interviewer: How about just the scientists and researchers that are strictly involved with research on issues related to global warming? What other topics would you find those sources useful for?

Genevieve: There are so many. Are you asking me the everyday uses of research? Well, of course, the temperature. Why there are so many hurricanes. Why are there so many more hurricanes than in past years? Why beaches are having to do dredging and stuff like that because the beaches are eroding. Stuff like that.

Genevieve also remarked on her trust of teachers:

Genevieve: I was going to say even if they don't really know that much about the subject, I think in general, people will trust their teachers to know so I think they should know. I think if they are going to teach a certain opinion or a certain subject or topic, they should do their research and look at things that could help their cause.

Interviewer: Ok and would you say this about just the teachers that you've had or would you expand this to include most teachers or all teachers?

Genevieve: All teachers.

Interviewer: You gave similar answers with respect to teachers in both interviews and I'm wondering when, where, how your opinion of teachers was formed.

Genevieve: I just had it most of my life. It starts out when you're really young. You are told that teachers have this authority and as long as teachers don't break your trust, which probably until you're in about middle school, it's pretty hard to break a little kid's trust. It only takes one teacher to ruin a person. I think little kids are really easy to manipulate – not manipulate, but easy to get them to believe what you want them to believe, and they're obviously going to trust their authority figure, just like little kids trust their parents. And most big kids trust their parents. So yeah, I guess that's where my trust for teachers came from.

Genevieve defined her epistemic authorities with respect to global warming as the scientific community. Unlike her evolution interview, Genevieve placed a heavy emphasis on consensus within that community. The community consisted of researchers specifically concerned with global warming. Any other source – journals, textbooks, or An Inconvenient Truth – only had authority because Genevieve felt that their claims resonated with the majority of the scientific community.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Genevieve's knowledge of global warming could be considered fairly domain-specific. These authorities were useful to Genevieve for a very limited range of subjects related to global warming and climate. Within that range, Genevieve had very specific requirements of them: they must be part of a consensus actively involved in current peer-reviewed research on global warming. As these sources would most likely be what the scientific community would consider the authoritative sources on global warming, Genevieve's sources mostly constituted knowledge, rather than belief.

Characteristics of global warming knowledge sources related to perception of authority

As previously stated, being part of a consensus position in peer-reviewed global warming research was the characteristic that defined authorities with respect to global warming for Genevieve.

Justification of epistemic authorities used in global warming position construction

Genevieve considered individuals who are actively involved in a consensus position in current peer-reviewed research on global warming to be legitimate authorities with respect to a geological science concept; therefore, Genevieve's justification of her sources of epistemic authority was very well-aligned. She understood that an individual actively involved in current peer-reviewed research on global warming was an appropriate authority.

Characteristics of student related to perception of global warming authority sources

Genevieve's educational experiences were clearly related to her perception of her instructors as her authority:

> Interviewer: Do you remember first developing your opinions about global warming?
> Genevieve: Probably some time in high school.
> Interviewer: What, if anything, do you think would be the main source or spark for your position?
> Genevieve: Al Gore and the Inconvenient Truth.
> Interviewer: Did you have any opinion about it one way or the other before then?
> Genevieve: Yeah. I mean I kind of knew what it was, and I knew that I was told it wasn't good, but I didn't really didn't know what it [was or] what its consequences were. So I hadn't really formed an opinion.
> Interviewer: Where did you encounter the movie for the first time?
> Genevieve: 10th grade at school.
> Interviewer: And so one of your teachers introduced it?
> Genevieve: Yes. I had to watch it.
> Interviewer: You said had to watch it. Were you particularly interested in seeing it before [then]?
> Genevieve: Not really.
> Interviewer: Tell me about this teacher.
> Genevieve: She was kind of crazy. She was very opinionated and I don't really know if she wanted us to believe her opinions, but she definitely wanted to share them with us.
> Interviewer: And how convincing did you find her?
> Genevieve: She was pretty convincing.
> Interviewer: What was it about her that made her convincing?
> Genevieve: She was very obnoxious and if you didn't at least pretend to agree with her, she was going to continue to get obnoxious.
> Interviewer: If she had not been so insistent – I'm just wondering what characteristics of this teacher made you decide that she knew what she was talking about.
> Genevieve: Well, she obviously did back up what she said with articles and in the textbook. And she taught us a lot of information that obviously is true, normal stuff you learn in 10th grade. Her teaching us stuff like that probably made it easier for us to believe what she was saying. Because like if you trust like your teachers, you don't think they're going to tell you something totally off the wall wrong.

These experiences, along with her statements about generalized trust of teachers, predisposed Genevieve to trust teachers as an early authority, and scientists were imbued with authority because her teachers endorsed that view. As Genevieve grew older, that trust reversed (e.g., teachers got their authority from scientists rather than the other way around), but this is entirely consistent with teachers losing their generalized authority as children get older (Raviv, Bar-Tal, Raviv, & Houminer, 1991).

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did exist in Genevieve's positions on evolution and global warming. The epistemic authority of scientists was very strong with respect to both evolution and global warming. Teachers also served as early, more generalized authorities. Additionally, Genevieve did not consider either religious or political figures as authorities.

Hazel

"Hazel", Description

Hazel was a 19-year-old female underclassman, self-identified as African-American, identified her religious identity as Christian, and did not state her political identity at the time of the interview.

Hazel, Questionnaire

Hazel's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 19 shows the quotes used to assign Hazel to position RE-AGW in the grid.

Table 19. Selected supporting quotes placing Hazel at position RE-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Rejects evolution	The Bible is a symbol of what is to come in the life of Earth so trying to base it on the scientific method is useless. I feel the scientific is useless then since future happenings are already outlined in the Bible.
Anthropogenic global warming is occurring	The effects of global warming will continue to become worse as time goes on and it's thanks to the politicians that decided to ignore the issue of global warming.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Hazel outlined her own position: "God created Adam and Eve but has not intervened with creation since then. There were 2 creation events, 1 at 4.5 billion years ago, then again for humans around 150,000 years ago; creation events coincided with the fossil record." Hazel had been placed at position RE mainly because she flatly rejected "the scientific" in favor of the Bible, as seen in Table 19. However, Hazel did not espouse a literalist view of the Bible, and merged her religion and science in her position. Because of this, Hazel was reassigned to evolution position M. The questionnaire did not accurately provide Hazel's evolution position.

On the global warming pre-interview position list, Hazel indicated that her global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This did not appear to correspond as closely with AGW as her questionnaire response; however, at the very beginning of the interview, Hazel stated that "I think it it's naturally a very little bit and humans have accelerated it a lot. It's mostly humans, but there is some sort of natural causes going on." In Hazel's case, the questionnaire appeared to place her global

warming position as AGW accurately, as she considered human technology the main source of global warming (supporting quotes later in text).

Sources of epistemic authority re: evolution

Hazel initially mentioned fossils when asked what she would trust for accurate information on evolution, but her interest in fossils was sparked by her educational experiences:

> Interviewer: Hazel, what sources would you trust for accurate information on evolution?
>
> Hazel: I would say fossils. Also looking at – because I know when I took biology we were looking at – genes of certain mammals and animals, about how they evolved over time, what different traits have changed, that's another thing.
>
> Interviewer: So where did you learn about the fossils that are used as evidence in evolution?
>
> Hazel: A while back. I can't even remember. It was elementary school because we used to make our own fossils and stuff, and she would tell us how you can look at it and see where it came from and distinguish [whether it was] a dinosaur or a plant. And I think by looking at that, especially seeing where the rock came from, it also tells what time period that this came from, which is why I know how they can tell when dinosaurs [were alive] and how long ago was it.
>
> Interviewer: Ok. So obviously this information comes from somewhere and so I'm wondering, you found out from the elementary school about the rocks, about fossils, about genes. Have you actually gone out collecting fossils?
>
> Hazel: No, I haven't.
>
> Interviewer: So I'm wondering where you learned about fossils, and so I think it sounds to me that you trusted those sources for information to say 'this is a fossil. And these are the right genes.' So where did you learn about that?
>
> Hazel: Well, biology recently is the one that really helped me with genes, understanding how about looking at how animals have evolved

over time, the differences and what they carry. And then, fossils really [were] resources from teachers, what I've learned in school, and how they say that scientists have discovered this.

Hazel then elaborated on reasons for considering teachers, textbooks, and scientists as accurate sources for knowledge about evolution:

Interviewer: You mentioned scientists, teachers and textbooks, so would it be accurate to say that you trust those sources for accurate information?
Hazel: Yes
Interviewer: So why do you consider these sources accurate?
Hazel: Teachers for the most part, especially at the college level, I would say I trust them more because they've had so many years of education. They've learned from other people that probably had more knowledge than them. And so I feel like they are accurate source[s], especially since they are here to educate me and I'm not here to educate them. And then textbooks, they are written by professionals; usually, all of them are professionals. I just trust what they are saying because they've done research and, they've actually went out and found these, had these findings somewhere, and they elaborated on them by doing tests. And then what was the other one said, I can't recall.
Interviewer: Scientists.
Hazel: Scientists. They do the scientific method, they make hypotheses, they test, they perform – they have results, and they can even argue against their own results saying, why this was not what we expected, what was something we did expect. And I think with the fact that they can play both sides of what they thought the answer might be, it just shows their intellect and what they could accomplish with how they explain what their thoughts used to be.

Hazel also mentioned the media as a potential source for information on evolution, but with a caveat:

Hazel: Usually, I trust nationwide news more than I would local. But I think local feeds off the nation's news anyway, because I know from my local newscast [that] they usually get feed from ABC and play it. And usually, they use different interviews with doctors [and] scientists, and I think that makes me trust it because I see the scientists – I see that they're the ones telling us that, so it's not just like they are coming out of nowhere with it.

Interviewer: So would it be fair to say that in order for you to trust a media report about something with a particular scientific topic that they've got to call in someone with some expertise?
Hazel: Yes.

Hazel defined expertise:

> Somebody who usually has their PhD, not necessarily, because I know my Mom has a master's, and she's pretty intelligent in her field. I also think that's high for someone because usually most people get a bachelor's. And it doesn't even really have to be that. A Ph.D. helps [to] make me feel like I can confide in them, because I know they've been though all that schooling and they've learned so much. But usually, general people, too, are working toward finding evidence and such. As long as they have support to back up their claim I feel like I can trust them, as long as they show me 'this is this is what the report says' and it makes sense, then I'm sure that I could believe what they are saying.

Hazel's epistemic authority with respect to evolution was scientists. Any other source – college professors, textbooks, or news media – had authority only if their claims originated with the scientific community. Hazel also apparently did not consider religion an authority with respect to evolution; she never mentioned it during the interview.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Hazel's knowledge of evolution could be considered fairly domain-specific. She largely limited the authority of scientists to science:

Interviewer: What other topics have you found scientists useful for, other than evolution?
Hazel: I know about psychology. There's plenty of science in that, like in the second part for education, they talk about a lot of different things of how the mind works and why certain children do this and some don't. Another subject like social studies, you have anthropology, anthropologists like kind of look back at history. The biggest thing is science, the field of science.

These authorities were useful to Hazel for a very limited range of subjects related to evolution; therefore, they could be considered domain-specific sources of authority.

Within that range, Hazel did not have very specific requirements of them; but she did consider involvement in research (e.g., "working toward finding evidence and such") as a necessary component in expertise. As these sources would most likely be what the scientific community would consider the authoritative sources on evolution, Hazel's sources mostly constituted knowledge, rather than belief.

Characteristics of evolution knowledge sources related to perception of authority

Knowledge originating from scientists, whether the sources using the knowledge were scientists, professors, or media, was the characteristic that defined authorities with respect to evolution for Hazel. She specifically stated that she would have to hear that a claim based in science would have to originate with an expert.

Justification of epistemic authorities used in evolution position construction

Given that Hazel considered individuals actively involved in scientific research on evolution to be legitimate authorities with respect to a biological science concept, Hazel's justification of the sources of epistemic authority was rated as very well-aligned. She understood that an individual actively involved in scientific research was an appropriate authority, and rejected claims that did not originate with the scientific community.

Characteristics of student related to perception of evolution authority sources

Hazel's educational experiences were clearly related to her perception of scientists as her authority; as seen previously, she had early experiences in elementary school "making fossils" and looking at characteristics of both what she made and of real fossils. Although she did not have direct experience with fossil collection, it was clear that this made a large impact on her views about evolution; Hazel mentioned fossils before anything else when asked what sources she would consider appropriate for

knowledge about evolution. Beyond this, it was difficult to assign Hazel's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Hazel initially stated that she would find the media an accurate source for information on global warming, but almost immediately mentioned scientists:

> Interviewer: Hazel, what sources would you trust for accurate information on global warming?
> Hazel: The news. They have it on there every day. Different articles they have written. And I know it's become like a big issue now, not as much back in the day but now, because it's more of an issue and things are happening around us. So I really would say news and articles to me are reliable sources for my information.
> Interviewer: Ok. Would you call all news articles – ?
> Hazel: I wouldn't say all. Some are better than others. And some have more support for their claim than others, so I would probably trust one that has more support for their claims over the ones who don't. Also, I would say people who are political leaders that have been discussing this issue. I can't say all, because some of them I think are just out there saying things because they are a political leader, and they are trying to make a movement. That [doesn't] necessarily mean they know everything about global warming, whereas a scientist would that's been studying.
> Interviewer: When you talk about support for the claims with the media articles, are you talking about specific evidence?
> Hazel: Yes. I would say that they have evidence from things, maybe people, scientists that have been researching it and the facts, what's been causing global warming. That's pretty much it.
> Interviewer: It sounds to me – and please do correct me if I'm wrong – the important thing for you about the news articles is that they have scientific support for their claims.
> Hazel: Yes.
> Interviewer: So would you say that the basis for that trust with the news is trust in the scientists who are providing the evidence?
> Hazel: Yes.

When Hazel was asked to why she would consider scientists to be an accurate source, she replied:

> A lot of them have been doing research, and a lot of them [have] seen the effects over the years and what's changed, and I think it give[s] them a

better idea of what may be causing the problems that we've been having. For instance, I feel that humans, that [technology] has played a major factor in the things that have been happening, because it didn't seem like this was a problem a few years back. But it seems that the biggest thing that's changed is the fact we have more technology than we used to, and not only that, but we're having we're giving birth to more and more people every day and our numbers just keep increasing.

Hazel was asked if she thought there was a controversy within the scientific community, in order to discern how she would differentiate between scientists:

Interviewer: Do you consider there to be a controversy within the scientific community about global warming?
Hazel: I do believe there is a controversy. I think there are so many different theories going around why this is happening now…
Interviewer: Let's say that you see a news report, and it's one of those news talk shows where you have people backing different sides, different opinions. And let's say that the two people who are arguing different positions are both scientists. How would you go about making a choice of which one of them to trust or to believe?
Hazel: I think that really relies on how I personally feel about the situation and I think generally people tend to side with people that have the same similarities of thoughts as they do. And so for me I don't want to lie cause I know that's just [unintelligible]. I would probably trust and confide in the person who has similar thoughts as me, just because I feel that what I believe is right. It might not necessarily be true, but since it's a debate, we don't necessarily know for sure [what] is true. So it's not like I'm wrong, but that's how I feel and that's how he feels, so I feel like I would confide in that scientist.

However, Hazel was not resistant to changing her ideas:

Interviewer: Let's say you've got two scientists again on this same sort of panel or the same sort of forum. And one of them is arguing the position that seems to be pretty similar to yours and one of them is arguing against that. Are you going to change your mind if the scientist who is arguing against your position has got what you feel to be better evidence?
Hazel: I would say yes because I have done that before. I mean I'm always willing to hear other people's opinions, and as long as they can back it up and prove me wrong of course I'll [say] 'Ok, I see your point. I can understand where you're coming from' because I've had that happen before and I had to realize that my way probably wasn't the exact answer and that some people have different

opinions that might be better than mine. So I always accepted it. I think it's constructive.

Interviewer: So it is the evidence itself that becomes the most important thing?

Hazel: Yeah. I guess that would fit instead, yes.

When Hazel was asked what other topics she found scientists useful for, she replied:

> I would say weather. Hurricanes [have] kind of gotten worse over the years, especially with Katrina coming through. And it's a concern for me, especially since my dad lives in Miami [and] that's an area where hurricanes hit most. So that's why I think it would be [a] concern not so much for [just] me, but other people who maybe be living there or people who have family living there. And then the weather, because it's getting hotter and colder and then there's snow in Georgia. It's just different things that could all relate back to global warming and technology and how it's affecting the weather.

When Hazel was asked what sources she would consider useful for adding to her understanding of global warming, she replied:

Hazel: I would say books. Books are always handy because you can always read about things from the past. [The] ice age, for example, [is] maybe something that has happened because of global warming, not necessarily global, well, yeah, global warming because – we've seen the movie The Day After Tomorrow, it shows the effects of something that could happen to earth one day. So books are always a good option to me. The news – it's always changing; it's updated every day. There [are] always new findings and they always find new things and put it on the] news so that's why we get another thing. And then articles as well. It could be scientific, or just [an] article in the paper, but usually it will come from a science. It would have some data from a scientist that supports it.

Interviewer: How would you choose between books that make claims to scientific authority that had different positions?

Hazel: You say, how would I – ?

Interviewer: How would you choose which one of those to buy into if you had two different books and [are] written by [different people with] Ph.D.s but they make different claims? How would you go about making a choice between those two things?

Hazel: [It's a] hard decision because I'm sure I would read both and understand both points of view, but I think the one to me that sticks

> out most would stick with me… but if they can get their point across and be able to support it with things I can actually believe and trust in, then I would say that would be a more reliable source even if its opposite [to] what I got before. As long as they can argue [their] point well to me, then I would be able to understand. I would trust that one more than the other.

Although Hazel stated that she trusted scientists, and she wished to see claims within media sources and books backed with scientific evidence, Hazel's perception of the scientific community's global warming position as one without consensus seemed to lessen its authority. Hazel did not mention valuing her own positions with respect to evolution, but she did with respect to global warming; there was a general sense that if an explanation "felt right," she would accept that position. When asked, Hazel stated that scientists were useful to Hazel for a very limited range of subjects related to global warming; therefore, they could be considered domain-specific sources of authority. She did specifically state that she would lean towards an expert who agreed with her position.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Hazel's knowledge of global warming could be considered knowledge in one respect; she mentioned scientists as authorities. However, her belief in controversy – one that does not have its roots in the scientific community opinion (DiMento & Doughman, 2007) – affected her views. The origin of this "controversy" is political in nature (McCright, A., & Dunlap, R., 2000); therefore, the view is fundamental to all others for Hazel does not have its origins in the scientific community, and may be considered belief.

Characteristics of global warming knowledge sources related to perception of authority

When asked what characteristics about scientists would make them useful for Hazel's position on global warming, she replied:

> I would say evidence that they have. I guess, the way they could put it in words that we could understand, so you can't necessarily just say this and this and [make me say] 'I don't understand what you are coming from.' As long as they can explain it to me and, again, provide support, show me 'this is [what] I think' and then show why they think that way. And what probably would be a factor in global warming.

This is consistent with Hazel's other statement; that she would consider changing her position if given sufficient evidence. To Hazel, scientists were most likely authorities with respect to global warming because they have credentials and can provide evidence for her position that she finds convincing.

Justification of epistemic authorities used in global warming position construction

Hazel considered scientists to be an authority with respect to global warming. However, what Hazel did not realize is that there is a consensus within the scientific community that global warming is occurring, with only one scientific organization – the American Association of Petroleum Geologists – holding a dissenting opinion (DiMento & Doughman, 2007). This misunderstanding led to Hazel trusting her own intuition more than scientists (e.g., "It might not necessarily be true, but since it's a debate, we don't necessarily know for sure [what] is true") unless what she considered to be indisputable evidence was presented. This unawareness that a consensus position exists in the scientific community with respect to anthropogenic global warming translated to a rating of poorly aligned with respect to Hazel's justification.

Characteristics of student related to perception of global warming authority sources

It was difficult to propose a set of Hazel's characteristics related to her perception of her global warming authority sources. She did not identify her political affiliation, nor did she attribute her belief about the "controversy" surrounding global warming to a specific source, a particular class, an experience, or an individual. Rather, Hazel had a vague impression that human technology (e.g., electrical appliances and devices) were heating the earth up without referring to a particular source (e.g., "they" know that technology causes global warming). She was unable to provide a specific source for these beliefs.

Epistemic commonalities between evolution and global warming sources

Tenuous epistemic commonalities did exist in Hazel's positions on evolution and global warming. Hazel relied strongly on scientists for her position on evolution, thereby constituting knowledge. However, her position on global warming – that her own opinions could override the opinions of scientists with whom she disagreed – did not constitute knowledge, but rather, belief. This disparity in strength of the perceived authority of scientists meant that although the two topics shared a superficial resemblance in authorities, and scientists were mentioned as domain-specific authorities with respect to both topics, these two topics were not epistemically similar.

Herbert

"Herbert", Description

Herbert was a 20-year-old male underclassman, self-identified as Causasian, and neither stated his religious nor his political identity at the time of the interview.

Herbert, Questionnaire

Herbert's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 20 shows the quotes used to assign Herbert to position AE-NA in the grid.

Table 20. Selected supporting quotes placing Herbert at position AE-NA.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution without attempting merging with religion	The comic makes a very valid point, creationists do try to find facts to support their claim of "intelligent design" but they can't sense the Bible is not a book of facts, but rather a book of stories. Science at least can prove their facts.
Anthropogenic global warming is not occurring	I don't really believe that global warming is a major issue. I do agree that it is occurring but I believe it is just a cycle that the Earth goes in and we have no part in it really.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Herbert outlined his own position: "I believe that God set up the rules of the universe at the beginning and let it go, resulting in evolution. God created the universe but allowed random chance in evolution." This Deist position was reflected in Herbert's assignment to AE; Deism allows a believer to retain belief in God, but does not postulate any sort of effect by God (or a designer) on evolution (Scott, 2004). Therefore, Herbert's position with respect to evolution was unaffected by his religion; e.g., there was no attempt to merge his religious beliefs with evolution. The questionnaire accurately provided Herbert's evolution position as AE.

On the global warming pre-interview position list, Herbert indicated that his global warming position was "I believe that global warming is occurring, but that humans have not affected it one way or another." This was reflected in his questionnaire

response. In Herbert's case, the questionnaire appeared to accurately place his global warming position as NA.

Sources of epistemic authority re: evolution

Herbert initially mentioned scientists when asked who he would trust for accurate information on evolution, and additionally specified scientists who study evolution:

> Interviewer: Herbert, the first question I'd like to ask you is what source or sources would you trust for accurate information on evolution?
> Herbert: The scientific community at large. I would go to them for information regarding evolution.
> Interviewer: Okay, can you define what you mean by "scientific community at large"?
> Herbert: I would say the major heads of the evolution study. [I] don't study evolution very much, so I'm not sure of any specific scientists in general, but just the scientific community.
> Interviewer: The scientific community is pretty diverse overall, so I'm wondering if you would consider just a scientist in general as a good source, or if you would consider, specifically, a scientist concerned with research on evolution as a good source, or do you not have any preference between the two?
> Herbert: I would stick more with the scientist who has a study in evolution, not just a normal scientist.
> Interviewer: Why would you consider this source accurate?
> Herbert: I would just feel if he made it his life's work to study evolution, then they would be a good source and they would know what they were talking about. Or at least have a better grasp about what they were talking about than, say, just a normal biologist or plant biologist or whatnot.

When asked what it was about a scientist that generated trust for him, Herbert replied:

> Herbert: They look at reason more than just going with gut feeling. Even if they believe that something is absolutely correct, they will still test and try to prove themselves wrong.
>
> Interviewer: What does that do in terms of your viewpoint of them as accurate?

Herbert: It presents a side of unbiasedness [sic]. I feel since they're not trying to get a certain point[1] across, they're just trying, eventually, to get a point across.

When asked to provide a definition of "biased," Herbert replied:

Just leaning more towards one side than the other. Trying to prove a point; they had a point in mind before they set up the experiment, and they tried to prove that point all along, rather than just taking the results.

This idea of scientists as unbiased continued when Herbert was asked what characteristics of the scientific community made it useful for his position on evolution:

Um, just for search for the unbiasness [sic], search for knowledge, um, there are reasonable and rational rather than intuition, gut feeling, so just seems that everything has a more objective point of view than some sensationalized, I don't want to say, "church-goer," but, just, another source on evolution.

Later in the interview, Herbert referred to personal bias in science when answering a different question:

Interviewer: If you have a scientist who's been a part of the field, for, let's say twenty or twenty-five years, and they publish a certain article in what the scientific community might consider a mid-level journal. In the meantime, you've got somebody who's in their third or fourth year of research, who publishes in a high-level journal, with an opposing position. Under those circumstances, which one do you go with?

Herbert: I would still go with the more experienced scholar, just because he's been in the field. He may have fallen a little bit down on his luck so he's had a lower publication or lower-level journal, and maybe, for some reason, because of his current line of work or whatnot, the well-respected or higher-up university kind-of declined his journal or took the new guy's ahead of time. Or then, you may have personal bias there and the younger guy may have done some favors or is related to somebody at the university or whatnot and pulled some strings to get it in the higher publication.

Interviewer: Well, that's interesting. If we return to why you consider sources accurate, you said that the relative lack of bias was

[1] Here, notes written during the interview indicated that Herbert made a "quotes" gesture with the index and middle fingers of both hands; this explanation was not provided within brackets so that the flow of the quote text was not disrupted.

something that was appealing to you with respect to the scientific community, but here you've introduced a source of bias. Can you reconcile those two comments for me?

Herbert: Well, science, in general, should be unbiased, but it's human nature to eventually to present some bias. There's no completely unbiased individual; regardless how much you claim you're unbiased, you always have your own personal matters and feelings into it. But I feel if you present through the scientific community and multiple institutions or multiple sources you're going to come to a conclusion that is the most unbiased that you can possibly get.

Interviewer: What you're basically describing sounds like the process of peer review, is that what you're referring to?

Herbert: Yes.

Interviewer: Do you feel, then, that peer review acts in a manner to offset bias?

Herbert: It accounts to it, yes.

Herbert was then asked which other sources he would use to add to his understanding of evolution:

Interviewer: What sources would you consider useful for adding to your current understanding of evolution? Where would you go to find out more?

Herbert: Further journals and studies and publications put out by not only the leading scientists in the fields, but pretty much any scientist that believes he or [she] has a new discovery or new proof of evolution.

Interviewer: Okay, journals and studies. Are there any sort of qualifying characteristics that you would used to pick those out?

Herbert: I would say it would be from a well-respected source such as a journal that goes back so many decades, or just from a well-trusted university or well-trusted professor or scholar that I would say that would qualify, as long as it's not their first, beginning study. I would still read and probably value the study that was their first, but I would still take it with a bigger grain of salt than their other studies.

Herbert was then asked if there were any other sources for information about evolution:

Interviewer: Can you tell me what other sources about evolution that you know of?

Herbert: I wouldn't say that there are other sources of evolution, but there are other people with opinions on evolution, the largest coming from the church.

Interviewer: What is it about these other opinions? Is [there] anything specific about those other opinions that lead you to value the position of the scientific community, with respect to evolution, more than those opinions?

Herbert: It's just [that] the scientific community's opinion of religion seems more rational to myself than what is commonly believed in Americans [in] the Christian Church.

Interviewer: What would you consider to be not rational about these opinions?

Herbert: Just believing the complete, not a word, 'refution' [sic], just their refusal, or some sects of Christianity's refusal [to believe] that evolution occurred, or does occur, or is going to occur. Just that everything was set just the way it is, how it stands currently, at the very beginning.

Interviewer: Is there anything about that refusal that turns you away from that opinion?

Herbert: It just seems completely irrational to me that over millions of years of just the history of life and the history of planets and whatnot, that nothing has ever changed.

Herbert's epistemic authority with respect to evolution was the scientific community of evolutionary biologists. Although Herbert did not explicitly mention this, he did allude to peer review being a corrective mechanism for personal bias in scientific publications. Therefore, he regarded the body of scientists participating in the peer review process to be a higher authority than any single scientist. Experienced scientists – "experience" referring to published studies – were considered to be more of an authority than inexperienced scientists; the implied imprimatur of the scientific community serves as another indication that the scientific community is the top authority. Scientists that were not a specific part of a subdiscipline within science were not considered as legitimate an authority with respect to a subdiscipline as scientists within it. Herbert specifically rejected religion an authority with respect to evolution; he was careful to distinguish religion as having an opinion, not being a source, about evolution.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Herbert's knowledge of evolution could be considered fairly domain-specific; he largely limited the authority of scientists to observations about natural phenomena:

> Interviewer: With respect to the scientific community, what other topics, other than evolution, have you found them useful for as a source of information?
> Herbert: Just day-to-day matters, just explaining the wonders of the world so we don't return to Greek mythology. Explaining, just, curiosity.
> Interviewer: Okay, would you say that they're accurate with respect to descriptions of natural phenomena, then?
> Herbert: They are very accurate, or, at least, present the most logical explanation of certain phenomena.

These authorities were useful to Herbert for a very limited range of subjects related to science. Within that range, Herbert considered involvement and experience in research as characteristics that would increase authority. As these sources would most likely be what the scientific community would consider the authoritative sources on evolution, Herbert's sources mostly constituted knowledge, rather than belief.

Characteristics of evolution knowledge sources related to perception of authority

Knowledge originating from scientists actively involved in research was the characteristic that defined authorities with respect to evolution for Herbert.

Justification of epistemic authorities used in evolution position construction

Given that Herbert considered individuals actively involved in scientific research on evolution to be legitimate authorities with respect to a biological science concept, Herbert's justification of the sources of epistemic authority was rated as very well-aligned. He understood that an individual actively involved in scientific research was an

appropriate authority, and rejected the idea that religion could serve as an authority with respect to evolution.

Characteristics of student related to perception of evolution authority sources

Herbert's educational experiences were clearly related to his perception of scientists as his authority:

> Interviewer: Can you can you remember when you first encountered science, or the idea of science, as somewhat objective? How did you initially decide that this was an accurate source?
> Herbert: Just was taught it all along, throughout on into school. Society assumed scientists are objective, unbiased; they're just for the sake of knowledge, they're not to push an agenda.
> Interviewer: You said elementary school was your first encounter?
> Herbert: I would say more than likely; when I was in first grade and was presented with basic science, and, then, eventually, as you go along through elementary school you learn about science in general, scientific method and, pretty much, they are just results and not trying to prove anything. Well, they are eventually trying to prove something in particular, but they would still take the result no matter what. They would try to change it to try to get the results done, but they would not just discard the other results. They present all sides.

Beyond this, it was difficult to assign Herbert's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Herbert initially stated that he would find scientists an accurate source for information on global warming, and immediately elaborated that answer to mention discipline-specific scientists:

> Interviewer: What source would you trust to go to for accurate information on global warming?
> Herbert: I'm going to have to go with, again, scientists at large, but more importantly for this aspect, probably geologists and climatologists.
> Interviewer: Why do you consider these sources accurate?

Herbert: They would be the two branches in the scientific field that would have the most knowledge and grasp of the workings of the earth. And then also probably I would throw in seismologists and just other scientists that focus on the cycles of the earth.

When Herbert was asked why he would consider scientists to be an accurate source, in light of his responses about the existence of anthropogenic global warming on his questionnaire and pre-interview list, the following exchange occurred:

Interviewer: I note that your position is that believe that global warming is occurring as a natural cycle, and that humans have not affected it in one way or another. Is that accurate?

Herbert: Yes.

Interviewer: What are your thoughts on the international panel for climate control? That's, I believe, twelve hundred climatologists worldwide who collaborated on the initial report that got global warming first into the public's eye. Given that you said that you trust scientists at large and geologists and climatologists, how do you reconcile your position, with the IPCC's position that global is anthropogenic, manmade?

Herbert: I'm not too sure how to reconcile that, I mean, being as, I just feel that global warming – mankind does have some effect, but it's so miniscule on global warming that, in my opinion, that I don't see the effect. That could be just my initial gut belief and the fact that I've never actually put that much research into forming a concrete opinion as to why not, but it just seems from what I've learned in the past regarding the earth's cycle, ice age, heat waves, El Nino, El Nina, and the idea of the astronomical recession where the earth's actual axis of rotation changes thirteen and a half degrees every sixteen thousand years that that may have some effect of why the planet's heating up. Not the fact that we're using oil and natural resources, fossil fuels, much more than we used to in the previous centuries.

Interviewer: Where have you learned about these cycles and the wobbling of the earth's axis?

Herbert: Just from my courses so far at the university and throughout my education growing up.

Interviewer: Did the teachers you've had in these courses voice an opinion on global warming?

Herbert: A few teachers did voice an opinion that we were a main cause of global warming and were helping further spur on global warming and I've also had a few that were staunch adamant that this is just the way the earth works, it's not anything that we can

either aid or hinder. So, I've kind of a mixed bag on both sides of that from authorities of my education.

Interviewer: So there was no real consensus in your direct experience?

Herbert: No, no, not growing up, one way or the other. It could have been a year of trying to convince everyone that it was man; another year, the following year, another teacher would be, well, this is just the way it is. So, I never had one concise [opinion] one way or the other that I'd been brought up on.

Herbert was then asked about what he would mean by "accurate" and "trust," and he then provided more information on how he would differentiate between scientists:

Interviewer: In this context [e.g., global warming], what would you mean by accurate and trust, giving this issue and your experiences with it?

Herbert: I would still look more towards someone in the science field or the science department at the university, especially in one of the aforementioned fields, and just look at the qualifications the faculty actually had in the field of experience, and just what exactly their main focus of the point was.

Interviewer: So, the focus of their –

Herbert: Opinion or their main reason or cause.

Interviewer: So would you focus, then, on what it was that they were researching?

Herbert: Yes.

Interviewer: Okay, and what characteristics about a researcher, then, would make you think, 'Okay, this is the authority that I need to pay attention to,' as opposed to choosing between someone in the geology department or a climatologist. If you've got several sources and you're winnowing them out to see which one has the best grasp on the situation, where would you go, or what qualifications would you look for?

Herbert: How much of their actual studies have been published, and their colleagues' opinions of that professor's or scholar's work. If he's respected in his own community and he's a quintessential authority from his community, I would put a lot more trust in him than just a run-of-the-mill professor of geology or climatology or cytology.

Interviewer: So, in this case, it's the active researcher that grabs your attention more.

Herbert: Yes.

Interviewer: And among active researchers you are looking for prominence in the field?

Herbert: Yes.

Interviewer: When it comes to prominence in the field, are you referring to the position of the institution that they're at, or, perhaps the

journals they're publishing in, or the number of articles they've published in their career? Can you describe for me what you consider to be prominent?

Herbert: I would probably determine it from which journals they were publishing in and just, overall, not respect, but just, opinions from their community. And, just because it's such a timely topic, they would have to be doing current research or have to be a part of the ever-changing field of researchers that are researching global warming. So, they would still have to be involved in the community, and actively involved.

Interviewer: Okay, could you tell me how you would determine prominence when it came to journals?

Herbert: Just one that has a well-respected history of, I don't want to say major findings, but just quality findings. I don't mean like life-changing, world-shattering findings that they've had, but just [the] overall quality of findings or researching or studies done and then, I imagine from that rate, just then as well as whatever institution or publishing house that the journal was released from, and just how well respected the journal itself is in the scientific community.

Interviewer: Okay, I'm a little curious to find out, um, how you would go about grading "well-respected." Are there certain criteria that you have?

Herbert: Honestly, since I feel I'm not well-versed in this field of study, I would just, I don't want to say, "blindly," but, close to blindly, just trust the community's opinion, of somehow asking the closest people I could, in the field, their recommendations, and then going and researching their recommendations, because without that I wouldn't actually even know where to begin.

When Herbert was asked what other topics he found scientists useful for, he replied, "Nothing specifically, but I would just say, just the workings of, the physical workings of the world. They would be a good source to turn to."

It is more difficult to distinguish Herbert's epistemic authority with respect to global warming than it is evolution. Although Herbert stated that he trusted scientists, was very specific as to relevant subdisciplines, and valued the opinion of the scientific community in determining the prominence of publications and journals, Herbert's position on global warming differed with the mainstream position of the scientific community (e.g., that global warming is anthropogenic). Herbert did not give

prominence to his own position with respect to evolution, but he did with respect to global warming; Herbert's contended that "mankind does have some effect, but it's so miniscule on global warming that, in my opinion, that I don't see the effect." This opinion outweighed the prominence of the IPCC in forming Herbert's views. He did not cite any specific authority for this stance; therefore, his views are based on his personal opinion, and not on specific scientific sources. Therefore, Herbert currently serves as his own authority with respect to global warming. He did, however, specifically state that he would investigate global warming by consulting journals considered to be prominent by the appropriate scientific community, and also stated that he could form an opinion based on credible sources. This willingness to reconsider his own position based on scientific literature indicates that, for Herbert, the scientific community does serve as a strong epistemic authority with respect to global warming.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Herbert's knowledge of global warming could be considered knowledge in one respect; he mentioned the scientific community as an authority. However, his belief that humans have not yet affected the Earth's climate – one that does not have its roots in the scientific community – affected his views. This view, fundamental to all others for Herbert, does not have its origins in the scientific community, and may be considered belief. That said, if Herbert investigates global warming further, he could potentially adopt a view that could be considered knowledge.

Characteristics of global warming belief sources related to perception of authority

When asked if humans could possibly have an effect on global warming, Herbert replied negatively:

> Interviewer: Your basic opinion that it's a natural cycle, that humans don't have much of an effect on global warming, one way or the other, is that based on the idea that humans can't have an effect on something that large as – ?
> Herbert: I believe they can, we just haven't reached that level. I feel that we can, unfortunately, get to that point, maybe by the middle of my lifetime, possibly the end of it at the earliest, but, the current state of the world now, we can't have that dramatic of a change that quickly.
> Interviewer: Okay. And, are there any sources that you've used to come to that conclusion?
> Herbert: Other than just basic secondary and few courses I've received now just in geology and just learning about the world, it just seems that it's not possible for the world to heat up that quickly or that dramatically in that quick an amount of time.

This seems to be an argument from incredulity; e.g., "this seems impossible to me; therefore it is impossible" (Plutynski, 2010). However, as Herbert specifically stated that he could form a new opinion based on prominent journals, the scientific community was most likely an authority with respect to global warming for Herbert because they have credentials and can potentially provide sufficient evidence to change his position.

Justification of epistemic authorities used in global warming position construction

Herbert considered his own opinion to be an authority with respect to global warming. However, given that Herbert would potentially change his position, given further investigation into global warming, using journals considered prominent by the scientific community, Herbert was well aware that his opinion was a less credible source than the scientific community. This awareness demonstrated that although Herbert held a

view based on his opinion, he understood that his opinion was not necessarily credible. Nonetheless, Herbert's justification for his epistemic authority was rated as poorly aligned.

Characteristics of student related to perception of global warming authority sources

It was difficult to propose a set of Herbert's characteristics related to his perception of his global warming authority sources. He did not identify his political affiliation, nor did he attribute his belief about the impossibility of anthropogenic contributions to global warming to a specific source, a particular class, an experience, or an individual.

Epistemic commonalities between evolution and global warming sources

Tenuous epistemic commonalities did exist in Herbert's positions on evolution and global warming. Herbert relied strongly on scientists for his position on evolution, thereby constituting knowledge. However, his position on global warming – that his own opinions overrode the opinions of scientists with whom he disagreed – did not constitute knowledge. This disparity in strength of the perceived authority of scientists meant that although the two topics shared a superficial resemblance in authorities, they were not alike.

Jane

"Jane", Description

Jane was a 19-year-old female underclassman, self-identified as Hispanic, identified her religious identity as Catholic, and did not identify her political identity at the time of the interview.

Jane, Questionnaire

Jane's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 21 shows the quotes used to assign Jane to position RE-AGW in the grid.

Table 21. Selected supporting quotes placing Jane at position RE-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Rejects evolution	I agree with the creationist method.
Anthropogenic global warming is occurring	This is funny and true, global warming is a big issue and is going to happen one day if we do not change our methods.

Questionnaire effectiveness and views

Jane was placed in RE because she stated that she agreed with creationism. On the evolution pre-interview position list, Jane outlined her own position: "I believe creation occurred, but each day mentioned in Genesis represents a much longer literal period of time - thousands, millions, or even hundreds of millions of years." This Day-Age (Scott, 2004) position was reflected in Jane's assignment to RE; the Day-Age position, which asserts that each of the six days mentioned in the Bible during the creation story represents a much longer period of time. This allows a believer to retain belief in God, and in creation, but allows for an old earth (Scott, 2004). Therefore, Jane's position with respect to evolution was a rejection of a naturalistic explanation. The questionnaire accurately provided Jane's evolution position as RE.

Jane was placed in AGW because one of her questionnaire responses attributed global warming to humans. On the global warming pre-interview position list, Jane

indicated that her global warming position was "I believe that global warming is occurring, and is primarily caused by humans." In Jane's case, the questionnaire appeared to accurately place her global warming position as AGW.

Sources of epistemic authority re: evolution

Jane initially mentioned the Bible when asked who she would trust for accurate information on evolution:

> Interviewer: I'd like to start by asking you what sources you trust for accurate information on evolution?
> Jane: I would say the Bible. And I also use the internet as well.
> Interviewer: Any particular types of sites on the internet? Can you describe some of those?
> Jane: Nothing in particular, I guess, just sites that summarize the Bible in layman's terms [and] just make it more simple for me to understand.
> Interviewer: What parts of the Bible do you rely on?
> Jane: The last section. What is it called? Is it Exodus? No, not Exodus. Revelations?
> Interviewer: And that's the part of the Bible that you trust for information on evolution?
> Jane: Yes. And also the beginning. Genesis.

Jane was then asked about accuracy:

> Interviewer: What is it about these sources that makes you consider them accurate?
> Jane: I just believe in it. I don't really question it. It's just like there's something in me.

Jane was then asked to elaborate on that response:

> Interviewer: You have said that you've gone to church. And you use the Bible in forming your opinions on evolution. Can you describe to me specific influences within the church?
> Jane: Like certain people?
> Interviewer: Yes.
> Jane: My pastor wouldn't really go into that topic. On evolution, so, the only influence in church, I guess, would be the Bible.
> Interviewer: Well, how about general knowledge? Let's set evolution aside for just a second. Just in terms of general knowledge about the world.

Jane: About the world?
Interviewer: Yes.
Jane: My pastor, people around me, my confirmation teacher. I went through confirmation, and she taught me a lot just about how to be with people and understand the religion more.
Interviewer: Do you mind describing which denomination?
Jane: No. Roman Catholic.
Interviewer: And how much of an influence would any of the official positions taken by the church have on your position on evolution?
Jane: Like priests?
Interviewer: Official positions that have been written down as positions of the church.
Jane: Can you give me an example?
Interviewer: For example, if the Pope issued a statement that said 'I find no inherent conflict between evolution and Roman Catholicism' or 'I do find a conflict between Catholicism and evolution' how much of an influence would that play in how you view it?
Jane: I think it would play – I know that I should form my own opinions, but I think I would take, I'd value that opinion a lot. Because I know that person has gone through a lot and understands the world more than I do right now. But yeah, I think I'd value it a lot.
Interviewer: So would you consider somebody who's really well versed in theology then to have really valuable opinions about?
Jane: I probably would. If I heard someone's opinion, I think I should research it on my own afterwards, but I knowing myself, I would probably value that opinion as well and think it was correct and accurate.

Jane was then asked if her opinions would change with church doctrine:

Interviewer: If at some point the Roman Catholic Church's official position became, 'We believe that God was involved somewhere in the process but we also believe that natural explanations can fit with our theology' would that change your view of evolution?
Jane: I think so, yes. Cause I believe in my church.

Jane then established that the Bible would serve as a more generalized authority:

Interviewer: Have you found it useful [the Bible] for a range of other topics?
Jane: Yes.
Interviewer: And what other topics?
Jane: Moral topics, I guess. Decisions that I've made in everyday life.

Jane then established that religion takes precedence over science with respect to evolution:

> Interviewer: If you encountered a couple of books about evolution and one of them had been written by an evolutionary biologist, and the other one had been written by a theologian, which one of those would you consider to be a more accurate source of evolution for you?
> Jane: More accurate?
> Interviewer: Yes.
> Jane: The scientist.
> Interviewer: Which one would you tend to trust more?
> Jane: The theologian.
> Interviewer: So would it be fair to say that in terms of trust and your way of understanding the world, that religion takes precedence over science?
> Jane: yes. Religion does.
> Interviewer: And do you ever feel a need to actually choose between the two?
> Jane: Yes, sometimes. Because sometimes they contradict each other. Like scientists [and] theologians do.
> Interviewer: Can you give me an example of that?
> Jane: Let me think. Well, evolution is one. [Of] course you're talking about that. Their believing that the theory of 'we came from mud and were created' and another thing that 'we evolved' isn't, I know the Darwin theory is like from monkeys and primates and stuff, and that contradicts itself. I can't think of any right now. But yes I can't think of any. Sorry.
> Interviewer: That's ok. So again, if you feel the two to be in conflict then you go definitely go with the spiritual one.
> Jane: Yeah, I do that.

Jane's epistemic authority with respect to evolution was her religion; more specifically, the Roman Catholic Church. Even though Jane specifically said that she would consider scientists more accurate with respect to evolution, she stated that she would trust theologians more than she would scientists, and if the two – religion and science – came into conflict, she would choose her religion. Additionally, Jane specifically said that she would change her views on evolution if the Church changed its

views. Therefore, the Roman Catholic Church served as a very strong epistemic authority with respect to evolution for Jane.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Jane's knowledge of evolution could be considered generalized; given that Jane considered the Bible as a generalized epistemic authority, it is not unreasonable to suggest that she considered the Church as a generalized epistemic authority, as well. As her sources would most likely be what the scientific community would consider belief, and the scientific community itself was subordinate in authority to her religious beliefs, Jane's sources constituted belief.

Characteristics of evolution belief sources related to perception of authority

The imprimatur of the Roman Catholic Church, or what she believed to have the imprimatur of the Roman Catholic Church, is the characteristic that defined authorities with respect to evolution for Jane.

Justification of epistemic authorities used in evolution position construction

Given that Jane considered the Roman Catholic Church, the Bible, or theologians to be legitimate authorities with respect to a biological science concept, Jane's epistemic justification was not congruent with what the scientific community would understand as evidence; Jane relied on authorities that have their foundation in the supernatural. Further, she did not realize that the Roman Catholic Church's position on evolution was more of a naturalistic stance than hers; they do not rely primarily on Genesis for information about evolution (Roman Catholic Church, 2004). Therefore, Jane's justification of her authorities was rated as poorly aligned.

Characteristics of student related to perception of evolution authority sources

Jane's religious experiences were clearly related to her perception of the Roman Catholic Church as her authority:

> Interviewer: So how did you initially decide that this [the Roman Catholic Church] was what you were going to trust?
> Jane: I guess when I started going to church. I've always gone to church, except [my] junior year of high school, I started really getting into it and going every Sunday. I'd say that's the time that I really started trusting, and I starting reading and looking more into it around that time.

Beyond this, it was difficult to assign Jane's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Jane initially stated that she would find the Internet an accurate source for information on global warming:

> Interviewer: The first question I would like to ask is, what sources would you trust for accurate information on global warming?
> Jane: I would trust the internet. It's convenient and I believe it's accurate.
> Interviewer: Why would you consider the internet to be an accurate source?
> Jane: I guess global warming is such like a recent event, that I guess the internet has the most recent information to keep you up to date. And that's why.
> Interviewer: Well, what is it about the internet that actually generates trust for you?
> Jane: I guess just because everyone can get on it and write it and [it's] so accessible. I guess not as many people can write books or publish books, but a lot of people can get on the internet and write their thoughts and information.
> Interviewer: So can you sort of define what you mean by accurate in this case?
> Jane: I guess books can be out of date with their information and the internet is something that you can refresh, I guess.

After defining accurate and truth in the context of global warming information, Jane was asked for further sources that she would consider accurate with respect to global warming:

Interviewer: You defined accurate as up to date, and then defined truth as accurate. So would you define truth as up to date?
Jane: Yes. I would.
Interviewer: So do you have any other sources other than the internet that you would consider reliable for information on global warming?
Jane: Articles in magazines. I would consider those. Especially like the Times.
Interviewer: And is that the New York Times?
Jane: No, Time Magazine.
Interviewer: And Time, is there a particular type of magazine that you trust more than others.
Jane: I guess news.
Interviewer: So where would you place a scientific journal in terms of trustworthiness about global warming.
Jane: A scientific journal?
Interviewer: Yes.
Jane: A scientific journal, in terms of trust, is that what you're saying?
Interviewer: Yes.
Jane: I'd trust it because I believe scientists are probably the most well informed people on this subject.
Interviewer: Can you compare scientists to the Internet or a news magazine like Time? Where would you rank those?
Jane: Scientists would be first.
Interviewer: And how about a news magazine versus the Internet?
Jane: Magazines.
Interviewer: Now, there are a variety of web pages on the internet and they are going to have opposing views. Could you talk for a little bit about [the characteristics of an] internet source [that] would make you look at it and say ok I trust this?
Jane: Like what would be something on the website?
Interviewer: Or characteristics of the website.
Jane: I guess the layout, if it was well done. If it's like part of an organization or if it's something thoughtfully done.
Interviewer: Would it be more important that it was part of an organization, or whether it was well laid out?
Jane: I think well laid out for me. I don't know, that's just something that I think.
Interviewer: What type of organism would you want to see as the author of a website for it to be a source of accuracy for you?

Jane: I guess weather services, news, like news websites. I guess scientific.
Interviewer: So you rate scientists as the highest, then followed by news magazines. Would you say professional journalism?
Jane: Yes.
Interviewer: And then, following that, the internet?
Jane: Yes.
Interviewer: What about scientists make[s] them useful for your position on global warming?
Jane: I think they understand the world more and how it works and why this is happening, and they analyze it and they just understand it. They have the best knowledge.

Jane was then asked what other topics she found scientists useful for:

Interviewer: Are there any other topics that you found scientists useful for as a source of knowledge?
Jane: Diseases, like cures.
Interviewer: Now I'm going to switch gears very briefly, and refer to our last interview. Diseases and cures are a biological phenomenon and evolution is also considered to be a biological phenomenon. How high would you rate scientists in terms of accuracy on evolution?
Jane: On evolution? Scientists?
Interviewer: Yes.
Jane: I'd say they have it half right, I guess.

Jane was then asked about other sources she would find useful for adding to her understanding of global warming:

Interviewer: Do you generally find textbooks a believable source?
Jane: Yeah, I think. Yeah, I do.
Interviewer: You looked a little uncertain when you said that.
Jane: Well, because like sometimes they go out of date. I just think there's more explanations that come up each day, but I think textbooks are pretty accurate but they get more accurate as the years go by.
Interviewer: And what impact does it make for you as to who the authors are of the textbook?
Jane: I never really read about the authors.
Interviewer: Well, if you were to get a college textbook, the most up to date college textbook on atmospheric science or on global warming, what would you like to see from the authors?
Jane: Characteristics of them? I guess professors, well known, like their reputation, [who] have some sort of degree in the subject.
Interviewer: Would it matter from where?

Jane: Of course. If it was a guy from Harvard I'd value his opinion more than someone from UGA, I guess.
Interviewer: Would you trust one person from Harvard to give you a really good accurate source, or would you find yourself seeking other opinions as well if you really wanted to become informed?
Jane: I would look at other opinions. I wouldn't just focus on one person.
Interviewer: Ok. Do you think a consensus opinion would be important to you?
Jane: What does consensus mean?
Interviewer: If the majority or the scientific community agreed on one particular viewpoint. Is that something that would be – ?
Jane: Yeah. I would, definitely.
Interviewer: ok
Jane: If a lot of people believe it, I believe it.
Interviewer: Let's say, then, that you've got a fairly decent consensus but the people who are against the consensus come from the Ivy League schools. So which side do you think you would be drawn to in that case?
Jane: I think I'd still be drawn to the consensus. Yeah, because I believe in the power of many.

Jane's epistemic authority with respect to global warming was clear: the scientific community. Although she mentioned the Internet and media first, Jane made it clear that a consensus position in the scientific community would outweigh individual scientists, even those from a prominent institution. The opinions of scientists outweighed news media, which outweighed the Internet as authorities for Jane.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Jane's knowledge of evolution could be considered fairly generalized. These authorities were useful to Jane for a wide range of subjects that were not limited to global warming. As these sources would most likely be what the scientific community would consider the authoritative sources on global warming, Jane's sources mostly constituted knowledge, rather than belief.

Characteristics of global warming knowledge sources related to perception of authority

According to Jane, the characteristics that made scientists useful for knowledge about global warming were that they "understand the world more and how it works and why this is happening, and they analyze it, and they just understand it. They have the best knowledge." Apparently, Jane trusted scientists for accuracy because they spend time in research.

Justification of epistemic authorities used in global warming position construction

Jane considered the scientific community to be an authority with respect to global warming. However, her justification was based on vague generalizations; that scientists can be trusted because they are good at research and therefore their knowledge is "the best." Jane did not mention any specific subdisciplines, nor did she mention any facts about global warming beyond a very basic understanding of the greenhouse effect. She did realize that global warming is a science-related issue and therefore trusted scientists. In the absence of more specific ideas, however, Jane's justification cannot be considered to be well-aligned; therefore, her justification was rated as somewhat well-aligned.

Characteristics of student related to perception of global warming authority sources

It was difficult to propose a set of Jane's characteristics related to her perception of her global warming authority sources. She did not identify her political affiliation, nor did she attribute her views about the possibility of anthropogenic contributions to global warming to a specific source, a particular class, an experience, or an individual.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did not exist in Jane's positions on evolution and global warming. Jane relied strongly on her religion for her position on evolution, thereby constituting belief. However, her position on global warming – even though her justification was rather weak – constituted knowledge. The key difference was in how Jane viewed scientists with respect to the different topics. During the global warming interview, Jane discussed the usefulness of scientists in broad terms, even mentioning biological concepts; however, when reminded that evolution was a biological concept, Jane's view of scientists as an authority with respect to evolution remained weak. This disparity in strength of the perceived authority of scientists – and the concomitant differentiation into knowledge with respect to global warming and belief with respect to evolution – meant that Jane's sources with respect to global warming and evolution did not have epistemic commonalities.

Karen

"Karen", Description

Karen was a 20-year-old female underclassman, self-identified as Caucasian, and stated neither her political nor religious identity at the time of the interview.

Karen, Questionnaire

Karen's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 22 shows the quotes used to assign Karen to position AE-AGW in the grid.

Table 22. Selected supporting quotes placing Karen at position AE-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution without attempting merging with religion	I think that people need to stop being so closed-minded about the theory of evolution and take some time to actually contemplate the science behind it. I don't see why people won't take the time to consider it. I find it highly believable.
Anthropogenic global warming is occurring	I think, as I previously mentioned, that global warming could be a real danger, but since the threat of global warming seems so high, procedures will be done to prevent any real damage.

Questionnaire effectiveness and views

Karen was placed in AE because she stated that she found evolution highly believable. On the evolution pre-interview position list, Karen outlined her own position: "I believe in evolution, and also believe in God. I think God played a role in evolution, but was so subtle that we can't detect that role." This position was reflected in Karen's assignment to AE; it allows a believer to retain belief in God, but allows for completely naturalistic explanations in evolution. This type of belief is sometimes referred to as "the God of the gaps" (Scott, 2004), in which God's role becomes more reduced as an individual accepts more naturalistic explanations with respect to species origins. Therefore, Karen's position with respect to evolution was an acceptance of naturalistic explanations, and the questionnaire accurately provided Karen's evolution position.

Karen was placed in AGW because one of her questionnaire responses attributed global warming to humans in an indirect fashion. On the global warming pre-interview position list, Karen indicated that her global warming position was "I believe that global warming is occurring, and is primarily caused by humans." In Karen's case, the questionnaire appeared to accurately place her global warming position as AGW.

Sources of epistemic authority re: evolution

Karen initially mentioned textbooks when asked what sources she would trust for accurate information on evolution:

> Interviewer: Karen, what sources would you trust for accurate information on evolution?
> Karen: Well, recently, I've been kind of thinking about different ways to go about thinking about evolution, because, in biology, we just went over the evolution section in class and it helped me strengthen my current beliefs in it right now. So if I'm going to look at evolution I would probably go to a textbook, versus a pastor or something of that nature.
> Interviewer: Okay, can you tell me how you would go about choosing a particular textbook? Are there any specific attributes in a textbook that you would look for?
> Karen: I think I would pick a textbook that is probably on a national level, versus just a college-specific biology book or anything of that sort. One that has a lot of people that would turn to it and look at it, so it's been critically analyzed, maybe more so than a college one.
> Interviewer: Okay, so it's the critical analysis of it that would make it more of a source for you.
> Karen: Yes. More reliable.
> Interviewer: Okay. Can you define what you mean by "reliable," in this case?
> Karen: Reliable in the sense that, not saying that college textbooks would be unreliable, but, just having more people of higher education look at it and analyze it would mean more to me than just one that's teaching college students and not to be just their first time learning about something like evolution.

When asked why she would consider this type of source accurate, Karen replied:

> Because, I feel that the people that would be in charge of writing it and getting it together would have many years of education behind them, and they're going to be critically analyzed for everything they put down in the book.

Karen was then asked about authors of these textbooks:

> Interviewer: Would there be a specific field that you would look for, in terms of authors?
> Karen: None specific that I could think of right now. But when looking at evolution from the author's perspective, I think I would want the author not to really take religion or theology into account, because,

when you're putting stuff into a textbook, I feel like it's fact-based and science-based and not anything to do with religion in that sense. And, if you're going to put down information, it doesn't need to have an outer being such as that put into it, because people have different views on religion, and if religion's mentioned in the book that could really turn people off of reading it. It needs to be just science and fact.

Interviewer: Would you want someone who's got a strong science background?

Karen: Yes.

Interviewer: Can you tell me what you would consider to be a strong science background?

Karen: Well, somebody who's had a bunch of, obviously, just a bunch of sciences, in their background, not necessarily a specific field or a specific area, I want them to kind of be cultured in a bunch of different areas.

Interviewer: More of a broad-based education?

Karen: Yes, a broad science education.

When asked what other sources she might rely on for information about evolution, Karen replied:

Karen: Possibly, online journals from the educated people that I would trust to write the textbooks, if they had any internet journals, or if there is a forum of some sort. Even if you have that kind of thing you're going to have a bunch of educated scientists coming and giving their opinions. If you're not strong on your own beliefs, and haven't formulated something else you could be easily swayed by that, so I don't know if I would necessarily look at that. I have a pretty good grasp on the different theories I have, and I can stay strong to having multiple theories, which is kind of confusing.

Interviewer: You mentioned online journals from educated people, of course, and scientists, and you talked about, just now, about how it could possibly sway your views if they weren't strong. Can you talk about what type of source it would take to sway your views, [if] somebody presents a position that's different from yours?

Karen: Well, that's kind of what's happened recently, and it's not from an educated person, per se, but my boyfriend's extremely objective about things, and he's the same way I am about questioning everything that goes on in your life. He and I had some pretty deep conversations about this very stuff, and listening to him kind of made me put certain old views in the back of my mind and consider the new ones. These new ones kind of make more sense than the previous views I held, so if you're going to look on an

internet journal or a forum where a bunch of educated scientists are going to post their feelings and their views, plus facts, it could easily sway you.

Distinguishing Karen's epistemic authority with respect to evolution required more than simply quoting her. Karen mentioned textbooks at the beginning of the interview, but it was clear that these textbooks would have to be written by an author with a strong science background and would have to be "critically analyzed" – in essence, peer-reviewed. Additionally, Karen specifically said that her views could be changed if presented with evidence by a scientist. Although Karen seemed to feel uneasy with this notion (as reported in notes of her tone and expression during the interview), the possibility that her views could be changed by scientists clearly indicates that she considers them an authority. Karen also considered textbooks to be an authority, but the textbooks derive their authority from their authors.

Belief/knowledge with respect to evolution

Karen's view of textbooks as an authority seemed fairly specific:

Interviewer: Okay, so what other topics have you found this type of source useful for?
Karen: Like textbooks?
Interviewer: Well, let's say in this case, a science textbook. What other topics have you found this type of source useful for?
Karen: Besides evolution?
Interviewer: Uh-huh.
Karen: Well, I have my science textbook from my health class, just purely out of curiosity, because I'm a very curious person. I'm going to ask a lot of questions about things, which is why I have so many theories kind of going on in my head about evolution, the upbringings of it. But I use that public health book for learning about the causes of cancer, like what smoking's going to do to your body, because I just recently started smoking. [I wanted to know] what is it doing to my body, like what, exactly is happening to me, what are my chances of coming down with cancer, or something like that. I want to know facts behind my decision. Because I don't want to have the bias that we talk about in other

classes where you view everybody else's risks accurately but you don't view your own accurately. So I want to view my own accurately and continue to make decisions based on the facts that I can find in books.

Interviewer: Okay. In other words, to obtain as much objectivity about your decisions as you can?

Karen: Yes.

Karen: I want a very objective point on, yeah, on things of that nature.

As Karen's example of using a textbook was a public health textbook used for information on the consequences of smoking, it is not unreasonable to assume that she would display a similar specificity with other science textbooks. Her sources would most likely be what the scientific community would consider knowledge with a significant caveat: Karen seemed to distrust the idea of specialists, associating them with bias. However, when Karen was asked what characteristics of her sources made them useful for her position on evolution, she specifically rejected religion:

Karen: Well, my position, kind of, it varies right now, like I told you, I have different theories that I've been thinking about, but, right now, it's leaning a lot more toward the science and facts-based coming-up of the world and its creatures. That answer the question?

Interviewer: The characteristics that make it useful for you at this time, would it be fair to say that it's science, fact-based, lack of bias?

Karen: Yes.

Interviewer: Okay. And omission of religion in this case?

Karen: Yes, because when you're talking on a science level, that's not a personal belief. Science is fact, and science can be backed up with proof. It can be backed up with genes proving your evolution and how you can be related. When you try to put something like God into that, it's getting too heated, people get too offended, people don't take the time to open their minds and actually listen to the science-based part of it because they're so set in the way that they view religion and God.

Therefore, as Karen was reliant on scientists as opposed to religious sources, Karen's sources constituted knowledge.

Characteristics of evolution knowledge sources related to perception of authority

For Karen, the main characteristic of her knowledge sources seemed to be research experience and interest in the subject:

> Interviewer: What is it about this kind of source that would generate trust for you?
> Karen: Just their years of experience. If they've dealt with something and they're passionate about something, they're obviously going to know quite a bit about it. And, I would want passion to come from the author; I want it to consume their life and then be absolutely enthusiastic about educating people about whatever I'm looking up. In this case, evolution.

Justification of epistemic authorities used in evolution position construction

Given that Karen considered scientists to be legitimate authorities with respect to a biological science concept, Karen's epistemic justification was congruent with what the scientific community would understand as knowledge; Karen relied on authorities that were based in the scientific community, and rejected the supernatural. However, she rejected the idea of scientists specializing in evolution research. Therefore, her justification was rated as somewhat poorly aligned.

Characteristics of student related to perception of evolution authority sources

It was difficult to propose a set of Karen's characteristics related to her perception of her evolution authority sources. She did not identify her religious affiliation, nor did she attribute her views about evolution to a specific source, a particular class, an experience, or an individual. She did say express a viewpoint that could be described as agnostic: "right now I believe that the world just "is," that evolution came about through, like, mutations in the genes, and, like, all of the science stuff, and then, I also think that there is something above everything, and it could just be like, I don't know, I can't accurately say an all-knowing, almighty, all-powerful creature, but I just think that

there's something above us that knows more about our world than we do." Karen's reluctance to assign religious figures any authority may have its origins in this stance.

Sources of epistemic authority re: global warming

Karen's expression of her views of authority actually changed during the course of the interview. As with evolution, Karen began by mentioning textbooks as a potentials source of information for global warming, but with a significant caveat:

> Interviewer: What sources would you trust for accurate information on global warming?
> Karen: I'm in an environmental health class right now, so I'm learning, quote-unquote, 'the facts' about global warming and actual numbers and different levels of pollutants in the air. I hear all the things in the book and I look at it as a source of information that I would want to go to and find accurate information because it is strictly numbers. There's not much you can do about a number, but all I hear out of that textbook that I viewed as an accurate source of information is, 'turn off your water, save energy.' It feels kind of subjective and not objective. It [says], 'If we make everybody do this then the world will be a happier place,' and is it really that important for us to take such drastic measures in order to prevent a process that's going on?
> Interviewer: So, in this case, you don't feel like the textbook that you're working with right now is necessarily a reliable source?
> Karen: It's kind of half-and-half. I do trust it for accuracy in the fact that it knows different ways to reduce air pollutants from factories. I trust it that it knows the dates and the years that certain conferences were held and what was discussed at the conferences. That certain amounts of methane are released into the air. But I don't really trust it because it'll tell you all these things, and it feels like the author jumps in there and [says], 'Don't you want to save this? Don't you want to do something to help about it?'
> Interviewer: Then, you feel like it's biased somewhat?
> Karen: Yes, it's biased after it gives you the facts.

Karen's caveat was bias. She was then asked to describe a better source:

> Interviewer: Can you describe a book that you would consider to be more reliable for your purposes?
> Karen: Well… one that I would trust? Just give me the facts without telling me that I should go out there and fix the world… I can see

why bias is important in that, but, in my personal views, I don't want to know all that. I want you to give me the facts. I will make my own decisions about whether I want to recycle or not.

Karen was then asked to describe an author who she could trust:

Interviewer: Can you describe the kind of author that you would want writing a book that you can trust?
Karen: Again, somebody with a strong science background that's going to look at the levels in the atmosphere, that's going to tell you what's going on. If there's a huge hole that's growing in our atmosphere, tell me about it, tell me why...
Interviewer: So would it be accurate to say that you would want a book written by someone with a strong science background because of research in this area? Who limits themselves to current facts, and not necessarily speculations or remedies?
Karen: Yes.

Karen then changed her mind with respect to trusting sources:

Interviewer: Different people are going to tell you different things, and say, "This is fact." Now, they're going to tell you it's fact.
Karen: So which one of those am I going to trust?
Interviewer: Which one do you trust? Do you look for certain characteristics about these people with different opinions?
Karen: Well that makes me want to not pick between either of the two and do the research myself, because you're going to have people that have so much bias fueling them anyway because it's a heated debate, and, when you have that bias thrown in there, everything's skewed.
Interviewer: Okay, so when you're looking to research things yourself –
Karen: I don't think that I, personally, as a single person, have the ability to go out there, take the methane readings for all of the world and stuff, but that's what I would, ideally, want to do.
Interviewer: So would you want to get as close to the data as you possibly could?
Karen: Yes.
Interviewer: What sources do you think would be as close to the data as you could get?
Karen: Sources from NASA, or something that is involved with our atmosphere more so than just the average scientist.
Interviewer: Okay, so someone who is not just the average scientist, but specializes in something like atmospheric science?
Karen: Yes. I would trust them more to give me accurate data on what's happening to our world.
Interviewer: Why would you consider these people to be accurate?

Karen: Because it's their life; why would they give me information, if they had accurate information, why would they give me false information? Well, that could be answered, because if they're giving you false information, telling you the world's coming to an end, we're going to, automatically, all freak out as a society and kind of do things to make our world better, and I think that's what's going on now. I think there might be a scare tactic factor because, global warming, I don't think it's as big of an issue as it's being blown up to be… I understand that things are going on in the atmosphere. I'm not completely bashing global warming, [saying], "It's snowing in April, there's no way global warming's going on." It's just, there's something going on in the atmosphere. I realize that there's the possibility that we could change it, but, how much?

Interviewer: Okay, so you've just talked about atmospheric scientists, and then you turned around and said that some of these people may have an agenda.

Karen: Yeah.

Interviewer: So, if you feel like they have an agenda, do you really trust those sources?

Karen: I don't think anybody can, like, technically be trusted, then. I kind of think out loud, and, like, watching my thought process do this is kind of interesting.

Karen was then asked about other sources she would find useful for adding to her understanding of global warming:

Interviewer: Let's say you want to find out more about global warming. Where do you go? What sources would you consider useful for adding to your understanding of global warming?

Karen: Well, I would originally say, a textbook that specializes in global warming. [However], since I've been in this environmental health class, I feel like biases are being put on me, even through the teacher... and like I said, I don't want bias, I want facts. I don't feel like there's any way I can actually find that except if I could go to some higher company that's in charge of determining atmospheric levels of pollutants. Like I said, that would be NASA, but even then, they could have this agenda they have that they can't release this kind of information, because if the world knows that it's not that big of a problem right now, and they're trying to save us for the future, if it's a small problem, they can scare us into thinking it's huge, make us change, and save the atmosphere, save the world.

Interviewer: Let's say you just want to find out more about the subject. Where do you go?

Karen: I would go to textbooks, I would go to the internet, and, [as] the same with evolution, I would want the people to be highly knowledgeable about it...
Interviewer: Okay. Where would you go for facts?
Karen: I am just very, very, very interested in just the facts, but I would want to get the facts first, before I start looking at any of the biases.
Interviewer: Sure. Tell me how you would go about doing that.
Karen: You want to know how I would get them? Magic, because everything's going to [be] biased in one way, shape or form, unless I actually get the documents that show me exactly what's going on at that current time. Then I could watch the numbers change, because they are constantly changing.
Interviewer: So, primary research.
Karen: Yes.
Interviewer: So, would it be fair to say that you would trust a primary research paper that said, "Here's what we did; here are the results, here's what may or may not be happening."
Karen: If it's all strictly computer data, that you can give me actual readings, yes.

Karen's epistemic authority with respect to global warming became less clear over the course of the interview. As she felt that all researchers and their conclusions would be tainted by bias, she stated that she did not trust anyone with respect to this issue. She did, however, state that she would trust raw data collected by scientists actively engaged in research into global warming, but it is likely that Karen, if reminded that scientists gather data based upon the questions they are asking, would have discounted this as well. This distrust, overshadowing all other considerations, did not have its basis in the scientific community; rather, it originated with Karen. She must therefore be considered her own epistemic authority. As Karen was not a practicing member of the scientific community, her views constituted belief.

Characteristics of global warming belief sources related to perception of authority

Karen's most important characteristic with respect to knowledge sources was the lack of bias, or at least, the apparent lack of bias. As she maintained that no one was free of bias in global warming research, no one met this standard.

Justification of epistemic authorities used in global warming position construction

Karen considered herself to be an authority with respect to global warming. However, her justification was based on vague generalizations; that no one else can be trusted because of their biases. Karen mentioned specific subdisciplines, and in the absence of her distrust, her justification could have been rated as very well-aligned. However, her distrust and ultimate reliance on her idea about extreme bias in the scientific community with respect to global warming caused her justification to be rated as poorly aligned.

Characteristics of student related to perception of global warming authority sources

Karen's characteristic related to her perception of her global warming authority sources was her belief that any research into global warming is tainted by bias. This belief came from her educational experiences, in which she felt that both her textbook and her teacher in an environmental health class exhibited bias towards conservationism.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did not exist in Karen's positions on evolution and global warming. Karen relied strongly on scientists for her position on evolution, thereby constituting knowledge. However, her position on global warming constituted belief. The key difference was in how Karen viewed scientists with respect to the different topics. During the global warming interview, Karen dismissed all researchers as biased

and even compared evolution and global warming research to defend her position. This disparity in strength of the perceived authority of scientists meant that Karen's sources with respect to global warming and evolution did not have epistemic commonalities.

Kate

"Kate", Description

Kate was a 19-year-old female underclassman, self-identified as Caucasian, and neither stated her religious nor her political identity at the time of the interview.

Kate, Questionnaire

Kate's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 23 shows the quotes used to assign Kate to position RE-U in the grid.

Table 23. Selected supporting quotes placing Kate at position RE-U.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Rejects evolution	I don't agree with macroevolution and want people to realize it is a theory not a fact.
Uncertainty, either in reality of GW or humans' role in GW	Maybe, maybe not. I see things that back it up (Global Warming) but I don't know how we could fix it.

Questionnaire effectiveness and views

Kate was placed in RE because she stated that she disagreed with macroevolution. On the evolution pre-interview position list, Kate outlined her own position: "I believe that a single creation event consisting of six 24 hour days literally occurred somewhere between eight to ten thousand years ago." As this is indicative of Biblical literalism, which rejects evolution, the questionnaire accurately provided Kate's evolution position.

Kate was placed in U because one of her questionnaire responses attributed global warming to humans. On the global warming pre-interview position list, Kate indicated that her global warming position was "I believe that global warming is occurring, but I do not know whether humans have affected it or not." In Kate's case, the questionnaire appeared to accurately place her global warming position as U.

Sources of epistemic authority re: evolution

Kate initially mentioned the Bible when asked who she would trust for accurate information on evolution:

> Interviewer: ok Kate what sources would you trust for accurate information on evolution?
> Kate: I would trust the Bible because I firmly believe that is all God's spoken truth. And then I would trust sources that are based from Biblical sources, like there is a creation museum in Kentucky or something, maybe Tennessee. So I would trust those type[s] of sources that have Biblical information that back up what they are saying.

Kate was then asked about other religious sources:

> Interviewer: How about so in addition to the creation museum, perhaps any things like the Journal of Creation Science? I believe that's a journal out there that does that has exactly the same viewpoint as the Creation Museum, so something like that you would also consider – ?
> Kate: Yes. I would have to look into it and look into where its sources came from. And I would probably talk to my pastor or other Christian peers that I have, and see what they thought about it as well, because I don't know much about that magazine. So I would say possibly.
> Interviewer: So you mentioned talking to your pastor or peers. Does your pastor assist to with helping to refine your views?
> Kate: To an extent. In college, I'm in a different church in a different environment, and so I would ask his opinion, but his opinion doesn't make it my opinion. I very much have my own views.
> Interviewer: But if it came to accurate information, or saying whether this particular journal is Biblically valid, the pastor would be someone–
> Kate: that I would trust?
> Interviewer: Yes.

Kate: Definitely.

Kate was then asked to elaborate on that response:

Interviewer: So tell me why you consider these sources accurate?
Kate: Both people or – ?
Interviewer: Everything we've just mentioned. We could start with the people and then talk about the creation museum, and so forth.
Kate: Well, I consider those people accurate because I've seen how I can trust them and I'm a senior so I've seen how I can trust them in these last four years. How they've stood strong on what they've believed in, how they've been able to back up their things as well. My peers and my pastor, for instance. And then as far as the Creation Museum, I have done a little research. I'm just seeing some of the things they've done [and] I think it's pretty cool. There [are] a few of them around the states, but I know the one either [in] Kentucky or Tennessee, wherever it is, [is] one of the better ones. However, I have not ever been there, so I can't like say with founded fact that that is true and that it is firmly what I believe. But I can say, looking at what they believe, that they seem to take a lot of where they get things from [a] Biblical perspective. And then, as far as the Bible goes, I have been raised with the Bible. It's a part of my life for my whole life, and I've seen God work in my own life and I've seen God work in other people's lives. I know that He's true and I have a firm faith that He is real and He is living. And He also says that His word is true and living and so if He says His word is true [and] living, I'm not going to doubt God.

Kate was then asked how she defined accuracy:

Interviewer: Can you tell me what you mean personally by accurate?
Kate: True, I guess. Yeah.
Interviewer: All right. I'm looking for a general definition, because the very first question I asked was what sources you would trust for accurate information on evolution.
Kate: I would say true. Founded. And accurate would mean there are multiple things that back it up, not just one person or one fact.
Interviewer: And by founded do you mean grounded Biblically?
Kate: yes.

Kate was then asked to elaborate on how her sources made them useful for her position on evolution:

Interviewer: So talk to me a little bit more about the Bible and about your pastor. What characteristics about them make them useful for your position on evolution?

Kate: Well, the Bible has a clear story about creation, Genesis 1 and Genesis 2. I've studied both of them and they are a little bit different, but there are different stories that back up why they may be different. Maybe they were written by two different people. Maybe there were two different stories passed down the lines from two different people. But I believe that both could have happened in the 6 day period just a little bit slightly differently. So the Bible tells me how the world began and then it continues to go on. And as far as my pastor goes, he believes firmly in the word of God and so do my peers. They don't believe that there's parts of the Word that we don't have to believe or that we don't have to abide by and I believe that the whole Bible, the whole thing, is important. And not just portions of it. You can't just take and choose what you want but you get to go with the whole thing. And so listening to them and their views on creationism, and I mean, I know we are talking about evolution, but to me creation is what happened and there is you know micro but there's not this other sense of evolution.

Kate was then asked about additional sources she would use to inform herself about evolution:

Interviewer: You've seen some of the materials about the Creation Museum, so it's obviously been a topic that at one time or another has been of some interest to you. If you were to look into it again and try to further your understanding of it, what sources would you turn to for adding to your understanding?

Kate: I'd definitely look at that museum and I'd look at different books. I mean I haven't done [much] research into to know[ing] what books say. There was a week at camp where I was counselor, and they talked a little bit about evolution one day and that's kind of what spurred just looking into other things. It was a couple of years ago. But they gave the counselors these books about evolution and how Biblically where it lines up and Biblically where it doesn't line up. And where the holes are in evolution and where it's just a theory, it's not a fact. And like a lot of times it gets preached as that. And when I was in high school in my biology class, creationism was given a little paragraph in our biology textbook. That was in a public school in Atlanta. I was given a little paragraph and my teacher didn't even discuss it. She just talked completely about evolution. We had a whole unit on it. Nine weeks. And it frustrated me a lot, because to the people in that class who didn't

have a founded faith or really understood Christianity or creationism or any of that, they took evolution to be a fact. And so those things frustrated me and spurred me on to try to figure out what are the gaps in it. And so [I would] definitely look at books. I [would] probably talk to some people that I know from the camp. I haven't talked to them in a while, but I know [they] would have resources that I could use to look at, because I've known them for years and I trust their opinions. I'd probably do some research on the internet, too, but that's always hard because you never know what you can trust or not trust.

Interviewer: I was just getting ready to ask you how you would choose between different internet pages. Are there any particular sites on the internet that through experience you have found to be trustworthy?

Kate: I use this site called Bible Gateway all the time… But for the most part, other than that, I don't really use the internet a lot to find sources for that. I hate even using it for school, because it's so hard to figure out what is a good source and what somebody just put on the internet and wrote… so if I was ever going to use the internet to do this, I would probably talk to someone who had already used the internet to try and find the website that they used or recommended. Or maybe find a Christian magazine that was online or something like that.

Kate's epistemic authority with respect to evolution was her religious beliefs. The first source that Kate mentioned was the Bible, and the authority of every other potential source was judged by how well it conformed to what Kate viewed as Biblical literalism. Kate mentioned her pastor, her peers, and the Creation Museum, but all of those sources were dependent on Kate's perception of them being "founded"; e.g., having their foundation in a literal reading of the Bible.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Kate's knowledge of evolution could be considered generalized:

Interviewer: What other topics have you found these sources useful for?
Kate: What do you mean [by] topics?

Interviewer: Other than evolution, what other topics have you found the Bible, your pastor, and your peers –

Kate: Oh. Everything. Life. Living. God gives me a purpose to live and a reason to be here on this earth. I see a lot of people without hope, and a lot of people who don't have a security in life and don't understand why they're here, and want to know a reason. God and the Bible give me that reason. The Bible is God's written word and so to be able to read what He has given me and to find, it gives me advice. It helps me to know decisions that I should make. And no, it wasn't written in this day and age, and so sometimes I've just got to be in prayer and talk with other peers and other people to make decisions, but it very much shows me how to live a life that is righteous and a life that follows God. I teach Sunday school [and] I tell my kids that the Bible teaches us three things. It teaches us about God, about God's people and then about how to be God's people. And those are the three main things that if you were going to throw everything into one of these three little categories it could go into one of these three little [categories].

As her sources would most likely be what the scientific community would consider belief, Kate's sources constituted belief.

Characteristics of evolution belief sources related to perception of authority

A basis in Biblical literalism, or what she believed to be a basis in Biblical literalism, was the characteristic that defined authorities with respect to evolution for Kate.

Justification of epistemic authorities used in evolution position construction

Given that Kate considered the Bible, or other religious sources, to be legitimate authorities with respect to a biological science concept, Kate's epistemic justification was not congruent with what the scientific community would understand as evidence; Kate relied on authorities that have their foundation in the supernatural. Therefore, Kate's justification of her epistemic authorities was rated as poorly aligned.

Characteristics of student related to perception of evolution authority sources

Kate's religious experiences were clearly related to her perception of the Bible as her authority. Beyond this, it was difficult to assign Kate's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Kate initially stated that she would find the Bible an accurate source for information on global warming:

> Interviewer: Kate can you tell me what sources that you would trust for accurate information on global warming?
> Kate: I mean probably the Bible, if it said anything about it, which I don't really know. And I guess my peers, and again, I would trust my pastor.

In the absence of direct references to global warming from the Bible, Kate seemed somewhat lost:

> Interviewer: What sources would you trust for accurate information on global warming, if your peers or pastor came back and said there's not really a lot that we can talk about with respect to global warming being endorsed or not endorsed by the Bible. Where would you then turn to for information?
> Kate: I don't even know. I mean I might look on the internet, but again, picking out what is accurate or what is true and not just written down, I don't know. I guess it's good to see extremes from both sides because it kind of gives you an overall view of what may be going on or may not be going on. I don't know.
> Interviewer: When you say extremes from both sides, what would you consider to be an extreme on both sides?
> Kate: Well, there's lots of people that say that it's rubbish, to quote them, and that it doesn't happen and that people need to stop freaking out about it. And then there's other people that are hard-core, 'this is happening we need to stop it we need to recycle everything or do everything that will stop global warming from happening.' So there's these really two extremes and they are both really passionate about both sides.

Kate was then asked about the global warming controversy itself, in order to attempt to draw out more information on potential sources:

Interviewer: Would you categorize it as a political, as a scientific controversy, as a intellectual controversy?

Kate: An environmental controversy. I feel like it comes into politics sometimes but it's not the biggest deal in politics. But the environmental people will bring it into politics and that's why it comes in. I guess that wasn't any of your suggestions.

Interviewer: Oh no, that's fine. I would far rather that you come up with something and tell me, than me lead you into something. Considering that it's a environmental controversy, where would you go to find out more about the environment?

Kate: Any environmental teachers here, [university] teachers. There's a lot of them, but a lot of them are really gung-ho, so I would take what they say but I would probably also research it myself. I don't just take what people say as fact.

Interviewer: You said ecology and environmental teachers. What is it about them that would make you – ?

Kate: They know their stuff. They are doing this for a living, so they know things about the environment [that] I don't know. my roommate, actually, she loves the environment. Yeah. And she loves to recycle and those things and I don't mind it, so I would probably talk to her, too. Because she knows a bit about the environment and a bit of what helps it.

Interviewer: Would you consider your roommate, or one of these professors who's involved in the ecology or with the environment? Which one of those would you consider be a more reputable source?

Kate: Probably the professor. Because my roommate's not studying it or anything, but I would definitely take what she says and think about it because she doesn't study it but she looks into stuff because she wants to.

Kate was asked more about how she viewed professors:

Interviewer: Would you consider the professors to be more well-informed then than your average layperson?

Kate: Yeah, than your average person on the street, definitely.

Interviewer: Do you consider the textbooks that you get in science class to be – ?

Kate: Sometimes, because I know professors will sometimes publish their textbooks. So how long have they been studying this stuff do they really know to publish this stuff today? I think it varies.

Interviewer: so would you trust a book that was published by the professor that was teaching the class? Would you consider that to be more or less a reliable source of information than if they brought in a textbook that they hadn't authored?

Kate: I think it's about the same, because if the professor brings in another textbook then they are going to trust it probably about as much as something that they would write and if they don't trust it as much as something that they would write they're going to tell you that. They're going to say well this is the best one I could find out there. They tell you their opinion.

Interviewer: If the teacher trusts the textbook would that imply to you that you should also trust the textbook as well?

Kate: I mean it would imply to me to look into it with a little more foundation than something that I just picked up randomly. Because there was somebody else backing it up.

Kate's epistemic authority with respect to global warming seems to be professors at the university she attends. Although she mentioned the Bible first, in the course of the interview, it became clearer that Kate did place some trust in professors in ecology or environmental classes for information on global warming. She was somewhat at a loss for answers in the absence of direct information from the Bible, but her statement that she would trust a book more if one of her professors mentioned it denotes trust. Kate admitted that she did not know much about global warming; at the end of the interview, she said, "I should be more well-informed. I'm not." This uncertainty almost certainly resulted from both a lack of information and a lack of any strong authority.

Belief/knowledge with respect to global warming

Although the epistemic authorities that made contributions to Kate's knowledge of evolution could be considered weak, these sources would most likely be what the scientific community would consider sources that drew their information on global warming from an appropriate source. Therefore, Kate's sources mostly constituted knowledge, rather than belief.

Characteristics of global warming knowledge sources related to perception of authority

According to Kate, the characteristics that made professors useful for knowledge about global warming were that "They know their stuff. They are doing this for a living, so they know things about the environment [that] I don't know." Apparently, Kate did trust scientists for accuracy because they spend time in research.

Justification of epistemic authorities used in global warming position construction

Kate considered university professors to be an authority with respect to global warming. However, her justification was based on vague generalizations; that professors can be trusted because they make their living studying the environment. Kate did mention professors having to do with ecology and environment, so she did narrow her choices somewhat. If she were more certain about the authorities she chose beyond generalizations, Kate's justification would have been rated as very well-aligned; however, given an obvious lack of consideration about global warming, Kate's justification was rated as somewhat poorly aligned.

Characteristics of student related to perception of global warming authority sources

Kate's characteristic related to her perception of her global warming authority sources was clear: she had not considered global warming important enough to investigate in detail. It is not unreasonable to posit that this resulted from Kate's inability to relate global warming to her religion; in fundamentalism, parents and the church teach children from a young age on that the Bible is a part of every aspect of life (de Ruyter, 2001). If Kate was unable to link global warming with the Bible in some fashion, she may have simply considered it unimportant.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did not exist in Kate's positions on evolution and global warming. Kate relied strongly on her religion for her position on evolution, thereby constituting belief. However, as she was unable to relate global warming to her religion, Kate was left with very weak epistemic authorities with respect to that topic. It is not unreasonable to think that Kate's position would very much be dictated by what her peers in her religious community and her pastor said. In this event, Kate's epistemic authorities with respect to global warming and evolution would be identical. However, at the time of the interview, they were not.

Rachel

"Rachel", Description

Rachel was a 21-year-old female upperclassman, self-identified as Caucasian, and neither stated her religious nor her political identity at the time of the interview.

Rachel, Questionnaire

Rachel's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 24 shows the quotes used to assign Rachel to position AE-NA in the grid.

Questionnaire effectiveness and views

Rachel was placed in AE because she called the anti-evolution cartoon "silly." Perhaps most tellingly, she referred to "someone's belief in creation," as opposed to "my belief in creation" or "my belief in religion." On the evolution pre-interview position list, Rachel outlined her own position: "I believe that evolution happened, and that the evolution of species can be explained without assigning a role to God in any

Table 24. Selected supporting quotes placing Rachel at position AE-NA.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution without attempting merging with religion	It's silly, the theory of evolution takes nothing from someone's belief in creation unless they choose to see it that way. Evolution has a basis in science, creationism has its basis in faith.
Anthropogenic global warming is not occurring	I happen to think this is still debatable. There are just as many scientists who support global warming as don't support it. Before we kill our economy for something we better have 99% of scientists in agreement.

fashion." As this is an acceptance of evolution while specifically denying a role for religion, the questionnaire accurately provided Rachel's evolution position.

Rachel was placed in NA because her questionnaire responses never attributed global warming to humans, and expressed doubt that global warming is even occurring. On the global warming pre-interview position list, Rachel indicated that her global warming position was somewhere between "I believe that global warming is occurring, and is a natural cycle, and that humans have not affected it one way or another" and "I do not believe that global warming is occurring." Notes from the interview indicated that Rachel chose to express her views this way because she thought that global warming was an unlikely proposition, and that even if it is occurring, humans have no effect on it. As either viewpoint denies an anthropogenic role in global warming, in Rachel's case, the questionnaire appeared to accurately place her global warming position as NA.

Sources of epistemic authority re: evolution

Rachel initially mentioned scientific journals when asked about information sources on evolution:

> Interviewer: Rachel, what sources would you trust for accurate information on evolution?

Rachel: Scientific journals. That's probably it. Not textbooks, so much.
Interviewer: Why would you consider a scientific journal as an accurate source of information?
Rachel: Because particularly if you have to publish in there, typically from what I understand, there is an editing process but it's more than just putting it in a newspaper. People have to look at it and make sure your reasoning [was] sound and that you actually did go through the scientific methods.
Interviewer: Is the phrase peer review is that what you are referring to?
Rachel: Yes.
Interviewer: And is it the peer review or is it the scientific method that makes it more accurate for you?
Rachel: Probably the peer review.
Interviewer: What is it about the peer review that generates trust for you?
Rachel: I basically believe that if several people all holding pretty much the same – that are experts quote unquote in their field that are looking at this and discussing it, they are going to be able to say 'yeah, that sounds right' or 'no it doesn't.' Not that they're all going to agree. That would probably be a miracle. But if you get more saying 'yeah, that's some pretty sound reasoning' and they put it in there. I guess I feel like [a] majority in that situation makes me feel a little more comfortable.

Rachel then outlined her image of an expert:

Interviewer: And how would you characterize an expert?
Rachel: Probably somebody holding a doctorate in that area. Somebody who has spent a pretty significant time doing some of the research in that area. Or somebody working on their Ph.D. in that area that's spent some pretty decent amount of time looking into something.
Interviewer: So how do you initially decide on what would be an accurate source?
Rachel: Well, typically, one of the first things I do is look at the author first. I do look for that 'Dr.', as haughty as that sounds. And then usually you can find something about the author somewhere. See how long they've been doing it, how long they've been researching it. And, I guess, word of mouth. Things start rolling and you start hearing that certain things are not credible sources [and you] kind of start to step back a little bit. Or at least look at it with a more critical eye.
Interviewer: So reputation then plays a part in it as well.
Rachel: Yes.
Interviewer: And what kinds of things do you look at to [recognize] that [someone] has got a good reputation?

Rachel: I guess reporting more factual stuff than opinion-based stuff. Somebody that's not afraid to publish both sides on something. If anything seems biased at all, if I read it, I read it with a grain of salt.

Rachel was then asked about scientists:

Interviewer: So we've mentioned journals and would you by extension also include the scientists that publish in these journals as sources of accurate information?
Rachel: Yes.
Interviewer: What is it about these scientists and the journals that they publish in that make [them] useful for your position on evolution?
Rachel: I guess [they are] useful for me because I feel like they answer questions obviously about that time or what had been around. And they have spent so much time in school learning these things, studying these things, running these tests, doing these experiments that I'm never going to have time to do and not get paid for. So it helps me because I still have questions about it myself but I can't do the research. And they are out there doing it, so it helps me to understand where we came from.
Interviewer: Would you think it would be fair to say that they generate knowledge that you don't have time to generate yourself?
Rachel: Yes.
Interviewer: And the way that they generate the knowledge, does that play into how you find it useful for your position on evolution?
Rachel: I would say that the more data that they have to support, the more willing I am to read into it a little bit more [and] find out more about it. I guess and basically trust [their] numbers are good.
Interviewer: So then is it evidence that they present in making their arguments?
Rachel: Yeah, evidence is a better word.

Rachel was then asked what sources she would consider useful for adding to her understanding of evolution:

Rachel: Some sources on the internet. If I could verify that they were trustworthy.
Interviewer: and how would you go about verifying them?
Rachel: Good question. I guess I could, probably most websites have at least some information about who is behind the website. If it's just some random person then I'm probably not going to buy it one hundred percent. If it is somebody [who has] a 'Dr.' in front of the name, I understand it can be [deceptive], so I guess I just have to

try to look at who's doing it and what their credentials are. If it's not on the website, I'm probably not going to look at it either.

Interviewer: How much would you want to see references to journals, or perhaps sources that you have already previously encountered? Is that something that you would look for or consider to be a necessity?

Rachel: I would look for it. I don't know if I would consider it to be a necessity or not. Yeah, no, I don't think I would consider it to be. I would look for it. It would probably make me feel a little bit more comfortable to see it.

Interviewer: And how about a peer review process?

Rachel: That would be much better, although I don't know how you go about looking for that on the website.

Interviewer: One example I could possibly think of would be a scientific organization that said we won't post anything on our website unless it's gone through review by the editors of the website.

Rachel: Yeah. That would be that would help me to trust the site a lot.

Interviewer: So you can say with some confidence that you would trust a website that had those characteristics over one that would not?

Rachel: Yes.

Rachel defined her epistemic authorities with respect to evolution as the scientific community, and within that community, researchers specifically concerned with evolution who were subject to peer review. Any other source – journals or internet sites – had authority only if their claims originated with the scientific community.

Belief/knowledge with respect to evolution

As her sources – scientists doing peer-reviewed research into evolution – would be what the scientific community would consider knowledge, Rachel's sources constituted knowledge.

Characteristics of evolution knowledge sources related to perception of authority

Knowledge originating from scientists actively involved in peer-reviewed research into evolution was the characteristic that defined authorities with respect to evolution for Rachel.

Justification of epistemic authorities used in evolution position construction

Given that Rachel considered individuals actively involved in peer-reviewed scientific research on evolution to be legitimate authorities with respect to a biological science concept, her justification of the sources of epistemic authority was rated as very well-aligned.

Characteristics of student related to perception of evolution authority sources

Rachel's educational experiences were related to her trust of credentials – which, in turn, may have led to her perception of credentialed scientists as her authority:

> Rachel: Actually my high school biology teacher was, held a doctorate. And I was actually impressed with how much he knew and how much detail he would go into. I would say probably in high school is when I started really I guess believing it [natural selection] – that's a bad word but. I mean believing in it – was probably high school with Dr. [name omitted].
> Interviewer: And so you said the fact that your high school teacher held a doctorate, was that is that part of what made a real impression on you? How important was that?
> Rachel: I think it was his base of knowledge because one little thing, and it would send him off on a tangent – a bad word again – but he had so much that it was almost like we never could get through it all. He knew so much about it [natural selection]. And later on in high school, I understood what it actually took to get a PhD. That's what kind of made it click, I guess, for me.

Beyond this, it was difficult to assign Rachel's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Rachel initially stated that she would find NASA and the Weather Channel's website accurate sources for information on global warming. She was then asked why she considered them accurate.

> Interviewer: Why would you consider those sources accurate when it comes to global warming?

Rachel: I read this study that NASA did on global warming. On the NASA website, it had listed the scientist that they had behind the study. Then again, I knew that NASA was government funded. And I know that had to go through peer review to get up there.

Interviewer: So you've mentioned peer review and you mentioned government funding.

Rachel: Yes.

Interviewer: So would you consider this to be this report to have been relatively free of bias?

Rachel: Yes.

Interviewer: So is it the combination of the peer review and what looks like as close to objectivity as you can get? Is that what appeals to you and makes you consider the sources accurate?

Rachel: Yes. I know everybody goes into everything with some sort of opinion, but I like to hear both sides. It may not change my opinion, but I like to hear both sides.

Interviewer: You just mentioned that you like to hear both sides. Did this report present more than one side?

Rachel: The first one did not. And I didn't really know what to think about global warming in the beginning when that happened. And then they came out with a release on their website. I don't know if they did it on the news or not, but on the website, it said that we have to retract this information because we found out that a lot of our temperate reading sites were next to air conditioning units. Trash cans. They were burning trash and all kinds of interesting things. So I guess it built back up my trust that they were able to go back and say oops, our bad, retract that.

Interviewer: So it was the retraction that boosted your confidence in it?

Rachel: Yeah. Because I think it takes, I don't want to say guts, but it's something when you are able to go back and say we made a mistake and we're going to go back and do that again.

Interviewer: Would it be fair to say that it was the essential honesty of it that – ?

Rachel: Yeah.

Interviewer: And so that's what generates trust for you, is the feeling that they were mostly concerned [with] was not an agenda but putting out what they felt were the most accurate facts?

Rachel: Yes.

Interviewer: And so, does that tie into what makes you feel something is an accurate source?

Rachel: Yes.

Later in the interview, when Rachel was being asked about the Weather Channel, she revealed her major reason for doubting global warming:

Interviewer: The Weather Channel, are there any other topics that you have found that useful for aside from global warming?
Rachel: I check my weather there. But I they sometimes have some pretty neat articles up there about weather patterns and I know there was one up there about this super storm that I read that one with a grain of salt too.
Interviewer: What made you read that one with a grain of salt?
Rachel: I don't know, I guess it's just that this idea of the perfect storm that all these pieces have to fall into place. I guess it definitely could happen but what's the likelihood, and why are you trying to scare me to death?
Interviewer: Was it the speculative nature of it?
Rachel: Yeah, I guess.
Interviewer: So does that same sort of speculative nature play into how you view global warming?
Rachel: Yeah. [There are] people who swear that it's happening. There are still people say that it's not. There's still evidence to show that it's not. There's evidence to show that it is. There's this, there's that, and there is so much up in the air. Yeah, I have a hard time saying global warming's happening.
Interviewer: So would it be fair to say that your position on global warming would be more definitive if you perceived a consensus within the scientific community?
Rachel: Yes.
Interviewer: So a consensus would be – ?
Rachel: Yes. I mean, if they suddenly all said 'we've looked at all the data and it is happening' I would be, like, wow, ok.
Interviewer: Do you consider there to be a consensus when it comes to the validity of evolution?
Rachel: In the scientific community?
Interviewer: Yes.
Rachel: Yes.
Interviewer: Ok. Just wanted to jump back to that for just a second.
Rachel: Yes, for evolution, for me, that's a debate between – a broad word – the church and science.
Interviewer: Ok, so then, you see global warming as a debate between – ?
Rachel: Scientists.
Interviewer: Between different scientists?
Rachel: Yes.

Rachel's epistemic authority with respect to global warming was the scientific community involved in peer-reviewed research into global warming. It was Rachel's belief that there is not a consensus position amongst the scientific community with

respect to global warming; she specifically stated that had she perceived such a consensus, she would have aligned her views with the scientific community.

Belief/knowledge with respect to global warming

Although on the surface, Rachel's denial of anthropogenic causes for global warming might seem like belief, the epistemic authorities that she values would most likely be what the scientific community would consider knowledge. Therefore, Rachel's sources constituted knowledge, rather than belief, especially given her willingness to change her views to reflect those of a consensus of the scientific community.

Characteristics of global warming knowledge sources related to perception of authority

According to Rachel, the characteristics that made the scientific community useful for knowledge about global warming were that they are actively engaged in research, and that their work is subject to peer review.

Justification of epistemic authorities used in global warming position construction

Rachel considered the scientific community involved in peer-reviewed research on global warming to be the ultimate authority with respect to global warming. Given this specificity, Rachel's justification could have been rated as very well-aligned. However, given her major misconception about the lack of consensus in the scientific community with respect to global warming, her justification was rated as poorly aligned.

Characteristics of student related to perception of global warming authority sources

Rachel's educational experiences; e.g., the trust of credentials – which, in turn, may have led to her perception of credentialed scientists as her authority – that

established scientists as an authority, were the main characteristic related to her perception of global warming authority sources.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities were very clear in Rachel's positions on evolution and global warming; in fact, they were identical. Rachel relied strongly on her perceptions of the scientific community involved in peer-reviewed research for both her position on evolution and global warming, thereby constituting knowledge in both cases. Despite her misapprehension about a lack of consensus in the scientific community with respect to global warming, it was clear that Rachel felt her position on both topics should align with the scientific community's.

Rick

"Rick", Description

Rick was a 19-year-old male underclassman, self-identified as Caucasian, stated his religious identity as Christian, and did not specify his political identity at the time of the interview.

Rick, Questionnaire

Rick's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 25 shows the quotes used to assign Rick to position M-AGW in the grid.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Rick's position was a mix of two positions: "I believe that God uses evolution for creation and has specifically directed evolution's pathway," and "I believe that God set up the rules of the universe at the

Table 25. Selected supporting quotes placing Rick at position M-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Anthropogenic global warming is occurring	This is REAL… Drastic things need to happen. Global warming is not a joke. We are stressing out planet with greenhouse gases and overpopulation. Resources are scarce and we need to start acting like it.
Accepts evolution and attempts merging with religion	It is scientific reasoning to believe that we evolved from one-celled organisms. I believe we were created by a higher power. However, we could have been created into single-celled organisms to evolve into intellectual beings.

beginning and let it go, resulting in evolution. God created the universe but allowed random chance in evolution." According to notes taken at the interview, Rick stated that he thought there was some random chance and some direction involved in evolution; therefore, his position was a compromise between the positions he chose. Rick was placed at position M because he clearly merged his religion with an acceptance of evolution in the questionnaire. His placement at position M clearly reflected his views, and the questionnaire accurately placed his evolution position.

On the global warming pre-interview position list, Rick indicated that his global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." Notes taken at the interview indicated that Rick's reason for choosing this position was that he felt that a natural cycle might play a slight role in global warming, but that global warming was mostly due to human activity. Therefore, the questionnaire appeared to place Rick's global warming position as AGW accurately.

Sources of epistemic authority re: evolution

When asked about what sources he would trust for accurate information on evolution, Rick went into detail about his views of evolution. Rick was then asked for the same information in a different fashion:

> Interviewer: If you were looking to add to your personal information base about evolution, what sources would you trust for that?
> Rick: Well, I would really like a textbook, a legitimate textbook. I wouldn't go to the internet for this kind of information. National Geographic, they put out a lot of stuff over the years. You feel like you could analyze [the] many thousands of clips or videos that they have and form your own opinions, and then summarize it all.
> Interviewer: So why would you consider a textbook legitimate? What is it about a particular textbook that would generate trust for you?
> Rick: The time that was spent to write it. A textbook, [as opposed to] just a book, has multiple authors. Multiple people that read over the book before it's actually put out. And the views of many, rather than just one person.
> Interviewer: So is it so multiple authors – ?
> Rick: I find it more legitimate, because with multiple people, more likely there's been more research and more thought put into it. And then also, being a textbook, it's probably broken down into simpler ideas so you can grasp it. And then you get a better idea of what they think and how they think.
> Interviewer: So that would be information that you would consider useful for adding to your understanding about evolution. You mentioned that the textbook breaks it down into simpler ideas. Those ideas are broken down from more complex things, so who would you trust in terms of the more complex arguments?
> Rick: I never really encountered anyone that has presented more complex ideas about it. But I would somebody like a theorist. It's a theory and so you could accept that theory [from] somebody that's been studying it. So like a professor presents that theory to you and it's something that you can kind of take in and judge as your own person. And see if that fits in with everything else you've ever heard.

Another angle was attempted to distinguish Rick's sources of information:

> Interviewer: So let me set up a little bit of a scenario for you. Let's say that you're talking to somebody and the topic [evolution] comes up. This person says, 'I don't know a thing about evolution or any of this debate. I just haven't paid any kind of attention to it but

now I'm kind of curious to know, where do I go to get good information on this?' What would you recommend that they do?

Rick: I would first – this is kind of out of character – but I would actually tell them to like go to church [and] see what they had to say on the matter. And then if they didn't like that, then to seek a book about it. And not just one book, but several different books to gain a variety of knowledge. So you can take what you've learned and kind of ingest it, compact it into one thing that you can regurgitate.

Interviewer: So let's say they take your advice, and are looking for books about evolution. And they say 'There's about ten thousand books in the library on evolution. What should I look for?'

Rick: Gosh. I'd read a textbook first. I would read a collegiate textbook and then I would go from there. And then maybe ask somebody that's more knowledgeable about the subject. I don't know. It's taken me 19 years to form this idea.

Interviewer: Well, I want to key in on something that you just said, which was that you would go ask somebody more knowledgeable. Who would you consider to be more knowledgeable?

Rick: [It was] a generalized statement. Somebody older than I am. Maybe somebody like a professor, for sure. And I had a chat with one of my good friends. He's very religious and we were about what's truth and he could just sit there and like reel off Bible verses as to how things were formed. That's pretty cool. That's legitimate that he can state that. But as far as the legitimacy of the story isn't like, Jesus said I am the truth. So where do you go from there? So then I would immediately go to a geologist, an anthropologist, and then a chemist. Get all their ideas on the matter. And see how we evolved: socially, culturally, from the beginning of time. When they thought the beginning of time was, or is.

Rick's epistemic authorities with respect to evolution were somewhat difficult to distinguish. The closest he came to defining any kind of scientific authority was when he referred to college textbooks. However, he also mentioned seeking a variety of sources and coming to his own decision. It was difficult to conclude that Rick had anything but very weak scientific epistemic authorities; he had an ill-defined set of views on evolution and did not appear to have any central ideas except that there was some kind of design involved in evolution:

> I feel there was something supporting design, but at the same time, there was evidence of it [life] evolving from just a rock to what it is now. Think about it. Everything is so perfect. It's all perfectly made to fit. Everything runs smoothly together. Of course, we've run into complications and stuff, as far as diseases and pollution and whatever. But there's complication all the way, but that was from the individual; that specific species or that one person. It's not from the environment that was created so perfectly and runs so smoothly together. And it's kind of hard; you can't really question that and say, well, there's no way that somebody or something had the idea of putting this here. And the idea that all these things work together so smoothly and the environment and it just fits. It's centered. Everything was just thought out so meticulously. And, I mean, how? We can study it, but we can't design anything like that. We can't design a human being to function exactly like we do. Designer. The tree to absorb carbon dioxide and have cellular respiration. For the environment to give us water [and] food.

Rick's epistemic authority, therefore, was most likely his set of religious beliefs.

Belief/knowledge with respect to evolution

As the most prominent underlying idea with respect to Rick's views of evolution was an idea, related to his religion, that some sort of design was involved, Rick's views would almost certainly be considered belief.

Characteristics of evolution belief sources related to perception of authority

It is difficult to pinpoint characteristics of Rick's evolution belief sources; perhaps, the only characteristic that can be advanced is that any sources would have to be easily integrated into Rick's worldview.

Justification of epistemic authorities used in evolution position construction

Given that Rick considered his religious views to be a legitimate authority with respect to a biological science concept, Rick's justification of his sources of epistemic authority was poorly aligned.

Characteristics of student related to perception of evolution authority sources

Rick's religious experiences were most likely related to his perception of his religious views as his authority. Beyond this, it was difficult to assign Rick's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

When Rick was asked what source he would trust for global warming, he mentioned his environmental health science class and then outlined his views about global warming. Rick was then asked for the same information in a different fashion:

> Interviewer: If you wanted to learn more about specifically global warming, where do you think you would turn?
> Rick: I would really turn to [name omitted]. She was my environmental health science professor and she was very knowledgeable on the subject. She's done a lot of independent studies and done a lot of case work, so I feel she could assist me in learning more about it. Or not trying to particularly sway [me], but help me find a direct path as to what I should believe, and how I should take it from some sort of information.

Rick went on to claim that "statistics" were skewed in "An Inconvenient Truth, and he was asked his source of information for that claim:

> Interviewer: So what's your source of information for thinking that the stats were skewed?
> Rick: My source of information was actually – really sad in saying this – but [the] internet, [the] textbook, [and] my class. We just talked about it a lot, and our source of information obviously [was] our teacher. She was telling us that some of the stats were kind of spiked, and she showed us what other theories were. Timelines and stuff, and how there are a lot more contradicting what he [Al Gore] was saying. So we can kind of conclude that they were skewed a little bit.
> Interviewer: So in this case you've mentioned the internet, textbooks, and your professor.
> Rick: Right.
> Interviewer: Why do you consider these sources accurate?
> Rick: I consider these sources accurate because they are – again, I was overly into this class. It was a smaller class [and] we had a lot of

discussions about it [global warming]. I [wondered] what was going on and how could we help. But I really credit those sources from my classmates and what they've learned to increasing my knowledge from just talking to them. Also from the professor leading the discussion. I was really impressed [with] her knowledge of stuff, so I guess I took it to heart to believe her. Because I felt she really knew what she was talking about. What was the other question you asked?

Interviewer: Well, I wanted to know what it is about these sources that generates trust for you.

Rick: What generates trust for me?

Interviewer: Yes, because you've got to make a decision as [whether] this is a trustworthy source for information or not. So what is it about this particular professor, or the text that she used, or these discussions, or internet pages? I'm wondering what is it about them that actually generates trust for you.

Rick: Well, personally I thoroughly enjoy [the] outdoors…and so really what generates trust for me is when somebody says that we see what's going on, we see that we're polluting the environment, we know that we need to make changes. Sources that support ideas of global warming and that give reasonable data that's believable are trustworthy to me because I really want to see change… and I really do feel that even if you do say it's a natural cycle, I think it's hard to back it up that humans aren't worsening it or accelerating it tenfold. It's really hard to not believe in global warming. And if we can do whatever we can to let it do its natural cycle and eliminate the effects of us being here, then I feel we could have cleaner air [and] a great place to live.

After Rick mentioned papers, he was asked about the importance of their authors:

Interviewer: And how about the credentials of the people who are actually writing the papers? Do you take those into account?

Rick: Yeah, credentials are important to me, and obviously if I wrote a paper and just turned it in, who's going to believe that? Where did I get all my information? Obviously I get it from external sources and I'd probably cite it, but I don't know, that's just from what I've studied. I guess.

Interviewer: So what credentials would you find convincing or important?

Rick: Convincing or important? Just their field of study. If an English major was writing on global warming, I would hopefully find their paper interesting and I'd look at their sources and probably visit them to see what I thought. I feel, I don't know, great, vast knowledge in the field is important.

Interviewer: All right. Degrees?

Rick: Sure. But I also want to say that even if they don't have a degree and they are just passionate about it. Al Gore, he's learned a lot and he has the money to really kind of strike a movement, and so I feel that's just passion.

Interviewer: If you had several different people talk to you, which of these would make you say, 'I should change my mind' or 'Maybe I need to look into my position a little bit further'? Which one of these would make you think about your views more? A layperson, a politician, or an atmospheric scientist?

Rick: You said layperson?

Interviewer: Yes, just a person off the street.

Rick: Oh, ok. Yeah, the atmospheric scientist; I would stare at him awhile and ponder, but I don't really think I would at this point reconsider my position. I might look more into it and see why he thinks that. But then I would present him with my [thoughts] and see how he backed up his.

Interviewer: So would you bother having the same conversation with somebody just off the street? What I'm looking for is to see which of those types of people that you would take the most seriously.

Rick: Probably the atmospheric scientist. I would take him the most serious because I mean that's what he does. It's his job. If he does it, he probably has a passion for it and has motivation behind it. And a politician, what's he going to do, lobby for it? He may have a little bit of knowledge of it, but he's just a politician. And a layperson? I feel his argument wouldn't be as compelling as a blue bird singing in a branch or a sunny day. I would just stare at him.

As with evolution, Rick's epistemic authorities with respect to global warming were somewhat difficult to distinguish. Within the same minute, Rick said that he valued credentials, but then didn't necessarily value credentials. In the same fashion, Rick said that he would take an atmospheric scientist more seriously than anyone, but then said that an atmospheric scientist would not necessarily change his views. Rick's influence may have been his love of the outdoors. He maintained that taking care of the environment was important to him, and this may have predisposed him to believe that global warming is anthropogenic. Rick's authority seems to be his feelings about the environment; he stated that "I'm pretty set on what I believe. Even when I didn't know about it, I don't think I didn't believe that global warming was an issue."

Belief/knowledge with respect to global warming

Although Rick does accept anthropogenic global warming, it is not because of any particular scientific source; Rick, for lack of a better term, went with his gut, based on how he felt about the outdoors and the environment. As this was not based at all in science, Rick's authority would almost certainly be considered belief rather than knowledge.

Characteristics of global warming belief sources related to perception of authority

For Rick, the only belief sources that he would immediately find legitimate were those that aligned with his views about the environment.

Justification of epistemic authorities used in global warming position construction

Rick considered sources that aligned with his views about the environment to be legitimate, and he was willing to be skeptical about expertise in global warming research if it conflicted with his views. Essentially, Rick's beliefs about the environment Given this, Rick's justification of his sources of epistemic authority was rated as poorly aligned.

Characteristics of student related to perception of global warming authority sources

Rick's recreational experiences were clearly important to his perceptions about potential authority sources:

> I just want to state that I really enjoy the outdoors and I love the beauty that it brings. And one of my all-time favorite things to do is ski. I love to ski… I want to see, instead of us driving around in huge SUV's and getting five miles to the gallon, I want to see us having better transit; a better form of transportation, so we're not taxing the environment.

Beyond this, it was difficult to assign Rick's perceptions of authorities to any other characteristics; Rick did not mention religion, political affiliation, or his upbringing; rather, he focused specifically on experience with the outdoors.

Commonalities

One main epistemic commonality did exist in Rick's positions on evolution and global warming: Rick had pre-existing beliefs, and those beliefs took precedence. With evolution, it was his belief in design, and with global warming, it was his belief in preserving the environment. Rick was willing to ignore or discount research scientists who held positions that disagreed with his beliefs.

Roy

"Roy", Description

Roy was a 19-year-old male underclassman, self-identified as Caucasian, and stated neither his religious nor his political identity at the time of the interview.

Roy, Questionnaire

Roy's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 26 shows the quotes used to assign Roy to position AE-U in the grid.

Table 26. Selected supporting quotes placing Roy at position AE-U.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Uncertainty, either in reality of GW or humans' role in GW	While the jury is no longer out on climate change, a better question for global warming is why, not what. We should be looking into all causes, both human and natural. What the right says is "natural cyclical climate change" is in part exactly that from a geologic viewpoint and we should try and learn its extent.
Accepts evolution without attempting merging with religion	HA! This cartoon plays into the "direct from monkeys" theme Christians like to tout to gain support. Personally, I support empirical information over faith any day. If only for the reason that it give you evidence beyond, this guy (God) said so.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Roy's position was: "I believe that evolution happened, and that the evolution of species can be explained without assigning a role to God in any fashion." Roy was placed at position AE because he clearly rejected religion in favor of empirical evidence in the questionnaire.

His placement at position AE clearly reflected his views, and the questionnaire accurately placed his evolution position.

On the global warming pre-interview position list, Roy indicated that his global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." Notes taken at the interview indicated that Roy's reason for choosing this position was that he felt that a natural cycle played a major role in global warming, but that, due to the enormous complexity of climate systems, that any human role was uncertain. Therefore, the questionnaire appeared to place Roy's global warming position as U accurately.

Sources of epistemic authority re: evolution

Roy initially mentioned textbooks when asked who he would trust for accurate information on evolution, and additionally specified research professors:

> Interviewer: What sources would you trust for accurate information on evolution?
> Roy: I would trust most likely scientific textbooks from whatever my course is; biology, geology, most likely geology textbooks, that kind of thing. I grew up with a geology professor father and so that's where most of my information on evolution comes from, is him or his colleagues or information that I've found through him. Those are probably my most trusted ones.
> Interviewer: How would you define scientific?
> Roy: I define scientific as a – well, a formal definition would be a peer-reviewed article that is based on empirical data that has been collected and tested, I guess. That's kind of a long definition of it.

The shorter would be one that's developed by scientists that are working in an objective fashion, I guess. If I'm looking at a text and it says scientific, then I would hope that it's objective; that is, that it looks at all the information available and weighs them equally based on their merit, not based on some other condition.

Interviewer: So why would you consider these sources to be accurate?

Roy: I would consider them to be accurate because the same reason [that] defines them. The peer review – if it's a scientific source that is peer reviewed, that means that it's been looked at by several different people. Also the same time the testing of it, if you can actually have a theory or hypothesis, whatever you want to call it, and you can test it against possible situations where it could or could not be true and see if it is. Then you have a better chance of finding out the truth of it, I think.

Roy was later asked where he would find new information on evolution:

Interviewer: So if you wanted to add to your understanding of evolution, where would you go? What sources would you pick or use first?

Roy: If I were to do it on my own personally I would probably use the same sources that I'm familiar with; most likely, university faculty of some sort, probably in an evolution research lab. I've had good luck asking them specific questions. They always have answers or two that I could work with. I don't know about any converse sources to evolution at the moment, because I haven't seen any that are viable that I would even begin with. So mostly it would be sources that confirm or support evolution.

Belief/knowledge with respect to evolution

Roy was very direct when speaking about sources he would rely upon: research faculty, and he specifically mentioned a evolution research lab as a place to gain information about evolution. He also defined scientific papers as peer-reviewed. Given that Roy's sources were specific to evolution, and involved the scientific community involved in peer-reviewed research, Roy's views would almost certainly be considered knowledge.

Characteristics of evolution knowledge sources related to perception of authority

The key characteristic of Roy's evolution knowledge sources that contributed to their authority was that their claims originated with peer-reviewed research from the appropriate discipline in the scientific community; in this case, from an evolution research lab.

Justification of epistemic authorities used in evolution position construction

Given that Roy specified university laboratories engaged in peer-reviewed research as an epistemic authority, and also added geology professors with respect to he fossil record, Roy's justification of his sources of epistemic authority was rated as very well-aligned.

Characteristics of student related to perception of evolution authority sources

Roy's upbringing was most likely related to his perception of scientists as his authority:

> Interviewer: So you said that you grew up as a son of a geology professor, is that correct?
> Roy: Yes.
> Interviewer: And can you talk about that a little bit more, about your father as a formative influence?
> Roy: Yeah, he shaped the way I view the world in an enormous way. But of course it was a different time scale. Growing up in [state omitted], most of the people around you think of the world as a very young place. Or you can think of it as an extremely old place, which is how most geologists view it. You can have the two theories of geology, which is that there are very long processes that affect the earth and shape it, and then there are spontaneous events. And it's kind of a mixture of those two things. There are processes that are always happening; weather and erosion, and all those kind of things are spontaneous events, like meteor impacts, volcanic eruptions, all that. And so those ideas about the way the earth actually shapes and changes itself over time affected the way I look at the way life changes over time. Because in response to the environment on the earth, you see life changing with that. And whether the function by which that happens was just introduced to me as evolution. And so it's not so much that for me that I was

> looking at life changing specifically, I was looking at both components; the earth component, and then the way that the life on the earth was affected by that.

Beyond this, it was difficult to assign Roy's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

When Roy was asked what source he would trust for global warming, he mentioned peer-reviewed scientific research:

> Interviewer: Roy, what sources you would trust for accurate information on global warming?
> Roy: Well these days, I'm not so sure about that, because accurate information on global warming is kind of hard to come by, I think. Because it's something as complex as the climate situation of the planet, if you're asking for information on sea level change from a scientific organization, they may have data from ten stations from around the world that were recorded most every day or some of them they skipped a day on this that or the other, so all your information is going to be incomplete. But as a base, I have to trust the same kind of sources that I trust for information on other scientific topics: university studies, peer-reviewed information of some sort at least. Most definitely not the media at the moment, because they don't seem to have [a] very clear picture of what's going on. And their reports seem to contradict each other quite often.

Later, Roy was asked for the same information in a different fashion:

> Interviewer: What would you advise somebody who had next to no knowledge about global warming? How would you suggest that they investigate it and learn about it?
> Roy: I would probably advise them to talk to climatologists, and to talk to people who make it their business to study the history of the earth and its relation to global warming. The historical relation, because I think the most important thing to look at in that situation would be what has gone on in the past, and [how] the present situation [is] different. And if it is, how so. So I'd advise them to talk to the people that have the historical applications, the longer term view.

After Roy drew a distinction between the terms "global warming" and "climate change," he was asked the initial question again:

> Interviewer: Ok, then given that, let's revisit the first question and say what sources would you trust for accurate information on climate change?
>
> Roy: That's the same kind of sources. The climatologist, obviously the people who it's their said spoken profession to study. And I think again, I'm not sure if there would be any other sources besides them. No, not that I can think of.
>
> Interviewer: Well it's not very common to have the background that you have, in terms of geology and in terms of the scientific mindset. What would you recommend to someone who did not? Where would you recommend that somebody start a search for information on climate change if they didn't have as much experience with science you have?
>
> Roy: A good starting point? I think you have to get a handle on the factors that control climate change, first of all. So I think a good starting point would be to try to understand how the earth changes naturally and why. And so that would be you'd want to start with the kind of background that I already have; I guess how I would break it down, which would be geology. You start with the geological implications of an ice age [and] what causes it. This is the kind of things that can set it off…I think the delicate nature of what people are talking about is like increasing by a couple hundred parts per billion of one gas in the atmosphere or whatever… It's such a complicated situation that really I think you would have to go to an expert and talk to them about it. And expert is someone [whom] you have to trust their judgment when you go to talk to them about it. So you have to familiarize yourself with the situation to pick an expert. So its kind of a hard thing to describe, I guess.
>
> Interviewer: You mentioned a climatologist. Can you [tell] me what you would look for in a climatologist?
>
> Roy: If I was going to go talk to someone, I would probably look for breadth of research; not just focusing on one simple factor of what the climate is, but things that effect it from different angles because I think that's what kind of problem it is, is a multiphasic one. So I would probably focus mainly on their view of the global situation that's being affected by many small things. And look for the person that I thought had the best handle on that.

Belief/knowledge with respect to global warming

Roy specifically mentioned a climatologist as a place to gain information about evolution, and also mentioned peer-reviewed university studies. Given that Roy's sources were specific to global warming, and involved the scientific community involved in peer-reviewed research, Roy's views would almost certainly be considered knowledge.

Characteristics of global warming knowledge sources related to perception of authority

The key characteristic of Roy's evolution knowledge sources that contributed to their authority would be that their claims originated with peer-reviewed research from the appropriate discipline in the scientific community; in this case, climatologists. Roy did have additional requirements. He wanted a climatologist to have an historical perspective; e.g., some sense of climate changes in geologic time. He also wanted a climatologist to not be an extremely narrow specialist. Roy evidently felt that the complexity of climate systems would require someone to be able to look at a broader picture, as opposed to one very small portion of a system.

Justification of epistemic authorities used in global warming position construction

Given that Roy specified a climatologist engaged in peer-reviewed research as an epistemic authority, Roy's justification of his sources of epistemic authority was rated as very well-aligned.

Characteristics of student related to perception of global warming authority sources

As with his evolution sources, Roy's upbringing was most likely related to his perception of scientists as his global warming authority sources.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities were very clear in Roy's positions on evolution and global warming; in fact, they were identical. Roy relied strongly on the scientific community involved in peer-reviewed research for his position on evolution and global warming, thereby constituting knowledge in both cases.

Sally

"Sally", Description

Sally was a 19-year-old female upperclassman, self-identified as Caucasian, defined her religious identity as Christian, and did not specify her political identity at the time of the interview.

Sally, Questionnaire

Sally's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 27 shows the quotes used to assign Sally to position RE-NA in the grid.

Table 27. Selected supporting quotes placing Sally at position RE-NA.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Rejects evolution	The Bible is several different <u>factual</u> books combined to make the Bible. No statement contradicts another. Find me several evolution books without contradictions.
Anthropogenic global warming is not occurring	Climate changes. It happens. Not too concerned about it. I'm not a fan of Al Gore. But if he is concerned about the environment, good for him. We all need a hobby.

Questionnaire effectiveness and views

Sally was placed in RE because she stated that the Bible is factual, and without contradictions, and compared evolution unfavorably with the Bible. On the evolution

pre-interview position list, Sally outlined her own position: "I believe that a single creation event consisting of six 24 hour days literally occurred somewhere between eight to ten thousand years ago." As this is indicative of Biblical literalism, which rejects evolution, the questionnaire accurately provided Sally's evolution position.

Sally was placed in NA because she evinced a lack of concern about global warming, and made light of Al Gore's concern with global warming. On the global warming pre-interview position list, Sally indicated that her global warming position was "I do not believe that global warming is occurring." In Sally's case, the questionnaire accurately placed her global warming position as NA.

Sources of epistemic authority re: evolution

Sally initially mentioned the Bible when asked who she would trust for accurate information on evolution:

> Interviewer: Sally, can you tell me what sources you would trust for accurate information on evolution?
> Sally: On evolution? Well, being a Christian, I would look to the Bible obviously for answers. But I mean anywhere in general you get information for anything, you get information from teachers, you get information from parents, from friends, and from all that you just have to form your own opinion.
> Interviewer: So can you give me a little insight on your decision making process what how do you decide that a source is a valid one?
> Sally: I mean it just depends on I mean like I wouldn't do any random teacher or any random friend I have to have some sort of respect for them and their opinions and their own thought processes. So just someone who I look up to or admire. Not necessarily believe, you know, just because I like them, and they have an idea, but I'll at least listen.
> Interviewer: So what sort of characteristics would you look for from somebody in order to say 'this is somebody whose position I can buy into' or 'this is somebody's position I can trust with respect to evolution'?
> Sally: I don't know. Probably the first time I was introduced to the idea of evolution was my AP biology teacher. I had biology when I was a freshman, but we skipped over evolution. We didn't even read it,

didn't discuss it. And so my whole thing was I was just like most people: 'I'm a Christian, evolution's crazy.' But I got into the AP biology class and he was a totally different guy. He wasn't from the small town like we were from. He was kind of a rebel. And he talked about evolution, oh my goodness. And he is a really smart guy but he was open to respecting what we believe, too. But still was there to do his job and get the information out to us. He's the reason why I've opened my mind up to it.

Sally then talked about how she became more open to studying evolution:

Interviewer: When you say that he was open to respecting [your views], how did he exhibit that?
Sally: Well, [I live in a] small town. We finally got 400 students in my school my senior year. It's really small and everyone goes to the church and everyone is like that. And so he knew what he was getting himself into when he did, and [when he] started off, he showed us a video on religious figures who still believe in evolution. And so that was when I [said] 'Oh. Ok.'
Interviewer: So which religious figures did he show? Do you remember that?
Sally: Just all kinds of priests and different denominations. The Baptists, Catholics, whatever, they were all a whole bunch of different Christians who [said] 'Hey, we believe in this too.'
Interviewer: Was there any one in particular of those [who] really opened things up for you?
Sally: Not that there was one really in particular, it was just that there were a lot of them, and that's what got me thinking.
Interviewer: So would it be fair to say that once you saw Christians and not only Christians but people who had some leadership roles in at least a local church, was that what really kind of opened – ?
Sally: It's probably what opened my mind.

Sally was then asked about characteristics of her AP biology teacher:

Interviewer: So what was it about your AP bio teacher that made you consider him as an accurate source?
Sally: He is the best teacher I've ever had. He is so smart. He is the smartest guy. He went here. He graduated honors and all that kind of stuff. And he also genuinely cared about his students… Just the fact that he cared.
Interviewer: And would you say it would be the same characteristics that generated trust for you in that case?
Sally: Probably, yeah.

Sally was then asked to contrast her teacher with an earlier educational experience:

Interviewer: Let's revisit the freshman biology class with the teacher that was there. If that person had introduced evolution just say straight from the textbook, how do you think that you would have felt about that at the time?

Sally: I probably would have still been closed off. One, because I was fourteen years old and when you're fourteen years old you really don't have a clue. And you're still going to pretty much listen to whatever your parents say or what your friends say. And this lady who was my teacher, she was so bland, too. She really just – I don't know, the other teacher was more [of a] good speaker. He was an able guy. I mean, not to say that that other lady wasn't able, but she didn't have that same connection with her students.

Sally was then asked about evolution information sources:

Interviewer: Obviously, you went through some learning about evolution in your AP bio class. Let's say you wanted to pick up more information about evolution. Where would you go?

Sally: [I would] probably email or go visit my AP bio teacher to see what I would need to do. We read an evolution book in that class, Evolution Explosion. So I mean I'm sure there are other books out there like that, so books or a library.

Interviewer: Well, there are a pretty wide variety of books about evolution spanning just about any kind of position you could think to take. So what I'm wondering would be how would you go about choosing one and thinking [it is a] reliable source of information.

Sally: I don't know. I guess – I don't know. I would probably pick one probably because it had a pretty cover or something, I don't know. To be honest, I would [think] 'oh, this looks cool' and I would pick it up and probably read it. And either make it make it through it or not. And then just decide from there whether or not I thought it was legit.

Interviewer: You think you might run it by your AP bio teacher?

Sally: Maybe.

Interviewer: Ask him, 'is this worth buying or is this worth looking into'?

Sally: Probably. I would probably email him and say 'guess what I did? I bought an evolution book today.' He would think I'm awesome. And he would say 'which one?' and then I would tell him and then he would probably say that he saw that [and] he has that in the library in his house. So that's probably how it would go.

Interviewer: Would you tend to trust a book more if he endorsed it?

Sally: Yes.

Sally has two primary epistemic authorities with respect to evolution: her religious beliefs, and her AP biology teacher from her high school. The first source that Sally mentioned was the Bible, and the authority of Sally's teacher began when he acknowledged the beliefs of Sally and her peers by showing them a video with Christian laypeople and clergy speaking about how they could accept evolution and religion. This most likely allowed Sally to feel as if her beliefs – e.g., her only epistemic authority with respect to evolution at that time – were not necessarily in conflict with learning about evolution. Sally's biology teacher became an authority, but only after establishing to Sally that he was not in conflict with her existing epistemic authority. It would be interesting to see how Sally views evolution in five or ten years; she did state her position as a young earth creationist in the pre-interview list viewed as Biblical literalism. These beliefs can be very persistent, even when an individual is presented with scientific authorities – or even religious authorities whom the individual does not specifically follow (Schimmel, 2008; Hood, Hill, & Williamson, 2005). Given that Sally still held her religious beliefs despite having had an educational experience she obviously valued, her primary epistemic authority was her set of religious beliefs.

Belief/knowledge with respect to evolution

Given that Sally considered the Bible, or her religious beliefs, to be legitimate authorities with respect to a biological science concept; Sally's primary epistemic authority was not a part of the scientific community, and had its foundation in the supernatural. Therefore, Sally's epistemic authorities constituted belief, rather than knowledge.

Characteristics of evolution belief sources related to perception of authority

Sally's religious beliefs were her primary authority. A basis in Biblical literalism, or what she believed to be a basis in Biblical literalism, was the characteristic that defined that authority with respect to evolution for Sally. Her AP biology teacher, who would have been considered a knowledge source, had to actively seek reconciliation with Sally's primary epistemic authority, and be very personable; these were the characteristics that enabled him to become an authority for Sally.

Justification of epistemic authorities used in evolution position construction

Although Sally stated that her biology teacher was an authority on evolution, which would rate her justification as somewhat poorly aligned, her primary epistemic authority was her set of religious beliefs. Therefore, Sally's justification was rated as poorly aligned.

Characteristics of student related to perception of evolution authority sources

Sally's religious experiences were clearly related to her perception of the Bible as her authority. Beyond this, it was difficult to assign Sally's perceptions of authorities to any other characteristics.

Sources of epistemic authority re: global warming

Sally initially stated that she would find her AP biology teacher an accurate source for information on global warming:

> Interviewer: Sally, can you tell me what sources you would trust for accurate information on global warming?
> Sally: Global warming? Maybe my AP bio teacher. I would really my say my dad on this one. On the other one not so much my parents, but my Dad.
> Interviewer: Can you discuss why you would trust your AP bio teacher on global warming, and why would you would trust your dad on this topic?

Sally: I would trust the AP bio teacher because just because he's smart and he knows a lot, so if I had any questions about it, I could go to him, no problem. And my dad, just because my dad when it comes to, not going to say evolution cause he's kind of closed off to it, but other, just big issues, he really researches stuff. He's an internet guru. He's a television guy, he listens to it all. Whether or not his opinions are, whatever, but I would listen to him on what he has to say.

Interviewer: And so do you think in these cases that you would be likely to get accurate information?

Sally: Yes.

Interviewer: With respect to the AP bio teacher, would you consider him not just a reference for biology, but an overall general science reference?

Sally: Yes. Both or actually anything. I emailed him last semester and needed help with my geography thing. I was freaking out about it, and he sat down with me and read over my papers and just helped me so. He's just the go to guy. School or education, things like that.

Interviewer: So what about what characteristics of your AP bio teacher and your dad make them useful for formulating your position on global warming?

Sally: My dad probably just cause he's my dad you know. He just comes from the same place I do, we live in the same place. He knows how I think, knows how I act. He's really well informed. If I missed the news or something he would be able to tell me what was going on. And then the AP biology teacher, he's just awesome, like I said.

Interviewer: You mentioned missing the news. Would you consider news to be a useful source for information on global warming?

Sally: Some. It's always there for information. It's biased, obviously, depending on what channel you're watching. So you have to take that into consideration.

Sally was asked about her sources in a different fashion:

Interviewer: Let's say that you wanted to find out more about global warming. Where would you go and what sources would you use?

Sally: You could always look on the internet. Watch the Al Gore video or something. I would go ask my teacher, you know, 'what should I do I'm confused.' Or even, say with my dad, what do you think, what do you know?

Interviewer: So these guys would be your starting point.

Sally: Yes.

Interviewer: When you went to them what kind of things would you ask for? Would you be asking, can you send me to a website? Can you

send me to a certain book? Is there any direction that you think you might prefer to go?

Sally: I would probably prefer the internet because it's quick and easy. But I love reading books.

Interviewer: So, with one of those sources, how would you make a decision as to whether you thought that they were giving you knowledge as opposed to –

Sally: An opinion?

Interviewer: An opinion.

Sally: I really don't know. I think with that you just have to – when you go on a website and you see this is obviously the Billy Bob page on shoes, and Billy Bob knows nothing about shoes, this isn't really legit. I mean you just have to use your own judgment, I think.

Interviewer: Well I'm wondering how you would decide whether a website was legitimate or not.

Sally: Probably if it was a university or it was really research involved, not just so and so's web page with their opinion on global warming, like 'Here's the facts, yo.'

Interviewer: And would it be important to you who was doing the research.

Sally: I mean, probably.

Interviewer: The thing that I'm heading towards is, would you want the research to be necessarily from a scientist? Or, if a scientist, would you want it to be a particular subdiscipline of science? Would there be anything you would look towards and say, this is information that I trust more than information in another place?

Sally: I don't know, probably. Something science related, but sometimes, no offense, science people are kind of cocky with their knowledge. Sometimes science people say, 'oh yes, I know all these things.' I really don't like that. I like a humble scientist. So, something that wasn't so in your face.

Interviewer: Would you say somebody approachable?

Sally: Yes, someone approachable. I guess. Not so abrasive.

Interviewer: Or with someone with at least decent people skills.

Sally: Yes.

Interviewer: Now, that plays into whether you would want to communicate with them. But how about deciding that the information that they have is accurate?

Sally: Accurate? Science is science, you know. Most of the time, you can't argue with facts. Unless, what is it, whoever discovered gravity first didn't have it all down right. I mean, obviously science changes, but you just have to take what you can get at that time.

Interviewer: So basically, you feel that science offers the best available knowledge for now?

Sally: Yes.

Sally's epistemic authorities with respect to global warming seemed to be her biology teacher, her father, and perhaps scientists, but she did not appear to have any strong authorities; in the course of the interview, it became clear that Sally was at somewhat of a loss for authorities on global warming, and only mentioned scientists after being prompted. Sally admitted that she did not know much about global warming; at the end of the interview, she said:

> Honestly, even between evolution and global warming, I know more about evolution because it's more interesting to me… a lot of talk with global warming is in the teacher because he likes it, and so I know it's selfish, but I don't really want to look into it that much.

This echoed one of the statements on her questionnaire: "Climate changes. It happens. Not too concerned about it." Sally's lack of concern about the topic translated into a corresponding lack of authorities.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Sally's knowledge of evolution were weak, and these sources would most likely not be what the scientific community would consider appropriate sources. Therefore, Sally's sources mostly constituted belief, rather than knowledge.

Characteristics of global warming belief sources related to perception of authority

The only characteristic that seemed of any importance to Sally was that she could communicate well or have a rapport with a potential source. Beyond this, she did not have any requirements.

Justification of epistemic authorities used in global warming position construction

Sally's justification was based on vague generalizations and establishing a rapport. Given an obvious lack of consideration about global warming, Sally's justification was rated as poorly aligned.

Characteristics of student related to perception of global warming authority sources

Sally's characteristic related to her perception of her global warming authority sources was clear: she had not considered global warming important enough to investigate in detail.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did not exist in Sally's positions on evolution and global warming. Sally relied on her religion for her position on evolution, thereby constituting belief. However, as she had little desire to pursue any kind of knowledge about global warming, Sally was left with very weak epistemic authorities with respect to that topic. As none of those authorities were associated with her religious beliefs, there were no epistemic commonalities.

Theresa

"Theresa", Description

Theresa was a 19-year-old female underclassman, self-identified as African-American, identified her religious identity as Christian, and did not identify her political identity at the time of the interview.

Theresa, Questionnaire

Theresa's questionnaire was examined for quotes supporting the positions from Figure 22 (Page 89). Table 28 shows the quotes used to assign Theresa to position M-AGW in the grid.

Table 28. Selected supporting quotes placing Theresa at position M-AGW.

Assigned global warming or evolution position code	Selected supporting quote(s) in context
Accepts evolution and attempts merging with religion	Why can't I be a creationist & believe in evolution, too? I have no troubles reconciling my faith with evolution. Christian? Yes. Believer in evolution ? Yes.
Anthropogenic global warming is occurring	I don't really get this one, but I assume it's about how the world will end if ignore man-made climate change. If that's the case, I agree. Ignoring climate change is like ignoring black mold – it only gets worse.

Questionnaire effectiveness and views

On the evolution pre-interview position list, Theresa outlined her own position: "I believe in evolution, and also believe in God. I think God played a role in evolution, but was so subtle that we can't detect that role." Theresa had been placed at position M mainly because she asked why she couldn't be a creationist and believe in evolution, as seen in Table 28. The questionnaire accurately provided Theresa's evolution position.

On the global warming pre-interview position list, Theresa indicated that her global warming position was "I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it." This did not appear to correspond as closely with AGW as her questionnaire response; however, notes taken at the interview recorded that Theresa stated that people "need to see Al Gore's graph" when she checked her position on the form; later in the interview, Theresa

referred to the graph in "An Inconvenient Truth" showing a sharp rise in CO_2 (supporting quotes later in text). In Theresa's case, the questionnaire appeared to place her global warming position as AGW accurately.

Sources of epistemic authority re: evolution

Theresa initially mentioned textbooks and scientific websites when asked what sources she would trust for accurate information on evolution:

> Interviewer: The first question I would like to ask you is, what sources would you trust for accurate information on evolution?
> Theresa: Well, textbooks and scientific websites that actually have backup. And that's about it, because you can't trust Wikipedia because anybody can go in there and say things like 'so and so died three years ago' when I saw them yesterday. And you know, you need scientific proof. Evidence.
> Interviewer: Evidence, ok. You said a scientific website with backup. What do you mean by 'backup'?
> Theresa: Well, I mean that the actual scientists go on there and they are not crackpots who say that stuff doesn't exist when it does in fact exist. And I can't think of one, but my brother's really into science, so he has like some specific websites that are done by science journals and stuff. And stuff that actual scientists do. Not stuff that people just randomly post on their blog about 'evolution is the devil.'
> Interviewer: Can you define for me what you would consider to be an 'actual scientist'?
> Theresa: Someone with a degree in a degree in science and someone who's actually as unbiased as they can possibly be. I know no one's completely unbiased, but someone who's not got – consider pharmaceutical scientists [who] work for pharmaceutical companies but their job is to prove that it works. If your job is to prove something one way or the other, I would not consider that an actual unbiased scientist.

Theresa was then asked further questions about scientists:

> Interviewer: What is about scientists that actually generates trust for you?
> Theresa: They have equipment to look at stuff. They have the resources and the education and they can actually look at it. I mean, I can say, 'Hey, my dog looks kind of like a wolf,' but I can't go in and look at it's DNA and [demonstrate that] my dog's a wolf. And I

can't look at stuff and [say] 'this is hydrogen,' but they can. They have the resources and the stuff to get evidence.

Interviewer: Well you mentioned resources and education. Do you have a threshold of education that imbues trust in scientists for you?

Theresa: Not really, no, because I have one science teacher I would consider a scientist and one I would not. And they have the same level of education, probably [a] master's degree because that's generally one level up and a little bit more specified.

Interviewer: ok. So what about what is it about scientists or in the case of the one science teacher what characteristics about them make them useful for your position on evolution?

Theresa: You mean, like how can I back my position up using them?

Interviewer: Yes.

Theresa: They have research. They have know proof – and "proof" again with finger quotes. They have the resources, they've got stuff to go and research it and say 'look at this' and they have numbers, and other people who don't have numbers? You can't just [say] 'Well so and so says this.' 'I heard it from a man in the bar' doesn't work.

Theresa was then asked to further characterize her sources:

Interviewer: What other topics have you found these sources useful for?

Theresa: Well, the science teacher who I really trust is very useful for physics as well. I know how to make a potato cannon. [Of] course that might have been because he was my physics teacher, but still. Anything about understanding the world on a physical level, you can use science to help you along. Science obviously made the made the building we're in, it's done everything.

Interviewer: Well, you mentioned understanding the natural world. Are there any additional sources, or what other sources would you consider useful for adding to your understanding of evolution?

Theresa: I don't know. I could probably take more classes on it but then that would still just be learning from people who've learned about it from textbooks and other scientists and what have you.

Interviewer: So do you find the idea that secondhand knowledge [is] not as useful or intrinsically valuable as first hand?

Theresa: Yeah. Because I say 'yeah' doesn't mean I don't believe in it as much, but firsthand knowledge is always going to be better.

Theresa was then asked about evolution information sources:

Interviewer: If somebody came to you and said, 'I know there's a big fuss about evolution and I don't really know that much about it, where should I go for information? And I don't want to pay tuition for a class.'

Theresa: I would probably just recommend books.
Interviewer: And what characteristics would you look for in these books?
Theresa: I would one, make sure that the book hadn't been paid for by [someone who] wanted to prove something. I would want to make sure that they weren't too biased, or if I could only find biased books, I would try to get him or her to even it out, like one biased on way and one biased the other way.

Theresa was then asked to further characterize scientists:

Interviewer: I'd like to revisit some of the things that we talked about in terms of qualifications of scientists. I'd like to set up a few scenarios for you and ask you to respond to those. You've got a dispute between two scientists; one's a biologist, one's a physicist. Which, if the two of them have opposing viewpoints about evolution, do you buy into?
Theresa: Probably the biologist because it falls more in his field of study. Unless the physicist can prove that that evolution goes against proven laws of physics.
Interviewer: So in that case, relevance to the subject matter?
Theresa: Yes.
Interviewer: Let's say you've got two biologists, one with a master's degree, and one with a Ph.D. And again different views on evolution. Which one do you go with?
Theresa: The Ph.D. guy is probably going to have more experience in the field, but if the master's degree guy had spent more time actually working on – again it's how well you work, because in biology, there's different little branches. But assuming they work in the same branch of biology, the Ph.D. Guy or girl? You never said.
Interviewer: All right, two Ph.D.'s. One is at a small level college something like [small land grant university]. And another is from Harvard.
Theresa: Well then, I would just have to listen to them both talk, because just because you went to Harvard doesn't mean you are not a class A moron. I have met one. Just saying. I know people who go to technical school, like beauty college, and they are smarter than that man.
Interviewer: Let's say two biologists from approximately the same level university. One's been in the field five years, one's been the field twenty.
Theresa: That's a good question. Because the one who's been in the field twenty could have more biases from whatever, but the one who's in the field five years didn't have as much experience. That's really hard. Do you have one who's only had ten? Because he would be perfect. I guess twenty, yeah, because he does sort of understand how things work better, I guess.

Interviewer: And let's try one more wrinkle. Someone who's been in the field five years, and has published twenty papers. Someone who has been in the field twenty years, and has published five papers.
Theresa: If you've been in the field twenty years and you've only published five papers, I'd have to go with five year guy then.
Interviewer: ok
Theresa: Although four papers a year, that's pretty good. Or maybe I'm just naive.
Interviewer: No, four papers a year would be incredible output.

Theresa was then asked whom she would want to take an evolution class under:

Interviewer: When I asked you what other sources you would consider useful for adding to your understanding of evolution, you said take more classes. Are there any specific classes that you would target, and what qualifications would you look for in a teacher or the professor?
Theresa: I don't know specific names of classes, but if I wanted to learn about evolution, I would probably take evolutionary biology. And I would want a teacher who had had experience with that specific field because I don't know about UGA, but I know there are smaller colleges where just because you haven't done your specific subject you're teaching doesn't mean you can't teach it. So I would want somebody who had actually worked in the field.
Interviewer: So, someone who specifically done evolutionary biology research?
Theresa: Research, yeah.

Theresa's epistemic authority with respect to evolution is biologists; specifically, those who have done evolution research. It was clear that she respected credentials and experience in the field. Any other source – college professors, textbooks, or news media – had authority only if their claims originated with the scientific community.

Belief/knowledge with respect to evolution

The epistemic authorities that made contributions to Theresa's knowledge of evolution could be considered fairly domain-specific. She limited the authority of scientists to observations of the natural world. Within that limitation, Theresa had specific requirements of them; she did considered involvement in research as a necessary

component in expertise. As these sources would most likely be what the scientific community would consider the authoritative sources on evolution, Theresa's sources constituted knowledge, rather than belief.

Characteristics of evolution knowledge sources related to perception of authority

Knowledge originating from research scientists was the characteristic that defined authorities with respect to evolution for Theresa. When she was talking about websites as a source of information, she stated that "backup" would have to be "actual scientists," as opposed to "crackpots," or "stuff that actual scientists do," as opposed to individuals who "just randomly post on their blog about 'evolution is the devil.'"

Understanding of epistemic authorities used in evolution position construction

Given that Theresa considered individuals actively involved in scientific research on evolution to be legitimate authorities with respect to a biological science concept, Theresa's justification of her sources of epistemic authority was rated as very well-aligned. She required that an individual be actively involved in scientific research, and rejected claims that did not originate with the scientific community.

Characteristics of student related to perception of evolution authority sources

Theresa's educational experiences were clearly related to her perception of scientists as her authority, but this originated with a negative experience:

> Theresa: Trust comes from being able to say this is as close to true as we are right now, and they're not going to make stuff up, like my science teacher who cut evolution out of the textbook did.
> Interviewer: Can you describe that?
> Theresa: Describe what?
> Interviewer: Your teacher cutting – ?
> Theresa: Oh, in seventh grade, we had biology and we were supposed to learn about evolution. There was a chapter about it. And she took out the old textbooks, which did not have evolution in them. And

the board [said] 'No, you have to use the new ones.' So she got the paper cutter out and cut evolution out of the textbook. It was quite interesting. I [thought] 'Wow, you are crazy."

Theresa returned to this anecdote in a later response:

Interviewer: Can you tell me your first experience hearing about evolution?
Theresa: I would have had to be really little. 6 maybe 7. And it was on TV, they were talking about a debate about it. So I went and looked it up – I couldn't spell evolution, I had to ask my dad – but I went and I looked it up, and I read about what it said. Then I asked him, and he [said] 'Ask your mom.' My mom's really religious and she [said] 'Well, evolution says that we came from monkeys.' So that's what I thought for ages until I actually went and learned more about it in 7th grade. Because when the teacher chopped it out of the book, I [felt it wasn't] fair. And I went and looked it up and learned some more.

Theresa's experience apparently prompted her to investigate evolution further, and she stated that it "made sense" to her. Ironically, her teacher's efforts to keep her from hearing about evolution spurred her to investigate it, and eventually accept it. Beyond this, it was difficult to assign Theresa's perceptions of evolution authorities to any other characteristics.

Sources of epistemic authority re: global warming

Theresa initially stated that she did not know whether she could trust any sources with respect to global warming:

Interviewer: Theresa, what sources would you trust for accurate information on global warming?
Theresa: I'm not sure I trust any source for accurate information on global warming. I trust the records of temperature changes; like last year we had more 100 degree August days than ever before. Or would that be year before last? I don't remember. But I trust the weather data more than actually people, [even] experts.
Interviewer: Can you tell me why?
Theresa: Because it seems like such a loaded issue. People are either trying to prove that it exists or prove that it doesn't, that's how it feels to me. I mean I watched "An Inconvenient Truth" and I

loved it, but it also felt like an Al Gore ad. So you're not really sure how much of it you can trust.

Interviewer: Well, you say it's a loaded issue. Evolution is also a loaded issue. And you have a specific set of people that you trust with that. Can you tell me the difference between that and this instance?

Theresa: Evolution is more about God versus science, whereas global warming isn't God versus science. It's 'is it our fault or is it just nature's course or is it even really happening?' So people have more of a monetary stake in proving that global warming does not exist or does exist. Because people who make cars don't want to say, 'oh global warming is this' but people who are trying to make hydrogen cars want global warming to exist.

Interviewer: So you feel like the entire question has been tainted with a lot of bias?

Theresa: Yes.

Interviewer: Would the presence of a scientific consensus sway your opinion one way or the other with respect to this issue?

Theresa: Probably, yes. [If] more people could agree with each other and be less – again, if I thought it had less to do with money, I would probably feel better about it. But money has so much to do with whether or not global warming exists that it's hard to say one way or not. Because we are greedy creatures. Myself included.

Interviewer: All right, then tell me this: if you wanted to find out more information on the ideas behind a phenomenon or if you wanted to investigate this for yourself, where would you go?

Theresa: I would just go to the library and start reading different books and compare them, because you're guaranteed to find books that [state] it doesn't exist [and books that state] it does exist. You can read them, compare the evidence, and decide for yourself.

Interviewer: What sort of evidence would you find convincing? First of all, what do you mean by evidence in this case? Secondly, what evidence would you find convincing?

Theresa: Evidence as far as global warming goes [is when] some people say, 'Look, it's been going on for years.' And they have proof of ice age, not ice age, ice age, not ice age. But then, you have the people who have things like data on the hole in the ozone layer, on how the ice caps are melting faster, and different facts and figures on how quickly temperature change happens. And whether or not it happens as steadily as some people claim or as drastically as other people claim its happening now.

Interviewer: One of the things that you mentioned, again with respect to evolution, [was that] you would go to primary journal articles, or as close to primary journal articles as you could get. Would that be the case here?

Theresa: Yeah, I guess I would look at it, and you're going to trust someone who actually goes out and works in it more. But at the same time, there is less trust on this issue than there is on evolution for me. Because again, it's a money thing. I mean that's just what really bothers me about it, is it seems like it's just become budget.

Interviewer: So do you feel that just about everybody involved, including the researchers, has some sort of financial stake in it?

Theresa: Well obviously, not everybody has a financial stake. There are some people out there who are trying to actually see and understand it. But I think there's enough people out there with a financial stake in it that it's hard to tell who has one and who doesn't.

Interviewer: So in other words things like funding issues, who's funding research, [and] so forth and so on?

Theresa: Yeah, who's funding research.

Theresa was then asked how she would defend her position:

Interviewer: Now your particular position on it [global warming] is that you think that it's a natural cycle that humans have really accelerated. Is that correct?

Theresa: Yes.

Interviewer: What evidence or what sources would you use to refute somebody who said 'Humans have absolutely no contribution to global warming and it's not even occurring. We had a really cold winter last winter.'

Theresa: Well, yeah, we had snow on my birthday which is like two weeks ago. But we never have snow in March, but it doesn't matter. I like the weather records. I know it's kind of weird, but to look at stuff and to [think] 'this has been the hottest in years and years and years.' And I mean to look at that in hindsight you can see that it's a cycle, but you can also see that it has been cycling up a bit. And there's also the graph that Al Gore has in "An Inconvenient Truth." That's the only thing that's actually in my mind about it. There's a graph and there's actually like a journal that has the graphs in them and it give[s] a better explanation. And it shows how there's more warming up and there's more carbon monoxide, carbon dioxide, there's more something in the air. It shows that if it is a cycle which I mean the graph even like kind of admits that – yeah, look it's a cycle – it goes up, but now its gone way up all of a sudden.

Interviewer: So it's the physical evidence, then.

Theresa: Yeah.

Interviewer: And what makes you trust that evidence?

Theresa: I actually have a little bit of a harder time with it because I have issues with the whole carbon dating thing. I don't understand how it works, so not understanding how it works leaves a tiny bit of

mistrust there. But I still I would trust it more, because it's physical proof. It's tangible, and you can touch it. And although I don't believe that only stuff I can touch exists, it's still it's a good starting point.

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Interviewer: So do you feel that just about everybody involved, including the researchers, has some sort of financial stake in it?

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global warming and it's not even occurring. We had a really cold winter last winter.'

Theresa: Well, yeah, we had snow on my birthday which is like two weeks ago. But we never have snow in March, but it doesn't matter. I like the weather records. I know it's kind of weird, but to look at stuff and to [think] 'this has been the hottest in years and years and years.' And I mean to look at that in hindsight you can see that it's a cycle, but you can also see that it has been cycling up a bit. And there's also the graph that Al Gore has in "An Inconvenient Truth." That's the only thing that's actually in my mind about it. There's a graph and there's actually like a journal that has the graphs in them and it give[s] a better explanation. And it shows how there's more warming up and there's more carbon monoxide, carbon dioxide, there's more something in the air. It shows that if it is a cycle which I mean the graph even like kind of admits that – yeah, look it's a cycle – it goes up, but now its gone way up all of a sudden.

Interviewer: So it's the physical evidence, then.

Theresa: Yeah.

Interviewer: And what makes you trust that evidence?

Theresa: I actually have a little bit of a harder time with it because I have issues with the whole carbon dating thing. I don't understand how it works, so not understanding how it works leaves a tiny bit of mistrust there. But I still I would trust it more, because it's physical proof. It's tangible, and you can touch it. And although I don't believe that only stuff I can touch exists, it's still it's a good starting point.

Interviewer: ok. Have you read any scientific accounts or any scientific journal articles that debunk, or work against, or speak out against global warming?

Theresa: Yeah, I have, and then I found out that they were the scientists [who] went ahead under the Republican Party and they were really adamant [that] it does not exist. And so I read that and, I [thought] 'Wow, these people actually they have a good argument." [Then I found out that they were] funded by the Republican Party. Nice.[2] But I read one that was kind of midway but more leaning towards it doesn't exist that I don't think was funded by anybody, and so that's probably the closest I've got to an unbiased one that leans [that way].

Interviewer: What would it take for a scientific article for you to view it as something that's relatively bias-free?

Theresa: I think you have to point out the flaws in your own argument to make a good agreement. Because if they were to say 'all the evidence supports this,' but you have to admit that there are going to be one or two things that don't fit, because there's always an exception to the rule. It's never going to work out perfectly and

[2] Here, Theresa's tone was very sarcastic.

when it shows that it works out perfectly like conclusively in your favor and that what you got thought was going to happen then I feel that that's bias. So you have to address both sides of the issue.

Interviewer: So if you find an article that has that sort of qualification and you look into the funding sources and they're grant funded by, say, the NSF, National Science Foundation. Would you tend to trust that more?

Theresa: Yes.

Interviewer: So somebody who basically points out flaws in their own argument and somebody who has a neutral source of funding then?

Theresa: Yes.

It is more difficult to distinguish Theresa's epistemic authority with respect to global warming than it is evolution. Although Theresa eventually stated that she trusted scientists whom she perceived to be free of bias and were funded by neutral sources, Theresa's perception of bias within the scientific community seemed to lessen its authority. However, Theresa did not mention any other sources besides research scientists; therefore, scientists doing global warming research would have to be considered Theresa's epistemic authority.

Belief/knowledge with respect to global warming

The epistemic authorities that made contributions to Theresa's knowledge of global warming eventually were determined as scientists doing research into global warming. Theresa's acceptance without question of the NSF as an organization without bias implied that she found the scientific community generally trustworthy. Theresa also placed a heavy emphasis on physical evidence. As these would most likely be authority figures that the scientific community would find acceptable, Theresa's authorities constituted knowledge.

Characteristics of global warming knowledge sources related to perception of authority

To Theresa, scientists were most likely authorities with respect to global warming if they appear bias-free and could provide evidence for neutral funding.

Justification of epistemic authorities used in global warming position construction

Theresa considered scientists doing global warming research to be an authority with respect to global warming. However, Theresa did not specify a particular subdiscipline of science. Therefore, Theresa justification of her global warming sources was rated as well-aligned.

Characteristics of student related to perception of global warming authority sources

Theresa's characteristics related to her perception of her global warming authority sources was similar to that of her evolution authority sources in that a negative event heavily influenced her thinking about the topic. She read an article published by scientists that debunked global warming, and then later found out that those scientists had been influenced by the Republican Party. This, apparently, removed a general trust of the scientific community with respect to global warming, and Theresa became uncertain that any sources were without significant bias.

Epistemic commonalities between evolution and global warming sources

Epistemic commonalities did exist in Theresa's positions on evolution and global warming. Theresa relied strongly on scientists for her position on evolution, thereby constituting knowledge. Her position on global warming – even given her doubts about the absence of significant bias in the scientific community – still relied on scientists, and therefore constituted knowledge.

Revised grid

Two of the fourteen interviewees, Fred and Hazel, were placed incorrectly on the 3x3 grid by the questionnaire analysis. Before moving to thematic analysis across the grid, an updated 3x3 grid was needed. Figure 23 shows the 3x3 grid with revised placements following the interviews. A thematic analysis of each evolution and each global warming position follows.

	Rejects evolution	Accepts evolution and attempts merging with religion	Accepts evolution without attempting merging with religion
Anthropogenic global warming is occurring	Jane RE-AGW	Rick Theresa Hazel M-AGW	Genevieve Karen AE-AGW
Uncertainty, either in reality of GW or humans' role in GW	Kate RE-U	Carly M-U	Roy AE-U
Anthropogenic global warming is not occurring	Sally RE-NA	Bryan Rachel M-NA	Herbert Fred AE-NA

Figure 23. Revised placement of interviewees on 3x3 grid.

RE position thematic analysis

Two superthemes, five themes, and eight secondary themes emerged from the codes and categories in Figure 24.

Supertheme 1. Sources are accepted as epistemic authorities with respect to evolution

The participants listed in category RE indicated that specific authorities had contributed to their views regarding evolution, and viewed them as legitimate sources for information about evolution. Participants also required certain characteristics of any

Sources accepted as evolution authorities · AP bio teacher a generalized authority · AP bio teacher a source · Creation Museum is an information source · Journal articles are a source of information · Bible a source of information · Bible is an authority · Bible is a guide for living · Biblical literalism is the ultimate authority · Books a knowledge source · Christian peers are a knowledge source · Christian website a source of information · Church is an authority · Church is an important influence · Church is influential · Church officials are an authority · Confirmation teacher is an influence · Different Christian denominations have equal authority · Evolution Explosion book an authority · Genesis is true but not literal · God is an authority · Pastor is an authority · Pastor is an authority but not a complete authority · Pope is an authority · Religious figures are an authority · The Internet is an information source · Employees at Christian camp are a resource · Genesis an information source on evolution · Internet a source of information
Sources rejected as evolution authorities · Scientists are not an information source on evolution · Father not an authority on evolution · Internet is unreliable as source of information · Sister is not an authority
Characteristics of accepted sources · Bible does not answer all questions about modern society · Bible is equivalent to God · Bible is literal · Bible is symbolic · Christian peers help with questions about Bible · God confers wisdom · God directed evolution · God is real · God's wisdom is not based on experience · Group of religious leaders a strong authority · Internet sources relied on are Bible sites · Pastor's authority comes from belief in Biblical literalism · Internet sources relied on are Bible sites · Creation museum is Biblically founded · Internet sources relied on are Bible sites · Pastor's authority comes from belief in Biblical literalism
Characteristics of rejected sources · Hard to distinguish legitimate sources on Internet · Internet sources have bias · Scientists are not accurate with respect to evolution · Father does not know much about science · Sister is uninterested in science
Characteristics contributing to source acceptance · Accuracy means grounded Biblically · Information source connects you with what you already know · Intelligence has authority · Personal trust contributes to authority · Rapport generates trust · Reliable sources must know "all sides" · Someone who is admired is a source of knowledge · Trust involves faith
Characteristics contributing to source rejection · Unbelief leads to rejection · Explanations that are not God-centered are not accurate
Descriptions of self · Asserts that has own views · Aware of lack of knowledge about evolution · Aware of personal bias · Beliefs got stronger as she got older · Had pre-existing bias against evolution · Resistant to learning about evolution · Searched for sources to invalidate evolution · Used to think most people denied evolution · Would research evolution in order to debunk it · Denied evolution in the past · Does not wish to learn about evolution · Ignores admitted flaws in creationism · Believes in Bible
Descriptions of views · Belief is equivalent to truth · Belief trumps knowledge that creationism has flaws · Could believe theistic evolution · Creationism has flaws · Creationism is a theory · Creationism is superior to evolution · Does not question Bible · Faith equated with knowledge · People not hearing creationism not exposed to truth · Reconciles conflicting creation stories · Religion takes precedence over science · Science must be considered in light of faith · Values religion over science · Views evolution and creation as competing · Evolution did not occur on its own · Evolution is a flawed theory · Evolution is false · Evolution seen as a scary concept · Spirituality leads to wisdom · Macroevolution is not valid · Microevolution is valid

Figure 24. Initial codes and categories, evolution position RE.

acceptable source. First, participants insisted that accuracy was only present if a source was "grounded Biblically"; in other words, the source had to be perceived as having its

basis in what the participants viewed as a literal interpretation Biblical scripture. This generated trust, which the participants indicated contributed authority. An additional source of trust for the participants involved faith; individuals who exhibited what the participants considered to be a strong Christian faith were also considered authorities. Individuals who were well-versed in knowledge about the Bible were also considered intelligent and therefore sources of knowledge about evolution. Participants also expected information sources to be easily incorporated into their existing worldview. Finally, the participants indicated that particularly reliable sources must "know all sides"; in other words, that sources know enough about evolution to, in their view, effectively argue against it. These accepted sources could be divided into three broad categories, which comprise the themes that follow.

Theme 1. Authorities from Christian religion.

These authorities were specifically associated with organized Christianity. Here, organized Christianity is defined as either the individuals or components essential to practicing Christianity as part of a denomination. The participants stated that their belief was equivalent to truth, that religion took precedence over science, and that the conclusions, methods, and questions posed by science must always be considered in light of faith. All of them considered a literalist account of creationism to be concomitant with Christianity, although one participant stated that she might be able to accept the idea of theistic evolution, so long as it did not interfere with the idea of a young earth. They all indicated that creationism is a theory, and that creationism is superior to evolution as an explanation of origins, particularly human origins. One of the participants acknowledged

differences between two creation stories in Genesis, but said that she had no problem believing that both represented truth.

Secondary theme 1. Bible/God.

The Bible and God are mentioned as one secondary theme because the participants stated that the Bible and God are equivalent. Although one of the participants indicated that the Bible does not answer all questions about modern society, and another stated that not all of the Bible was literal and portions could be symbolic, all of the participants considered the account of creation found in Genesis to be both literal and truth.

Secondary theme 2. Church.

Participants referred to their own experiences with the church. The three participants belonged to at least two different Christian denominations; one self-identified as a Roman Catholic, and one referred to a church official as a pastor rather than a priest. They identified their churches as important influences during their childhoods.

Secondary theme 3. Church officials.

Participants indicated that officials within their respective churches were authorities. One participant stated that her pastor was an authority, and that this authority was derived from his belief in Biblical literalism. Another participant, self-identified as Catholic, stated that the Pope was an authority and stated that if she saw a statement by the Pope confirming evolution, she would change her views to conform to that statement.

Secondary theme 4. Internet.

One participant viewed the Internet as a resource for evolution; she visited an online Bible site. Although this site is mainly concerned with scripture, it also contains

explanations of particular verses, dictionaries, additional resources, and an online store (BibleGateway.com, 2010). As the site is not limited to the Bible itself, this site is not listed as identical to the Bible. However, as the participant did not state that she used the site for anything besides finding Biblical passages in several different versions of the Bible, this site was listed as an authority from the Christian religion.

Theme 2. Nonspecific authorities.

Secondary theme 1. Creation Museum.

One participant mentioned the Creation Museum located in Kentucky. The Creation Museum was constructed by the creationist organization Answers In Genesis (Answers In Genesis, 2010). Although AiG is heavily involved in ministry, it does not refer to itself as a church or claim formal affiliation with any specific denomination (Answers In Genesis, 2010), and therefore has been classified as a nonspecific authority. The participant who mentioned the Creation Museum stated that she had not visited it, and therefore could not be completely certain that it matched her beliefs, but had heard that it was Biblically founded from peers and was prepared to accept it as an authority.

Secondary theme 2. AP biology teacher.

One participant mentioned her AP biology teacher as an authority on evolution. Although she ultimately retained her creationist views, the student did view this teacher as an authority with respect to scientific knowledge, and also referred to him as a general mentor. She was impressed with his intelligence and developed a good rapport with the teacher; her favorable view of his teaching style seemed to contribute to his authority.

Theme 3. Scientific authorities.

The same participant who referred to her teacher as a source of information about evolution also referred to the book Evolution Explosion (see Palumbi, 2001) as a source of information about evolution. This was the book used by her AP biology teacher. As it was written by a member of the scientific community, it has been categorized as a scientific authority. The participant who referred to this source stated that it used examples that were easy to understand; this ease of understanding resulted in her viewing it as an authority because it did manage to connect with what she regarded as prior knowledge. It must be noted, however, that the participant who mentioned this source did not allow it to interfere with her creationist beliefs; she stated that microevolution might be valid, but that macroevolution was not.

Supertheme 2. Sources are rejected as epistemic authorities with respect to evolution

The participants listed in category RE indicated specific authorities that did not contribute to their views regarding evolution, and did not view them as legitimate sources for information about evolution. The main characteristics leading to rejection were closely related; the participants stated that explanations that are not God-centered are not accurate, and also stated that any source that they considered to be indicative of unbelief or lack of belief in Christianity was unacceptable.

Theme 1. Scientific authorities.

Scientists were specifically rejected as authorities with respect to information about evolution. It is noteworthy to add here that the participants did not necessarily reject scientists as knowledgeable about evolution itself; however, the fact that scientists

considered evolution accurate at all – disagreeing with a literalist account of creation – removed them as authorities on information about evolution. Participants specifically stated that scientists were not accurate with respect to evolution. Additionally, as they felt that scientists who were proponents of evolution did not consider science in light of Christianity, they did not view scientists as a reliable source for information about the origin of species diversity.

Theme 2. Nonspecific sources.

Secondary theme 1. Internet.

Participants rejected the Internet as an authority because they did not know how to distinguish legitimate sources on the Internet. This caused them to view of the Internet as an unreliable source of information.

Secondary theme 2. Family.

Participants rejected family as an authority on evolution as they did not feel that their family members were either knowledgeable or interested.

Figure 25 is a thematic map representing evolution position RE.

M Position thematic analysis

Evolution codes from the interviewees who were in position M were combined; the interviewees were Rick (M-AGW), Theresa (M-AGW), Hazel (M-AGW), Carly (M-U), Bryan (M-NA), and Rachel (M-NA). Eleven initial categories with 182 codes emerged. Initial codes and categories are listed in figures 26 and 27.

Two superthemes, five themes, and thirteen secondary themes emerged from the codes and categories in Figures 26 and 27.

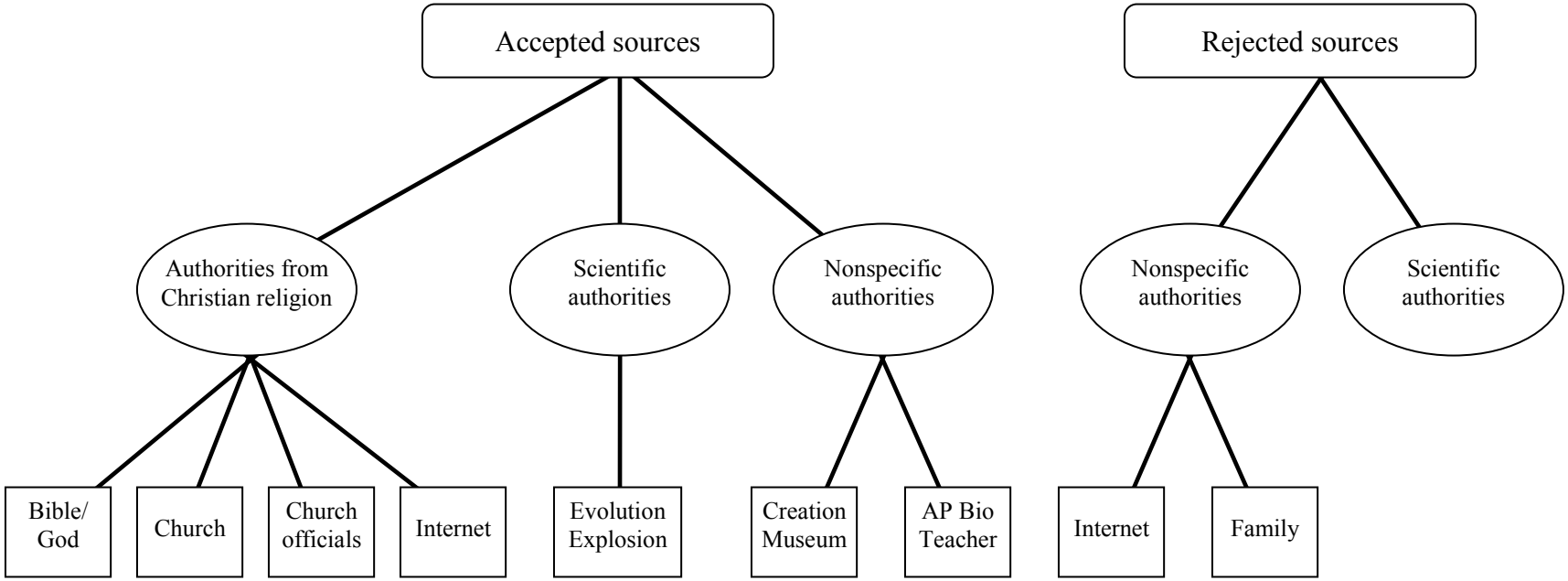

Figure 25. Thematic map, evolution position RE.

Supertheme 1. Sources are accepted as epistemic authorities with respect to evolution

The participants listed in category M indicated that specific authorities had contributed to their views regarding evolution, and viewed them as legitimate sources for information about evolution. Participants also required certain characteristics of any acceptable source. First, participants insisted that accuracy was only present if a source used repeatable, verifiable, physical data; any claims to facts had to be demonstrated with evidence. Several characteristics increased the authority of a potential information source: education, research experience (which was considered to increase expertise), expertise in evolution, flexibility in thinking, honesty, objectivity (also expressed as "lack of bias"). Some of the participants wanted information gathered from a variety of sources; more specifically, non-scientists. These participants indicated that their ideal authority source would merge science and religion. Concepts contained in the source had to "make sense" in order to be acceptable, as well.

Theme 1. Scientific authorities.

Participants had conflicting ideas about science. Some were positive: participants felt that science is progressive, has predictive validity, helps to understand the physical world, and the scientific method is a valid source of knowledge. Some described limitations of science: it is only accurate with physical evidence, cannot test origins, cannot test creation, has not explained the origins of the universe, and does not provide adequate answers to life. One participant characterized science as opinion-based. Other descriptions involved participants' view of the nature of science: science can only explain small phenomena, theories are not as valid as facts, scientific knowledge is

Sources accepted as evolution authorities · Books are an information source · College textbooks are source for evolution information · Reference books an information source · Scientific journals are an information source · Bible is an information source · Astronomy class a source of valid information · Biology class a source of information · Evolutionary biology class a source of information · College professors are sources of information · Teachers are sources of information · Evolutionary biologist an information source · Scientists a source of authority · Father an information source · Moderate clergy an information source · Media is a source of information · National Geographic is a source of information · News a source of legitimate information · Scientific websites a legitimate source of information · The internet is a source of information

Sources rejected as evolution authorities · Catholic Church not a strong information source on evolution · Church is not an information source on evolution · Internet is not a legitimate source of information · Literalist clergy not an information source · Friends not an authority · Parents are not a strong authority · Government sources are not a legitimate information source · Genesis is not an authority on evolution · Textbooks are not an information source · The Bible is not an authority on evolution

Characteristics of accepted sources · Authority source could merge science and religion · Books were an initial source of information · Classes aid in understanding of evolution · Classes must be current for understanding · Consensus contributes to legitimacy to textbooks · Consensus amongst sources is important · Peer review is essential to a scientific organization · Peer review makes a website more reliable · Productivity within the scientific community is important for scientists · Professors have learned from experts · References to journals can make websites more reliable · A scientist's reputation in scientific community contributes to authority · Reputation of scientist's university contributes to authority · Scientific journals are accurate · Scientific journals are accurate because of peer review · Scientific organization has to have communication · Scientific organization has to have lack of bias · Scientific organization has to have peer review · Scientific website must be written by scientists · Requires physical evidence from professors · Scientific websites must be written by scientists · Scientists an authority because they can provide evidence · Scientists must try to be unbiased · Scientists should have degrees · Teachers are trustworthy · Textbooks allow comprehension of evolution topics · Textbook authors are experienced in science · Textbook authors are experts · Textbook authors are researchers · Website authors have to have credentials for site to be reliable · Websites sponsored by scientific organizations are reliable · Father is intelligent

Characteristics of rejected sources · Bible is outdated on some things · Conflict between Bible and evolution comes from Bible being old · Internet is not reliable · Literal creationism is hard to believe · Government sources are biased · Researchers with an agenda aren't "real" scientists · The Bible is not literal

Characteristics contributing to source acceptance · Accuracy depends on repeatable data · Arguments must be convincing · Being able to validate assertions generates trust · Concepts must "make sense" in order to be acceptable · Communication important in science · Credentials and experience result in accuracy · Demonstrable base of knowledge more important than credentials · Editorial control can affect information source's validity · Education can increase authority · Evidence and argument are persuasive · Experience contributes to authority · Experience contributes to expertise · Experience can offset lower educational level in terms of authority · Experiences required to become a professor make them expert · Expertise in evolution contributes to authority · Facts must be demonstrated with evidence · Flexibility in thinking contributes to authority · Honesty generates trustworthiness · Information must be gathered from a variety of sources · Information must be gathered from non-scientists · Lack of bias generates trustworthiness · Firsthand knowledge is more reliable than secondhand · Multiple sources have more validity · Multiplicity of sources is important · Must be experts to be reputable source · Must reconcile arguments with prior knowledge · Objectivity grants authority · Objectivity is valuable · Perceived lack of bias generates trust · Physical evidence is persuasive · Verifiable evidence makes arguments convincing · All sides of an argument must be examined · Supporting evidence and data determine reliability

Figure 26. Initial codes and categories, evolution position M, part 1.

Characteristics contributing to source rejection · Bias detracts from information sources · Bias diminishes authority · Hearsay is not evidence · Inflexibility diminishes authority · Unfamiliarity with source decreases authority
Personal views about evolution · Accepts microevolution · Physical evidence supports evolution · Has doubts about macroevolution but can buy it · Evolution and creationism are in conflict · Evolution and religion can be merged · Evolution cannot explain origins
· Evolution has been directed · Evolution is hard to define · Evolution is not a finished theory · Evolution is real · Does not accept macroevolution · Buys into intelligent design · Buys into microevolution · Science and religion can be merged to explain evolution · Theistic evolution occurred · There are two legitimate "sides" in the evolution/ creationism debate · There is consensus in the scientific community in favor of evolution
Personal views about religion · Religion does not require logic · Religion does not require proof · Religion is based on faith · Religion valid to explain origins · Religious sources not as important as scientific ones · Belief accompanies trust · Belief trumps scientific knowledge with respect to origins · Creation occurred · Does not know the role of God in affecting the world · Does not question basic authority of Bible · God/creation has a role in the universe's origin · Religion trumps other authorities · There is more to knowledge than the Bible · Other religions do not have as high a value as Christianity
Descriptions of science · Science can only explain small phenomena · Science cannot test creation · Science cannot test origins · Science does not provide adequate answers · Science has not explained origins of universe · Science has predictive validity · Science helps to understand the physical world · Science is an authority · Science is only accurate with physical evidence · Science is opinion based · Science is progressive · Scientific knowledge is tentative · Science tries to understand the physical world · Scientific method is valid source of knowledge · Evidence contributes to legitimacy · Evidence has authority · Evidence must be facts · Evidence must be gained in a repeatable fashion · Evidence must be numbers · Theories not as valid as facts · Views held by a majority in science are valid · Different disciplines in science answer different questions
Descriptions of scientists · Scientists are accurate · Scientists are honest · Scientists are intelligent · Scientists are objective · Scientists are trustworthy · Scientists do not fabricate facts · Scientists generate closest approach to truth · Scientists generate knowledge · Scientists generate proof · Scientists have evidence · Scientists have resources to generate trust · Scientists usually work from results · Scientists' authority is limited to science
Description of self · Combines multiple sources for information · Comes from background where evolution is not taught · Decided scientists were accurate early · Exposed to evolution early · Feels guilty about not being literalist · Reliant on beliefs for accuracy · Separates belief from knowledge · Synthesizes information with prior beliefs · Synthesizes sources for information · Separates of belief from knowledge

Figure 27. Initial codes and categories, evolution position M, part 2.

tentative, views held by a majority in science are valid, and different disciplines in science answer different questions.

Secondary theme 1. Scientists.

All participants in this group considered scientists as a source of authority, and one considered evolutionary biologists an information source in particular. The

participants held different ideas about what increases the authority of individual scientists. Standing within the scientific community was important; students mentioned reputation, and productivity. One said that the reputation of a scientist's university contributes to his/her authority. Scientists were also considered an authority because they usually work from results, can provide evidence to back their claims, and generate knowledge. Participants described scientists as accurate, honest (they do not fabricate facts), intelligent, objective, and trustworthy. Participants wanted scientists to have degrees. Altogether, participants felt that scientists generate the closest approach to truth, but that their authority is limited to science.

Secondary theme 2. Scientific publications.

Participants described scientific journals as accurate, and attributed that accuracy to peer review.

Secondary theme 3. College science classes/textbooks.

Participants considered college science classes such as astronomy, biology, and evolutionary biology to contain accurate information relevant to evolution. As these students attended a Tier I research university, they also took it for granted that their lecture professors are also members of the scientific community. College textbooks were seen as resources that had been vetted by a scientific consensus, or at least the peer review process.

Secondary theme 4. Internet.

Participants considered some websites to be useful sources of information; however, websites were considered much more legitimate if they contained references to peer-reviewed journals, or had undergone peer review themselves. Participants also

stated that websites with scientifically credentialed authors, as well as websites sponsored by scientific organizations, were credible.

Theme 2. Authorities from Christian religion.

Participants had a variety of personal views about religion: first, they stated that religious sources were not as important as scientific sources in seeking information about evolution. That stated, participants also felt that religion, although based on faith without proof or logic, was valid to explain origins, as all of them maintained that some sort of creation occurred. They also did not question the basic authority of the Bible, but felt that there was more to knowledge than the Bible.

Secondary theme 1. The Bible.

Participants stated that not all of the Bible was literal and portions could be symbolic. All of the participants considered the account of creation found in Genesis to be symbolic rather than literal. Nevertheless, these participants did maintain a belief that some sort of creation occurred; therefore, they considered the Bible as an authority because it contained a creation story.

Secondary theme 2. Moderate clergy.

Participants stated that they could consider moderate clergy an information source on evolution, but specifically stated that Biblical literalists were not an information source. In fact, "moderate" appeared to be synonymous with clergy who did not espouse a literalist position.

Theme 3. Nonspecific authorities.

Secondary theme 1. Science teachers.

Participants considered science teachers to be trustworthy, and valued their role in making complicated evolution topics comprehensible.

Secondary theme 2. Media.

Participants felt that the news (e.g., TV/Internet/ newspapers) could be a source of legitimate information, but were quick to state that the media's reliability absolutely depended on its information originating in the scientific community.

Supertheme 2. Sources are rejected as epistemic authorities with respect to evolution

The participants listed in category M indicated specific authorities that did not contribute to their views regarding evolution, and did not view them as legitimate sources for information about evolution. A number of different factors contributed to rejection of these sources, but the main two factors involved bias and inflexibility of views; participants assigned both of these factors to Christian fundamentalism.

Theme 1. Authorities from Christian religion.

Secondary theme 1. The Bible.

Participants stated that the Bible is outdated on some things; conflict between the Bible and evolution came from the Bible being old. They also stated that literal creationism was hard to believe, and that the Bible was not to be taken literally.

Secondary theme 2. Clergy.

While the participants felt that moderate clergy could contribute to views of evolution, they did not consider even moderate clergy a legitimate source for knowledge about evolution. The role of clergy was much more restricted for this group than the RE group; clergy were clearly not as generalized an epistemic authority.

Theme 2. Nonspecific sources.

Secondary theme 1. Government sources.

One participant rejected government sources because he felt that government sources were inherently biased or had an agenda. This did not extend to government grant funding; he felt that the peer review process involved in grant funding lessened bias in research. He also stated that researchers with an agenda are not "real" scientists.

Secondary theme 2. Textbooks.

One participants rejected textbooks as an authority on evolution, as she felt that science progresses so quickly that the information included in textbooks was always out of date.

Secondary theme 3. Internet.

Participants rejected the Internet as an authority because they did not always know whether sources on the Internet made claims originating with the scientific community. This caused them to view of the Internet as an unreliable source of information. Figure 28 is a thematic map representing evolution position M.

AE Position thematic analysis.

Evolution codes from the interviewees who were in position AE were combined; the interviewees were Genevieve (AE-AGW), Karen (AE-AGW), Roy (AE-U), Herbert

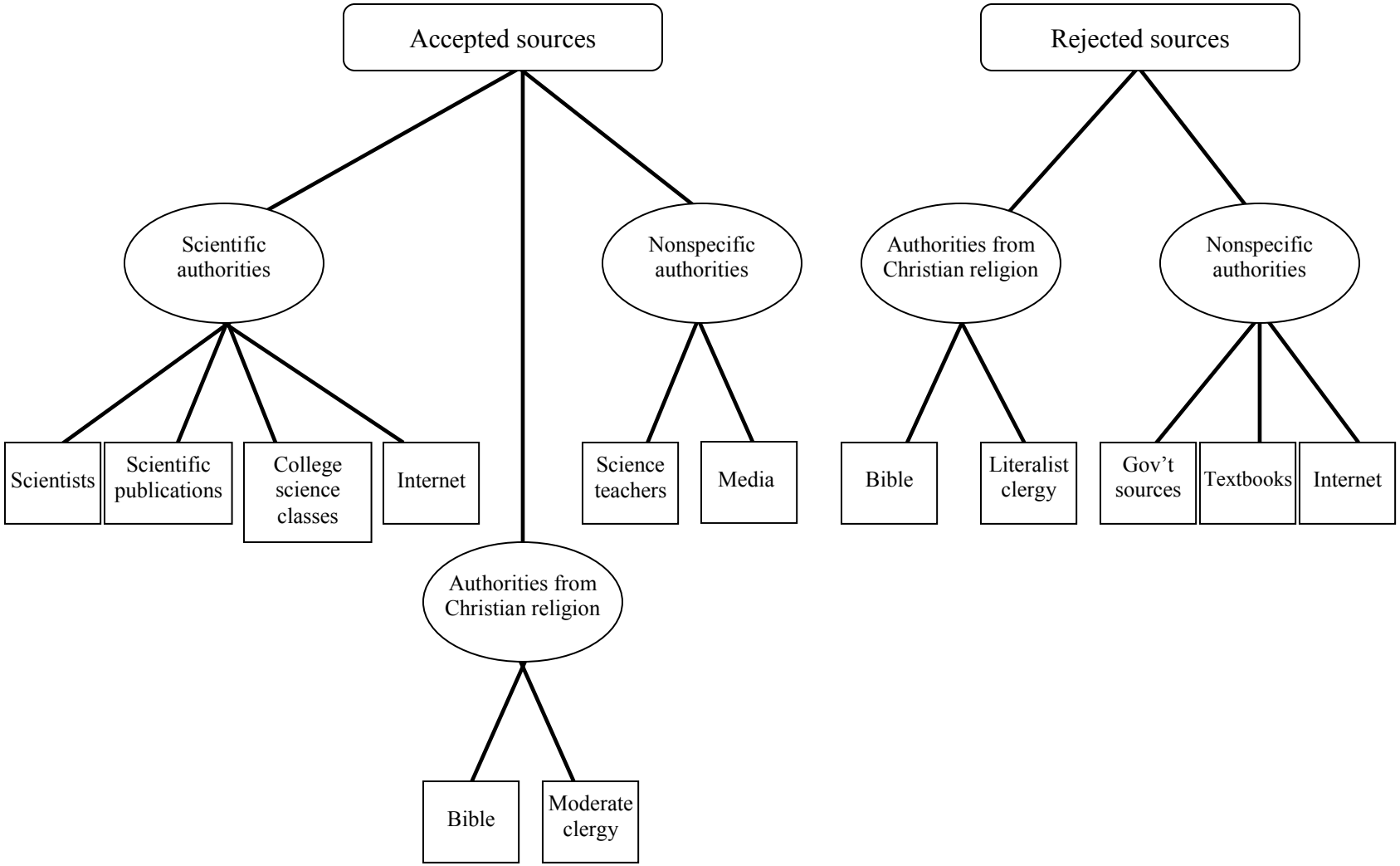

Figure 28. Thematic map, evolution position M.

(AE-NA), and Fred (AE-NA). Ten initial categories with 124 codes emerged. Initial codes and categories are listed in figures 29 and 30.

Two superthemes, four themes, and eleven secondary themes emerged from the codes and categories in Figure 31.

Supertheme 1. Sources are accepted as epistemic authorities with respect to evolution

The participants listed in category AE indicated that specific authorities had contributed to their views regarding evolution, and viewed them as legitimate sources for information about evolution. Participants also required certain characteristics of any acceptable source. First, participants expected any authority source to have research experience involving evolution. They expected any source to provide proof for their claims in the form of physical evidence. They expected sources to be intelligent, objective, hard-working, display a high level of reasoning ability, and be interested in the subject matter. They expected sources to investigate opposite sides of arguments; this did not mean that participants expected scientists to investigate claims by creationists. Instead, it meant that participants expected scientists to investigate both sides of any scientific disputes. Finally, they considered sources that agreed with their prior knowledge about evolution to be a strong authority; in other words, they expected claims to be conservative.

Theme 1. Scientific authorities.

These participants had specific ideas about science: that although science is backed with proof and represents fact, scientific knowledge is tentative because science changes. Participants also felt that science is taught with objectivity being a goal.

Sources accepted as global warming authorities · Anthropology professor an authority source · Biology professor an authority source · Biology teachers are an authority · Books are an information source · Evolution researchers are an authority · Online journals are sources of information · Professor is an authority source · Science journals a legitimate source of information · Scientific community an authority · Scientific community is only legitimate information source on evolution · Scientific journals are an authority · Science textbooks an authority · Scientists are authorities · University professors are an authority · Wikipedia is a credible source
Sources rejected as global warming authorities · Bible is not an authority source · Documentaries are not a good information source · Evolution opponents are not viable information sources · Nonscientists are not an authority · Pastors are not an information source for evolution · Religion is not an authority · Religious schools are a weak authority · Wikipedia is not a legitimate source
Characteristics of accepted sources · Academic credentials contribute to scientist's authority · Best experts in evolution should be exposed to other science disciplines · Biology teachers an intermediate between science research and students · Biology teachers form opinions from scientific community · Books credible because of peer review · Consensus contributes to authority · Consensus is as important as credentials · Consensus of research community is important · Degrees must be current to contribute to scientist's authority · Education contributes to authority of scientists · Established research record important for journals · Established research record important for scientists · Experience in a field contributes to authority of scientists · Expertise a source of authority for scientists · Extensive analysis makes textbooks more reliable · Journal articles are legitimate because of peer review · Must be doing current research to be an authority · Online journals must be from scientists · Prestige of scientist contributes to authority · Professors a source of expertise · Research experience contributes to authority of scientists · Research experience results in expertise · Science textbooks can be used to gain objective facts · Scientific community has an objective point of view · Scientific community is rational · Scientific community is reasonable · Scientific community lacks bias · Textbook authors should have multidisciplinary expertise · Textbooks from journals are an authority · Textbooks must be reviewed by experts · Textbooks must be written by scientists to be an authority · Wikipedia is a credible source because of monitoring
Characteristics of rejected sources · Agenda of documentaries detracts from authority · Bible is not literal · Documentaries have an agenda to capture viewer's attention · Nonscientists only have opinions on evolution · Pastors are not experts in evolution · Religion is not objective · Religion should not be in science textbooks · Religious denials of evolution are not rational · Religious writings are not logical · Religious schools are not objective · Religious schools cannot be trusted · Wikipedia can be edited by anyone
Characteristics contributing to source acceptance · Authority source is nonbiased · Experts should believe in some sort of religion · Connecting with prior experience important · Data are key to accepting source · Evidence is important for arguments · Hard work results in expertise · Intelligence contributes to authority · Interest in subject matter aids authority · Investigation of opposite sides of an argument results in knowledge · Objectivity contributes to authority · Peer review leads to legitimate knowledge · Peer review offsets bias · Practicality of argument is of value · Proof is important · Reasoning ability contributes to authority · Research experience is more important than the prestige of a journal · Research experience is more important than the prestige of an institution · Sources that agree with prior knowledge are a strong authority
Characteristics contributing to source rejection · Bias takes away from authority · Creationism being static detracts from its legitimacy · Supernatural explanations are not desirable
Personal views about evolution · Buys theistic evolution · Evolution is of interest · Experts in evolution should focus on evolution · Individuals with strong views of evolution cannot be dissuaded of them

Figure 29. Initial codes and categories, evolution position AE, part 1.

Descriptions of science · Expertise in evolution is very specific · Expertise in science is very specific · Scientific knowledge is tentative · Observation is truth · Science best describes the natural world · Science changes · Science is an authority · Science is backed with proof · Science is fact · Science is not belief · Science taught with objectivity being a goal · Scientific knowledge can change
Descriptions of scientists · Scientists are reliable · Scientists can change beliefs · Scientists lack bias · Scientists use evidence more than "gut" feeling · Scientists use reason
Description of self · Does not like to be "converted" · Does not like to be manipulated · Does not recall ever believing in creationism · Examines variety of sources for information · Father's career as geologist an influence on evolution views · Has religious beliefs · Makes choices based on multiple sources · Not a biblical literalist · Parents encouraged open· mindedness · Parents value reason · Supports theistic evolution or maybe deism · Synthesize multiple sources for knowledge · Synthesizes views from multiple sources · Taught scientists are objective

Figure 30. Initial codes and categories, evolution position AE, part 2.

Participants also felt that observation and truth were equivalent; therefore, science does not constitute belief, but knowledge.

Secondary theme 1. Scientists and research professors.

Participants had specific descriptions about scientists; they viewed them as reliable, flexible in their beliefs, lacking bias, and dependent on evidence more than "gut" feelings. Participants had requirements of scientists for authority; they expected current degrees, experience in the field including an established research record, and prestige in the scientific community.

Secondary theme 2. Scientific publications.

Participants expected scientific publications, whether journals, books, or textbooks, to undergo peer review.

Secondary theme 3. Scientific community.

Participants valued the scientific community more than any other source; they felt that the scientific community as a whole is rational, objective, and reasonable. They felt that peer review and consensus amongst the scientific community acted to mostly eliminate any bias or subjectivity present in an individual researcher or research group. They rated consensus as more important than credentials of individual scientists.

Theme 2. Nonspecific authorities.

Secondary theme 1. Biology teachers. Participants considered biology teachers as authorities on evolution for two primary reasons: they felt that biology teachers generally form their opinions and views on science from the scientific community, and felt that biology teachers represented an intermediate between science research and students. Participants did state that any authority of biology teachers was wholly derived from the scientific community; they would not respect the views or assertions of biology teachers who disagreed with the scientific community.

Secondary theme 2. Wikipedia.

One participant mentioned Wikipedia as an authority on evolution. He stated that some pages on Wikipedia are policed carefully and constantly, and the Wikipedia page on evolution was one of those, resulting in a sort of amateur version of peer review.

Supertheme 2. Sources are rejected as epistemic authorities with respect to evolution

The participants listed in category AE indicated specific authorities that did not contribute to their views regarding evolution, and did not view them as legitimate sources for information about evolution. There were specific attributes that resulted in rejection of potential sources. First amongst these was the appearance of bias; these participants felt that any lack of objectivity nullified claims. They rejected supernatural explanations in science. Participants also felt that, as they viewed science as progressive, that the static nature of creationism alone – aside from the supernatural nature of creationism as an explanation – was enough to detract from its legitimacy.

Theme 1. Authorities from Christian religion.

Religious authorities were specifically mentioned as rejected sources with respect to evolution. Participants felt that religious denials of evolution were not rational, and that religion is not objective. They also stated that religious writings are not logical, and should not be included in science textbooks.

Secondary theme 1. Bible.

Participants rejected the Bible for one of two reasons: either they did not believe in the Bible, or did not believe that it should be interpreted literally.

Secondary theme 2. Clergy.

Participants rejected clergy as an authority on evolution as they did not feel that clergy had the necessary education or experience.

Theme 2. Nonspecific authorities.

Secondary theme 1. Documentaries.

Participants rejected documentaries because they felt that documentaries are made either to make money or to entertain, and either of these objectives introduced bias. They felt that documentaries must capture the attention of the general public to be successful, and this would result in the omission of important information.

Secondary theme 2. Nonscientists.

One participant stated that nonscientists did not and could not have expertise in evolution, but only opinions, as they are not directly involved with research into evolution. He made reference to nonscientists because he felt that lack of expertise was not limited to just clergy or individuals who reject evolution.

Secondary theme 3. Religious schools.

One participant stated that religious schools are not objective and cannot be trusted. As many religious schools are not affiliated with a specific denomination, this rejected source was considered as a nonspecific authority.

Secondary theme 4. Wikipedia. Unlike another participant in this group, one participant stated that Wikipedia was an unreliable source, as anyone – not just anyone with expertise – could edit Wikipedia. He said that in any given moment, therefore, that Wikipedia could include errant information or deliberate disinformation.

Figure 31 is a thematic map representing evolution position AE.

AGW Position thematic analysis

Participants' views were not as clear-cut with respect to global warming authorities as they were with evolution. Participants felt that claims on both sides of the global warming issue were more or less biased. All of them also felt that climate changes have happened without human influence, but that humans are mostly responsible for accelerating global warming. Two major points of confusion arose for these participants: first, they found it difficult to distinguish between biased and nonbiased sources; and second, three of the participants showed a major misconception by conflating the ozone hole with global warming.

Global warming codes from the interviewees who were in position AGW were combined; the interviewees were Jane (RE-AGW), Rick (M-AGW), Theresa (M-AGW), Hazel (M-AGW), Genevieve (AE-AGW), and Karen (AE-AGW). Ten initial categories with 127 codes emerged. Initial codes and categories are listed in Figures 32 and 33.

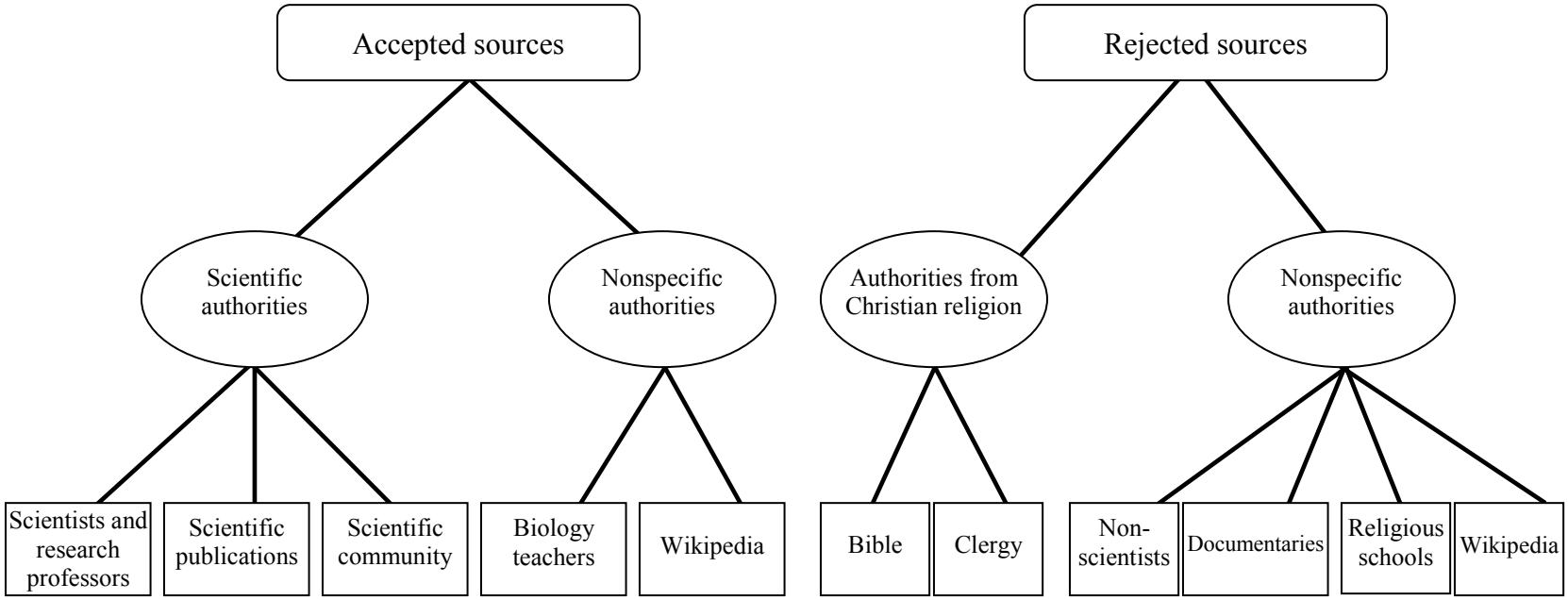

Figure 31. Thematic map, evolution position AE.

Two superthemes, five themes, and fourteen secondary themes emerged from the codes and categories in Figures 32 and 33.

Supertheme 1. Sources are accepted as epistemic authorities with respect to global warming

The participants listed in category AGW indicated that specific authorities had contributed to their views regarding global warming, and viewed them as legitimate sources for information about global warming. Participants also required certain characteristics of any acceptable source. First, although participants stated that a good argument can enhance authority, arguments should be backed with evidence. Education was another consideration; it was considered necessary for expertise, and contributes to knowledge. Participants also wanted a variety of viewpoints; avoidance of bias was a major concern for them, and they felt that a multiplicity of sources increased the validity of any claims. Likewise, participants also felt that a source of funding established as neutral would enhance their trust.

Theme 1. Scientific authorities.

Secondary theme 1. Scientists.

Participants had specific descriptions about scientists; they viewed them as well-informed, having a great understanding of the natural world. Participants felt that scientists generate evidence about global warming, resulting in good ideas about climate problems. Participants also felt that scientists with a greater ability to communicate generated trust. Participants had specific requirements of scientists; they expected scientists to have proper credentials, research experience, and be involved in the proper field of study (atmospheric scientists in particular were mentioned). Participants felt that

Sources accepted as global warming authorities · Al Gore is an authority · An Inconvenient Truth is an authority · Atmospheric scientist is information source · Books are an information source · Class discussions a source of information · Internet a source of information · Magazine articles are a source of information · Print media is a source of information · Professors are a source of information · Scientific journals are a source of authority · Scientific community is a strong authority · Scientists are an authority · Teacher of environmental health class an authority · Teachers are an authority source · Textbook a source of information · TV media is a source of information
Sources rejected as global warming authorities · An Inconvenient Truth is not an authority · Internet is not a source of information · NASA is not a legitimate source of information · Politicians are not an information source · Professors are not a source of information · Scientists against global warming not authorities · Textbooks are not a good source of information
Characteristics of accepted sources · Active research is very important to scientists' authority · Aesthetics contribute to internet site trustworthiness · An Inconvenient Truth is a good source for getting people passionate · An Inconvenient Truth is convincing · Atmospheric scientists have expertise · Books can provide information about the past · Good communication skills enhance authority of scientists · Consensus generates evidence · Consensus is more important than individual credentials · Scientists with the same views are trustworthy · Scientists' credentials are important · Scientists' current training is more important than degrees · Evidence in scientific journals constitutes proof · Evidence provided in books contributes to authority · Experience contributes to authority of scientists · Field of study is an important credential for scientists · Information from the internet is current · Internet accuracy comes from it having a wide variety of sources · Scientific journals contain evidence · Magazines are accurate · Media is reliable · News is source of information because it's up to date · Reputation of scientists is important · Scientists need support for claims · Teachers are knowledgeable · Teachers get their information from scientists · Textbooks an intermediate between science and laymen · Textbooks are accurate · Textbooks contain evidence · The internet has current information · Research training contributes to scientists' authority · Trust for media depends on scientists providing it
Characteristics of rejected sources · An Inconvenient Truth was biased · An Inconvenient Truth stretched the truth · Does not want appearance of bias in textbooks · Initial experience with global warming websites instilled idea of bias · NASA is biased · Politicians are a change agent more than an authority on global warming · Professors are biased · Scientists against global warming are biased · Scientists against global warming funded by Republican Party · Textbooks are biased · Textbooks can go out of date
Characteristics contributing to source acceptance · A good argument can enhance authority · Admitting flaws enhances trust · Arguments should be backed with evidence · Education is important · Education is training for research · Education necessary for research · Education is necessary for expertise · Experience contributes to knowledge · Multiplicity of sources increases validity · Neutral source of funding enhances trust · Similar views to own generate trust · Temperature data are an important part of evidence · Authorities cannot conflict with beliefs · Variety of viewpoints is valuable · Veracity of arguments is dependent on data · Wants facts separated from recommendations
Characteristics contributing to source rejection · Appearance of bias in textbooks diminishes authority · Bias comes from not admitting weaknesses in study · Bias detracts from authority · Bias detracts from trust · Bias takes away from accuracy · Does not trust positions drawn with money as motive · Money introduces much bias · Perfect data a sign of bias
Descriptions of evidence · Evidence can change views · Evidence generates trust · Evidence has authority · Facts are independent of bias · Numbers have authority · Raw data are only really trustworthy source · Replicates make data more valid · Data alone can be trusted · Data constitute proof

Figure 32. Initial codes and categories, global warming position AGW, part 1.

Descriptions of scientists · Scientists are domain-specific authorities · Scientists are well· informed · Scientists generate evidence about global warming · Scientists have a great understanding of the natural world · Scientists have done many observations · Scientists have good ideas about climate problems · Scientists know more about global warming than politicians · Scientists' ability to communicate generates trust
Description of self · Had pre-existing bias towards anthropogenic global warming · Hobbies built in bias for environmentalism · Is set in beliefs · Is skeptical about outliers · Knows less about global warming than evolution · Seeks evidence to support prior beliefs · Separates learning from belief · Tries to find own data
Views about global warming · Accounts on both sides of global warming issue are biased · Anthropogenic global warming is real · Air pollution contributes to global warming · All individuals in global warming debate are biased · Climate changes have happened without human influence · Conflates ozone with global warming · Difficult to distinguish between biased and nonbiased sources · Heat from electronic devices produce source for global warming · Human technology has played a major role in global warming · Humans responsible for accelerating global warming · There are many theories about global warming

Figure 33. Initial codes and categories, global warming position AGW, part 2.

a consensus of scientists was more important than the credentials of individual scientists. As participants attended a Tier I research university, they assumed that professors were research scientists, and accorded them the same authority.

Secondary theme 2. Scientific publications.

Participants valued scientific publications because they felt that scientific publications, whether journals or textbooks, contained evidence.

Secondary theme 3. Scientific community.

Participants valued the scientific community more than any other source; they felt that consensus amongst the scientific community acted to reduce bias or subjectivity present in an individual researcher or research group. They rated consensus as more important than credentials of individual scientists.

Theme 2. Media authorities.

Secondary theme 1. Al Gore/"An Inconvenient Truth."

Participants considered "An Inconvenient Truth" an authority for two primary reasons. First, they felt that "An Inconvenient Truth" (AIT) presented convincing evidence of anthropogenic global warming. Second, two participants stated that AIT was a good source for getting people passionate about finding remedies for global warming.

Secondary theme 2. Print media.

Participants mentioned print media (newspapers, news magazines, etc.) as solid information sources on global warming. However, trust for this form of media was completely dependent on whether their information was provided by the scientific community.

Secondary theme 3. Television news media.

Television news media was considered a legitimate information source for two reasons: first, participants felt that the tendency of news media to present "both sides" represented a lack of bias. Second, participants felt that information given by news media was current.

Secondary theme 4. Internet.

Participants trusted the Internet for information because they felt that the Internet has current information.

Supertheme 2. Sources are rejected as epistemic authorities with respect to global warming

The participants listed in category AGW indicated specific authorities that did not contribute to their views regarding global warming, and did not view them as legitimate

sources for information about global warming. There were specific attributes that resulted in rejection of potential sources. First amongst these was the appearance of bias; these participants felt that any lack of objectivity nullified claims. They listed characteristics of bias; participants felt that bias came from not admitting weaknesses in studies, and felt that money (e.g., study funding sources) introduced bias. They also felt that data that were "too perfect" indicated bias.

Theme 1. Scientific authorities.

Secondary theme 1. NASA.

One student stated that she thought NASA was biased, and this eliminated NASA as a legitimate information source for her.

Secondary theme 2. Professors.

Participants who felt that research professors were not a legitimate authority held this view out of a belief that those research professors were biased towards anthropogenic global warming.

Secondary theme 3. Scientists refuting anthropogenic global warming.

One participants felt that scientists who refuted a prominent human role in global warming were biased, and were probably funded by the Republican Party.

Secondary theme 4. Textbooks.

Participants who rejected textbooks as information sources did so because they felt that the information in textbooks was out of date.

Theme 2. Nonspecific authorities.

Secondary theme 1. Politicians.

Participants rejected politicians as an authority on global warming as they did not feel that politicians had the necessary education or experience for expertise. One participant characterized politicians as change agents, rather than experts.

Theme 3. Media sources.

Secondary theme 1. "An Inconvenient Truth."

Participants who rejected AIT as a source did so because they felt that AIT was biased, or was projecting a political agenda, and therefore could not be trusted.

Secondary theme 2. Internet.

Participants who rejected the Internet as a source did so because they could not tell biased sources from nonbiased sources; therefore, they could not rely on any particular site to be legitimate.

Figure 34 is a thematic map representing global warming position AGW.

U Position thematic analysis

Participants in this category – undecided – had, perhaps not unexpectedly, trouble elucidating their views, with the exception of Roy. Some of the positions posed by the other two participants in this grid row were that: anthropogenic global warming is a Democratic idea; denying anthropogenic global warming is Republican; global warming confirmation is associated with liberalism; global warming deniers are in denial, uninformed, and have what amounts to an argument from incredulity; global warming confirmers can take theory for fact; and perhaps most surprising of all, global warming is not a big political issue. In the meantime, Roy stated that global climate change is too

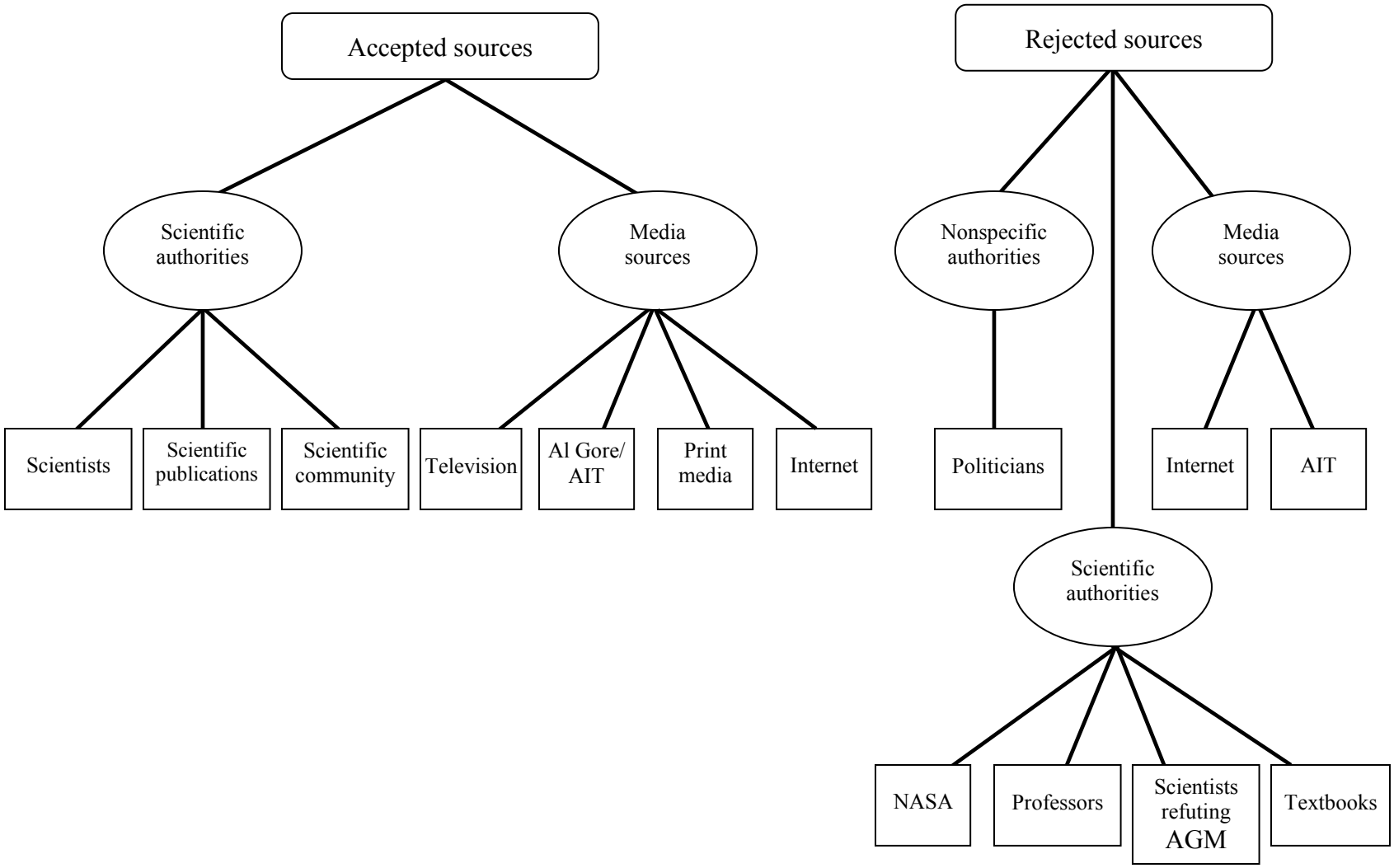

Figure 34. Thematic map, global warming position AGW.

complex for anyone but an expert to comprehend it, global warming is too complex for one cause, and it is hard to get accurate info on anthropogenic global warming. All three participants did at least agree that people on either side of the debate do not listen, and science does not have complete information on global climate change. Global warming codes from the interviewees who were in position U were combined; the interviewees were Kate (RE-U), Carly (M-U), and Roy (AE-U). Nine initial categories with 81 codes emerged. Initial codes and categories are listed in figure 35. Two superthemes, five themes, and ten secondary themes emerged from the codes and categories in Figure 35.

Supertheme 1. Sources are accepted as epistemic authorities with respect to global warming

The participants listed in category U indicated that specific authorities had contributed to their views regarding global warming, and viewed them as legitimate sources for information about global warming. While the other two participants did not have very clear ideas about authorities, Roy stated that geology was a necessary background for understanding global warming. Additionally, any authority must acknowledge complexity of global warming, have a breadth of knowledge of factors affecting climate, and gain legitimate results from unbiased studies/experiments. All of the participants agreed that objectivity contributes to authority and that vested interest leads to bias.

Theme 1. Scientific authorities.

Secondary theme 1. Scientists.

All of the participants agreed that scientists should be an authority. Roy stated that climatologists and atmospheric scientists were authorities, as well as geologists. All

Sources accepted as global warming authorities · Atmospheric scientists an authority · Books are knowledge source · Climatologists an authority · Journal articles are a source of authority · Pastor is a knowledge source · Professors are knowledge source · Reference books an authority · Scientists are an authority

Sources rejected as global warming authorities · Environmentalists are not an information source · An Inconvenient Truth is not a good source · Internet is not a reliable source · Media is not an authority · Older people not an authority on global warming · Parents a weak authority on global warming · Researchers are not an authority without objectivity

Characteristics of accepted sources · Books edited by experts · Credentials lend authority to scientists · Experience contributes to scientists' expertise · Formal publication makes books more trustworthy · Climatologists have the most experience with global warming research · Professors are experts because they have studied global warming a lot · Reference books have facts that have been checked · Researchers have the most current data · Researchers are in contact with raw data · Teacher recommendation raises authority of books · Universities do not have vested interest in global warming · University is not biased

Characteristics of rejected sources · Environmentalists have made global warming political · An Inconvenient Truth has a confirmation bias · Internet edited by anyone · Media has incomplete information · Media is biased · Parents are set in beliefs · Older people are set in beliefs · Researchers can be biased · Textbook quality can vary

Characteristics contributing to source acceptance · Authority must acknowledge complexity of global climate change · Authority must have breadth of knowledge of factors affecting climate · Breadth of research is important in understanding global climate change · Convincing argument has authority · Moderate views are important in an information source · Expertise contributes to authority · Expertise is based on trust · Geology a necessary background for understanding global climate change · Legitimate results come from unbiased studies/experiments · Objectivity contributes to authority · Passion is an important characteristic in a source · Vested interest leads to bias

Characteristics contributing to source rejection

· Appearance of bias detracts from authority · Bias is hard to control even in science · Bias takes away from authority · Incomplete information detracts from authority · Many agendas being pushed using global warming · Subjectivity takes away from authority

Descriptions of science · Bias is undesirable in science · Experimenters can make their experiments unbiased · Experiments can be biased · Facts have authority · Fact supersedes theory · Objectivity should be a goal of research

Description of self · Does not see self as epistemically dependent · No formal exposure to global warming as a concept · Trouble forming views without Biblical guidance · Trusts long· term observations more

Views about global warming · Anthropogenic global warming is a Democratic idea · Cannot decide between conflicting views of global warming · Denying anthropogenic global warming is Republican · Does not exactly understand human role in global climate change · Does not know any informed Christians who deny global warming · Global climate change is too complex for anyone but an expert to comprehend it · Global warming confirmation associated with liberalism · Global warming confirmers can take theory for fact · Global warming deniers are in denial · Global warming deniers are uninformed · Global warming deniers have argument from incredulity · Global warming is not a big political issue · Global warming too complex for one cause · Hard to get accurate info on anthropogenic global warming · People on either side of debate do not listen · Science does not have complete information on global climate change

Figure 35. Initial codes and categories, global warming position U.

of the participants mentioned professors as information sources; they regarded professors as research scientists. Roy stated that climatologists have the most experience with global warming research. All of the participants felt that professors had expertise based on their research experience, and that the research experience put researchers in contact with raw data – considered the most current form of data. The participants also all felt that university researchers were less biased than other research scientists.

Secondary theme 2. Scientific publications.

Participants expected scientific publications, whether journals, books, or textbooks, to undergo peer review.

Secondary theme 3. Scientific community.

Participants valued the scientific community more than any other source; they felt that consensus amongst the scientific community minimized bias or subjectivity present in an individual researcher or research group. They rated consensus as more important than credentials of individual scientists.

Theme 2. Nonspecific authorities.

Secondary theme 1. Pastor.

One participant stated that her pastor might be a source of information for global warming; however, she was clearly struggling to name information sources and may have defaulted to a religious authority.

Supertheme 2. Sources are rejected as epistemic authorities with respect to global warming

The participants listed in category U indicated specific authorities that did not contribute to their views regarding global warming, and did not view them as legitimate

sources for information about global warming. There were specific attributes that resulted in rejection of potential sources. First amongst these was the appearance of bias; these participants felt that any lack of objectivity nullified claims, and felt that many agendas were being pushed using global warming.

Theme 1. Scientific authorities.

Secondary theme 1. Textbooks.

One of the participants felt that her textbook was biased towards anthropogenic global warming.

Theme 2. Nonspecific authorities.

Secondary theme 1. Environmentalists.

Two participants rejected environmentalists because they felt that environmentalists have made the global warming issue unnecessarily political.

Secondary theme 2. Parents.

One participant stated that her parents could not serve as an authority because they did not have sufficient expertise or experience with global warming, and are set in pre-existing beliefs.

Theme 3. Media authorities.

Secondary theme 1. "An Inconvenient Truth."

One participant felt that AIT had a "confirmation bias"; e.g., AIT's purpose was to place the blame for global warming on humans.

Secondary theme 2. Internet.

The participants all felt that the Internet was an unreliable source of information because web pages could be composed and edited by virtually anyone. This resulted in a basic distrust of the Internet as an information source.

Secondary theme 3. News media.

Participants felt that the media has incomplete information, and that different news channels are biased in different political directions (e.g,. MSNBC has a liberal bias, FoxNews has a conservative bias).

Figure 36 is a thematic map representing global warming position U.

NA Position thematic analysis.

Global warming codes from the interviewees who were in position NA were combined; the interviewees were Sally (RE-NA), Bryan (M-NA), Rachel (M-NA), Herbert (AE-NA), and Fred (AE-NA). Ten initial categories with 96 codes emerged. Initial codes and categories are listed in figures 37 and 38. Two superthemes, four themes, and eleven secondary themes emerged from the codes and categories in Figures 37 and 38.

Supertheme 1. Sources are accepted as epistemic authorities with respect to global warming

The participants listed in category NA indicated that specific authorities had contributed to their views regarding global warming, and viewed them as legitimate sources for information about global warming. The participants had specific expectations about potential sources; they expected sources to be educated, honest, effective communicators, use research that is current and peer-reviewed, and be objective. The

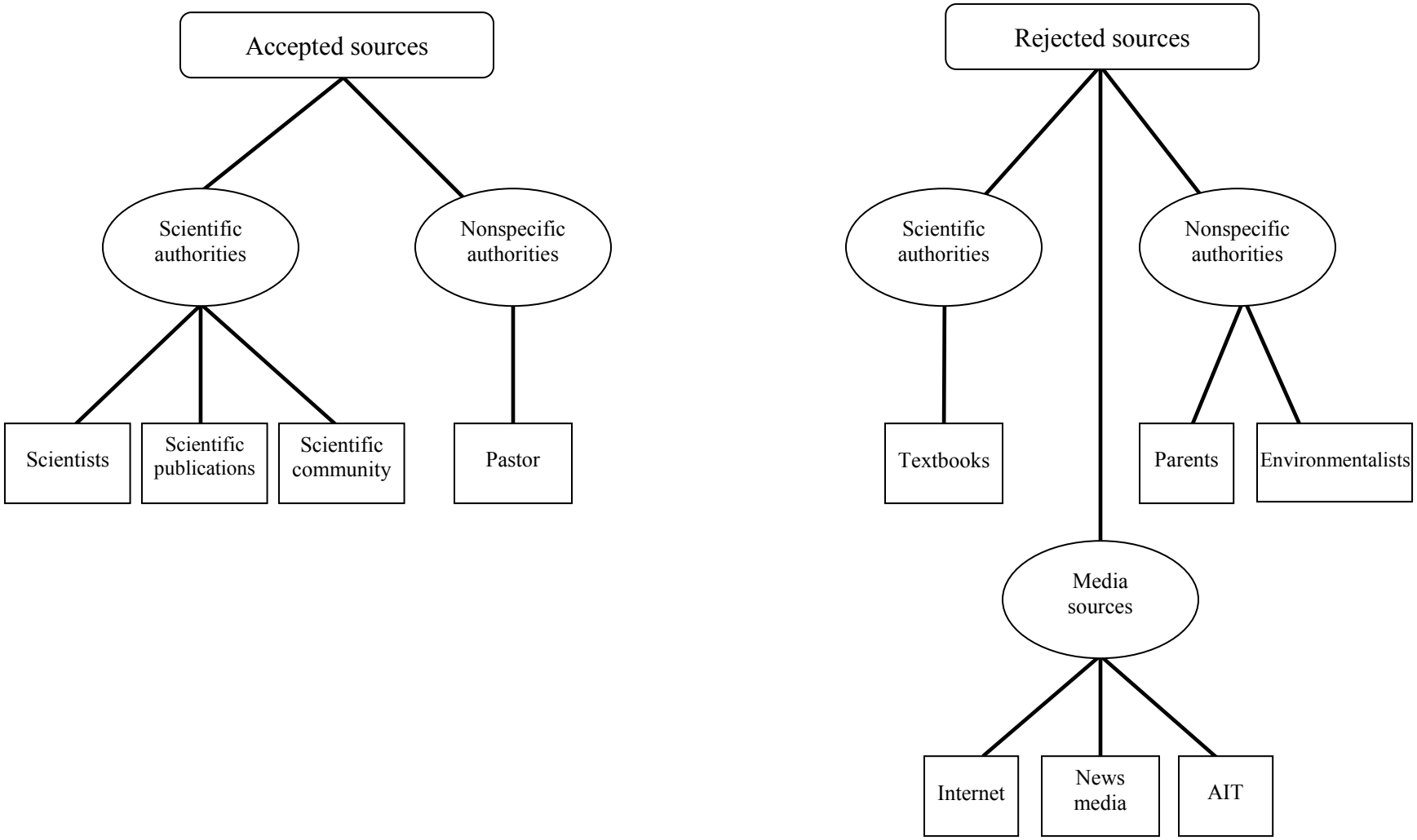

Figure 36. Thematic map, global warming position U.

participants also maintained that arguments that can be best understood are the most appealing, and argument takes precedence over evidence.

Theme 1. Scientific authorities.

Secondary theme 1. Scientists.

All of the participants agreed that scientists should be an authority. Herbert stated that climatologists and geologists were the most appropriate sources. All of the participants mentioned professors as information sources; they regarded professors as research scientists. All of the participants felt that professors had expertise based on their research experience. The participants felt that active research contributes to scientists' authority, and Herbert felt that the particular focus of a scientist's research determines his authority. Most of the participants in this group felt that prestige in the scientific community contributes to that scientist's authority, and that a successful publication record contributes to authority. Additionally, they felt that the status of the journals in which a scientist's publications appear contributed to that scientist's authority.

Secondary theme 2. Scientific publications.

Participants expected scientific publications, whether journals, books, or textbooks, to undergo peer review. They also felt that the reputation of any given journal amongst the scientific community added to its authority, and that the history of the journal also contributed to its authority.

Secondary theme 3. Scientific community.

Participants valued the scientific community more than any other source; they felt that consensus amongst the scientific community minimized bias or subjectivity present in an individual researcher or research group. They rated consensus as more important

Sources accepted as global warming authorities · AP bio teacher an authority · Books an authority source · Classes are source of information · Climatologists the best information source for climate · Father an authority · Geologists are a knowledge source · An Inconvenient Truth an authority source · Integrated science class a source of information · Internet is a source of information · IPCC is an authority · Multidisciplinary group an authority · NASA is a source of information · Professors are a source of knowledge · Reference books are a knowledge source · Scientific community is an authority with respect to global warming · Scientific journals are a source of information · TV an authority · University is an authority · Weather Channel is a source of information
Sources rejected as global warming authorities · Conservative talk show hosts are not legitimate sources · Documentaries are not a legitimate information source · Environmental scientists are not a legitimate information source · Environmentalists are not a legitimate information source · Media is not an authority · University professors not an authority on global warming
Characteristics of accepted sources · Active research contributes to scientists' authority · Climatologists more legitimate than scientist at large · Consensus contributes to authority of scientific community · Credentials are important for scientists · Experience contributes to expertise of scientists · Father is well informed · Focus of research determines scientist's authority · History of journal contributes to authority · An Inconvenient Truth had convincing evidence · Institutional credentials are important for scientists · Internet has current information · IPCC has the world's leading experts on climate · Broad perspective is the best way to look at global warming · NASA has convincing evidence · Peer approval contributes to scientists' expertise · Prestige in scientific community source of authority for scientists · Reputation of journal amongst scientific community contributes to authority · Scientific consensus is a strong epistemic authority · Status of journals in which publications appear contribute to authority · Success in publication contributes to authority
Characteristics of rejected sources · Conservative talk show hosts are biased · Documentaries have to be entertaining · Documentaries have commercial purposes · Environmental scientists are biased · Environmentalists are biased · Media is biased
Characteristics contributing to source acceptance · Argument takes precedence over evidence · Arguments that can be best understood are the most appealing · Concern with accuracy contributes to credibility · Current findings are more authoritative · Demonstrated honesty contributes to credibility · Education contributes to authority · Effective communicators are more trustworthy · Expertise is important · Information must be current to be correct · Lack of bias contributes to credibility · Need present and past sources of data · Rapport is important · Research must be up to date · Research must use methods that are peer approved · Values economy in considering global warming
Characteristics contributing to source rejection · Appearance of bias detracts from credibility · Bias diminishes accuracy · Bias diminishes authority · Funding leads to bias · Goal of entertainment is itself a bias · Unwillingness to examine conflicting data takes away from credibility · Unwillingness to look at other positions takes away from credibility

Figure 37. Initial codes and categories, global warming position NA, part 1.

than credentials of individual scientists. Herbert specifically stated that the IPCC has the world's leading experts on climate. NASA was also mentioned synonymously with the scientific community, and the participant also stated that NASA has convincing evidence with respect to global warming.

Descriptions of evidence · Data are valuable · Direct experience is very persuasive · Evidence has authority · Evidence is important

Descriptions of science · Scientists' epistemic authority is strong but limited to specific topics · Peer evaluation important in science · Peer review contributes to science's credibility · Scientific knowledge changes

Description of self · Attempts synthesis from various sources · Collects evidence from various sources · Does not accept speculation without evidence · Trusts others to make connections between arguments · Would trust another individual to interpret scientific data

Views about global warming · Beliefs about natural cycle influence assigning authority · Buys into "natural cycle"· Conflict between different sources leads to uncertainty about anthropogenic global warming · Factors affecting anthropogenic global warming seem real · Global warming is a natural cycle · Humans cannot have an effect on global warming · Humans do not yet have a large effect on climate · There are two sides to global warming debate · There is consensus on anthropogenic global warming in scientific community · There is no consensus in the scientific community about global warming

Figure 38. Initial codes and categories, global warming position NA, part 1.

Secondary theme 3. Scientific community.

Participants valued the scientific community more than any other source; they felt that consensus amongst the scientific community minimized bias or subjectivity present in an individual researcher or research group. They rated consensus as more important than credentials of individual scientists. Herbert specifically stated that the IPCC has the world's leading experts on climate. NASA was also mentioned synonymously with the scientific community, and the participant also stated that NASA has convincing evidence with respect to global warming.

Secondary theme 4. University classes.

The participants equated professors that they might have for university science classes with research scientists.

Theme 2. Nonspecific authorities.

Secondary theme 1. AP biology teacher.

One participant stated that AP biology teacher might be a source of information for global warming; she clearly regarded him as a generalized epistemic authority with respect to science as a whole.

Secondary theme 2. Father.

The same participant stated that her father might be a source of information for global warming, and claimed that he was very interested in and current on knowledge disseminated by the news media.

Secondary theme 3. Integrated science class.

One of the participants had taken an integrated elementary science course at a local, smaller college, and referenced that class when discussing natural cycles that could result in climate change.

Theme 3. Media sources.

Secondary theme 1. Television.

One of the participants referred to the Weather Channel as a source of information about global warming, with the idea that weather experts also were climate experts.

Supertheme 2. Sources are rejected as epistemic authorities with respect to global warming

The participants listed in category NA indicated specific authorities that did not contribute to their views regarding global warming, and did not view them as legitimate sources for information about global warming. There were specific attributes that resulted in rejection of potential sources. First amongst these was the appearance of bias;

these participants felt that the appearance of bias detracted from credibility. They maintained that funding led to bias, and any unwillingness to examine conflicting data or to look at other positions constituted bias.

Theme 1. Scientific authorities.

Secondary theme 1. Environmental scientists.

One of the participants maintained that environmentalist scientists had an inherent bias towards anthropogenic global warming, and were not a legitimate information source.

Secondary theme 2. University professors.

One of the participants maintained that university professors carried a liberal bias, and therefore had an inherent bias towards anthropogenic global warming.

Theme 2. Nonspecific authorities.

Secondary theme 1. Environmentalists.

One of the participants maintained that environmentalists had an inherent bias towards anthropogenic global warming, and were not a legitimate information source.

Secondary theme 2. Conservative talk show hosts.

One participant stated that conservative talk show hosts could not serve as an information source on global warming because of bias.

Theme 3. Media authorities.

Secondary theme 1. News media.

Participants felt that the media has incomplete information, and that different news channels are biased in different political directions (e.g,. MSNBC has a liberal bias, FoxNews has a conservative bias).

Secondary theme 2. Documentaries.

One participant felt that documentaries were unreliable sources of information because they have commercial purposes and have to be entertaining; these attributes of documentaries were seen as introducing bias.

Figure 39 is a thematic map representing global warming position NA.

Revisiting research questions

The first research question and its sub-questions posed in this study were: What sources of epistemic authority do undergraduate students consider accurate in informing their knowledge and/or beliefs with regard to current science-related controversies such as evolution and global warming? What characteristics of these sources, both generalized and specific, inform students' perception of them as an epistemic authority? How well do the students' sources align with the appropriate epistemic authorities? How do these epistemic authorities establish students' views as beliefs or, alternatively, scientific knowledge about evolution and global warming? With the breadth of beliefs and knowledge represented by just fourteen participants, any comprehensive list of authority sources, their characteristics, and their justifications would be massive, and a recapitulation of several large figures already presented in this study. However, each of the participants did have one or two major epistemic authorities that served as a baseline for their chosen positions on evolution and global warming, with exceptions that will be noted below. These authorities had specific characteristics, had specific roles and justifications. As justification of a true belief is a requirement for knowledge, it can be used to support the division of participants into those holding scientific knowledge or,

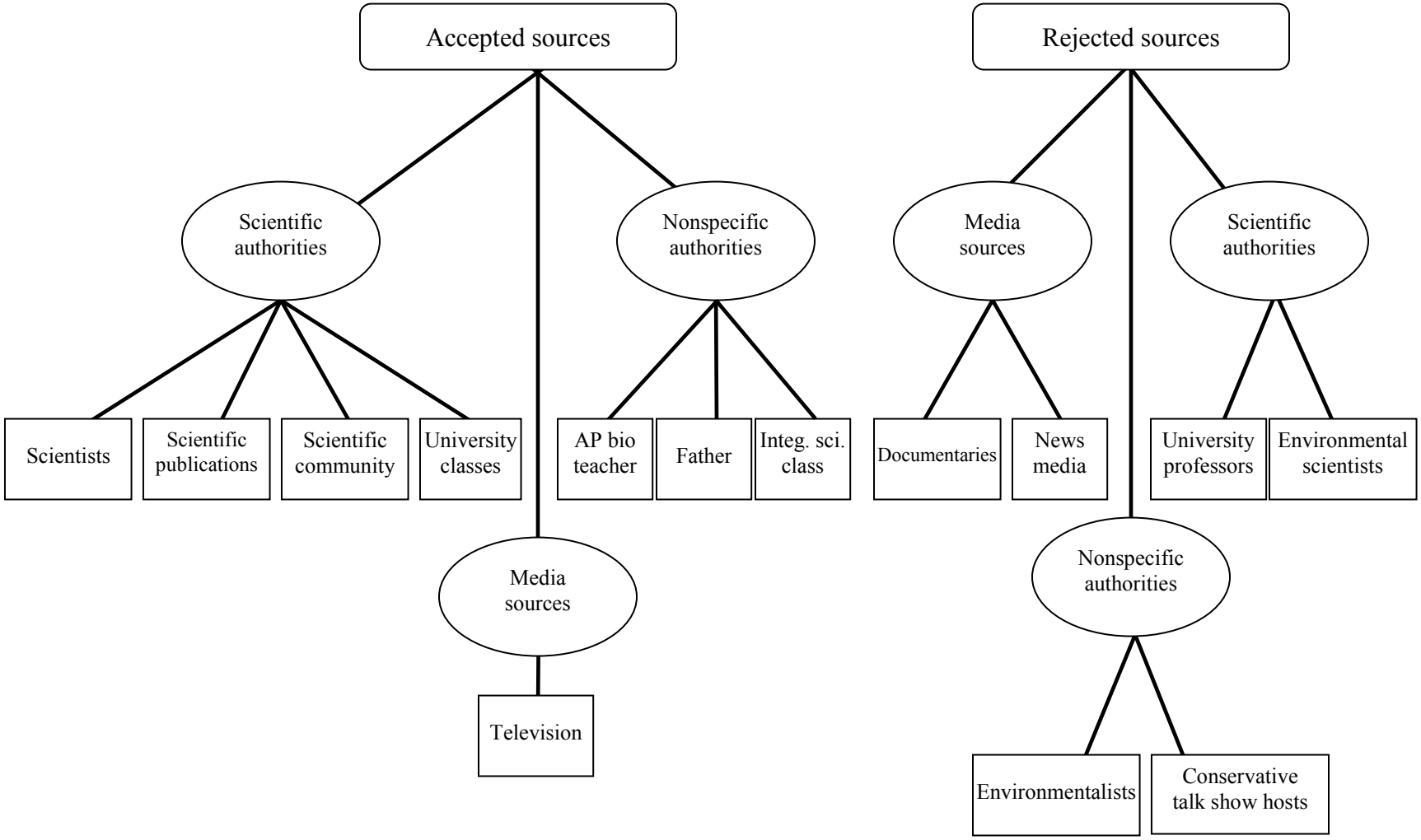

Figure 39. Thematic map, global warming position NA.

alternatively, belief. Table 29 contains each participant's information with regard to evolution, while Table 30 contains each participant's information with regard to global warming.

One research question remains: what epistemic commonalities exist in undergraduate students' knowledge and/or beliefs with regard to current science-related controversies such as evolution and global warming? The answer to this lies in the combined thematic maps in Figures 40-43. Tables 31 and 32 are color keys to the combined thematic maps. There are four maps; the first represents all accepted evolution authorities. If an authority was accepted by all three columns in the 3x3 grid (e.g., AE, M, and RE), then the map element is white. If fewer than three groups accepted a particular authority, then the map elements are color-coded. For instance, if groups AE and M both accepted evolutionary biologists as an authority, but not RE, then the map element representing evolutionary biologists would be colored green. The second map represents all of the rejected evolution authorities; in this case, a green color would mean that groups AE and M rejected a particular authority, but RE did not. The maps for global warming authorities work similarly, as noted below.

Table 29. Primary evolution authorities, roles, characterizations, justifications, and knowledge/belief.

Participant	Major authorities	Characterization	Role	Explanation of role	Justification	Knowledge/ belief
Bryan	Scientists and moderate clergy	Scientists have research experience, contributing to their expertise. They can provide physical evidence to back their claims. They cannot provide evidence to explain origins, and can only explain small phenomena. Moderate clergy represent religion (in this case, the Roman Catholic Church). Religion is based on faith, and is valid to explain origins, as well as philosophical questions that science is not equipped to answer.	Scientists are domain-specific authorities, while clergy are generalized authorities.	Scientists' authority is limited to science. They are authorities within a specific domain of knowledge, but even within that domain, have limitations as authorities. Clergy fulfill a more generalized role, answering questions that scientists cannot.	Somewhat poorly aligned	Belief
Carly	Professors and personal religious beliefs	Professors are trusted under the general assumption that they have both research experience into evolution and have expertise. The Bible is considered a very strong authority. Carly did not question a literal creationists account until recently. Although the Catholic Church is not specifically considered an authority on evolution, religious beliefs override any other authorities which conflict with it; for instance, Carly accepts micro-evolution, but not macroevolution. The Bible is also a generalized source of authority for life.	Professors are domain-specific authorities. Personal religious beliefs constitute a generalized authority.	Scientists' authority is limited to science. They are authorities within a rather fuzzily defined (for Carly) domain of knowledge, and were not considered as authorities when conflicting with beliefs. Beliefs fulfilled a more generalized role, serving as a delimiter for the role of scientists.	Poorly aligned	Belief

Fred	Professors	Biology and anthropology professors are considered authorities based on the assumption that they have an extensive education, have research experience, and expertise in biology. Demonstrated passion for the subject and obvious intelligence add to authority.	Scientists are domain-specific authorities.	Scientists operate as authorities only in the domain of science.	Well-aligned	Knowledge
Genevieve	Evolutionary biologists/ scientific community	Scientists must be actively involved in current peer-reviewed research on evolution. Expertise in science and in evolution is very specific. Although research experience contributes to authority, scientists must be doing current research to be an authority. For credentials to count towards authority, degrees must be recent. All other sources must make claims originating from current peer-reviewed research on evolution.	Scientists are domain-specific authorities.	Scientists operate as authorities only in their immediate subdisciplines.	Very well-aligned	Knowledge
Hazel	Scientists and research professors	Scientists must be actively involved in research in evolution, and have expertise, usually indicated by degrees or a publishing record. Research experience enhances authority. Scientists are thought of as intelligent, honest, objective, and flexible thinkers. Having learned from past scientists enhances the authority of current scientists.	Scientists are domain-specific authorities.	Scientists operate as authorities only in their immediate subdisciplines.	Very well-aligned	Knowledge

Herbert	Scientists and the scientific community	Scientists specializing in evolution research are seen as the strongest individual authorities. An established track record of research is a necessity for authority. Scientists are seen as reliable, objective, using reason, and using evidence to come to conclusions. The scientific community's authority exceeds that of any individual scientist; it is seen as rational, reasonable, and objective. Peer review is seen to offset bias in individual scientists or research groups.	Scientists are domain-specific authorities.	Scientists operate as authorities only in their immediate subdisciplines.	Very well-aligned	Knowledge
Jane	The Pope, the Roman Catholic Church, and personal beliefs	Although scientists are seen as generally good authorities, they should consider science in light of faith and religion should take precedence over science. Any scientists who do not follow this are dismissed as authorities. The Bible is seen as a general source of information, with Genesis serving as an authority on creation, but not necessarily in the literal sense; Jane does not find theistic evolution unbelievable. The Roman Catholic Church and the Pope are very strong authorities; Jane stated that if she thought the Church and the Pope accepted evolution, she would change her views to conform.	Faith and the Bible are very generalized authorities.	Faith and the Bible can apply to many different domains of knowledge.	Poorly aligned	Belief

Karen	Scientists	Experts in evolution are considered authorities, but at the same time, specialists are considered biased. Exposure to other science disciplines enhances authority. Science is seen as objective fact, backed with proof, and not beliefs. Peer review is seen as a necessary component to authority.	Scientists are domain-specific authorities.	Scientists operate as authorities only in the domain of science.	Somewhat poorly aligned	Knowledge
Kate	Religious beliefs and the Bible	The Bible is a generalized and overwhelming authority. All other sources derive any authority from a shared belief that the Bible represents literal truth; for instance, Kate's pastor and her peers derive any authority with Kate from their literalist beliefs. Kate thought of the Creation Museum as a potential authority because of its emphasis on creationism. Evolution, any supporting arguments, expertise, or research experience were completely discounted by personal belief.	The Bible is a very generalized authority.	The Bible is relevant to and governs all domains of knowledge.	Poorly aligned	Belief

Rachel	Scientists and scientific organizations	Scientists are seen to generate knowledge, along with supporting evidence and data, about evolution. Authority is enhanced by credentials and expertise, which come from research experience. Authority is most enhanced by involvement in peer-reviewed research into evolution. Scientists are seen as accurate, trustworthy due to their objectivity, and honest. Scientific organizations are seen as objective, with that objectivity dependent on peer review.	Scientists are domain-specific authorities.	Scientists operate as authorities only within particular subdisciplines of science.	Very well-aligned	Knowledge
Rick	Primarily personal beliefs, secondarily research scientists	Evolutionary biologists are seen as a strong authority with respect to information about evolution. The evidence that they generate adds to their authority, as does research experience. This authority, however, is overridden by Rick's conviction that intelligent design plays a part in diversity of species and complexity in biology.	Scientists are domain-specific authorities. Belief in intelligent design is a domain-specific authority.	Scientists operate as authorities only within particular subdisciplines of science. Belief in intelligent design only applies to this particular topic.	Poorly aligned	Belief
Roy	Research professors and scientific community	Research professors are seen as the primary authority; specifically, researchers into evolution. As observation is truth, observations and experiments by scientists generate truth. Academic credentials enhance authority, as does research experience. Consensus amongst the scientific community is seen as important; peer review leads to objectivity and legitimate knowledge.	Scientists are domain-specific authorities.	Scientists operate as authorities only within particular subdisciplines of science.	Very well-aligned	Knowledge

Sally	Primarily personal beliefs, Secondarily, AP biology teacher	Sally's AP biology teacher served as an authority and general mentor for Sally. He taught evolution in such a fashion as to not conflict with Sally's creationist beliefs, resulting in his acceptance as an authority. Sally's creationist beliefs remained paramount. The Bible is a generalized authority, covering all domains of life. Any conflict with creationist beliefs is dismissed.	AP biology teacher is a generalized authority. The Bible is a very generalized authority.	AP biology teacher serves as an authority on science and was referred to as a "life coach." The Bible and beliefs originating with it are relevant to and govern all domains of knowledge.	Poorly aligned	Belief
Theresa	Evolutionary biologists	Evolutionary biologists are the primary authority source for knowledge about evolution. Their authority comes from their education, their research experience, and knowledge gained through firsthand encounters with data. Scientists must be actively involved in peer-reviewed research. Scientists help to understand the physical world, generating the closest possible approach to truth. Scientists must strive for objectivity, and present convincing, verifiable physical data.	Evolutionary biologists are domain-specific authorities.	Evolutionary biologists operate as authorities only within their particular subdiscipline of science.	Very well-aligned	Knowledge

Table 30. Primary global warming authorities, roles, characterizations, justifications, and knowledge/belief.

Participant	Major authorities	Characterization	Role	Explanation of role	Justification	Knowledge/ belief
Bryan	Scientists	Scientists are a source of information, except for environmental scientists, who are biased. Because of this bias, a multidisciplinary group has more authority, and consensus amongst the scientific community is more important. Effective communication skills and prestige in the scientific community enhance authority.	Scientists are domain-specific authorities.	Scientists' authority is limited to science. They are authorities within a specific domain of knowledge, and some scientists are not trusted to provide answers within their own research fields.	Somewhat poorly aligned	Belief
Carly	Atmospheric scientists or other researchers who specifically study global warming	Atmospheric scientists and professors are an authority. Their research experience contributes to their expertise. Credentials and a publication record contribute to authority, but perception of authority is based on a perceived lack of bias more than any other attribute.	Scientists are domain-specific authorities.	Scientists' authority is limited to a particular subdiscipline of science, but they are a strong authority within that domain of knowledge.	Very well-aligned	Knowledge
Fred	Professors and research scientists	Scientists are an authority, but have more authority when in research groups or are part of a consensus. Authorities must have experience, current information, and peer approval. The IPCC has the world's leading experts in global warming research. However, professors, perceived as having an extensive education, research experience and expertise in fields related to global warming, override other authorities.	Scientists are domain-specific authorities. Professors are domain-specific authorities.	Scientists operate as authorities only in the domain of science and are not authorities on any other topic.	Very well-aligned	Knowledge

Genevieve	Scientific community	Scientists doing research into global warming are an authority. Education and experience are highly valued, but current training and research are more important than degrees/credentials. Being part of a consensus or research group enhances authority.	Scientists are domain-specific authorities.	Scientists operate as authorities only in the domain of science and are not authorities on any other topic.	Very well-aligned	Knowledge
Hazel	Primarily belief in political controversy, secondarily scientists	Scientists are experienced in research, generate evidence about global warming, and have good ideas about climate problems, but for Hazel, their authority can be nullified if they have views other than hers about global warming causes (e.g., anthropogenic). Hazel's perception of "many theories" about global warming and active controversy within the scientific community dramatically lessens the authority of the scientific community and scientists.	Scientists are domain-specific authorities.	Scientists operate as authorities only in the domain of science and are not authorities on any other topic.	Poorly aligned	Belief
Herbert	Geologists, climatologists, scientific community, argument from incredulity	Geologists and climatologists are seen as focusing on "cycles of the earth" and are therefore the best authorities with respect to global warming. Success in publication and standing among the scientific community contribute to authority, as does active research. However, all of this authority is overridden by Herbert's personal belief that humans cannot affect as large as system as the earth to a large degree, or at least, have not yet.	Scientists are domain-specific authorities. Argument from incredulity is a domain-specific authority/	Scientists operate as authorities only in the domain of science and are not authorities on any other topic. Argument from incredulity did not apply to other mentioned topics or domains.	Poorly aligned	Belief

Jane	Scientists, scientific community	Scientists are seen as having a great understanding of the natural world Credentials and the reputation of scientists amongst the scientific community enhance authority. With respect to global warming, belonging to a consensus of scientists is very important.	Scientists are generalized authorities.	Scientists operate as authorities within and without the domain of science.	Somewhat poorly aligned	Knowledge
Karen	Primarily own belief in bias, secondarily atmospheric scientists and scientific community	Although all individuals in the global warming debate are biased, including professors, textbooks, and NASA, researchers in global warming, specifically atmospheric scientists, have some authority. However, as bias detracts from authorities, the only real authority is Karen's belief that everyone involved in the global warming debate is biased.	Personal belief is a domain-specific authority	Karen's skepticism about the bias of the scientific community seemed limited to global warming.	Poorly aligned	Belief
Kate	Research professors and personal experience	Research professors are an authority because they engage in research and have expertise. Research experience adds to authority. Any appearance of bias detracts from authority. Personal experience seeing glaciers calving in Alaska convinced Kate that global warming is occurring. Although attributing global warming to humans is associated with liberalism (a negative in this case), skeptics are seen as unaligned, and in denial.	Scientists are domain-specific authorities. Direct experience is a domain-specific authority.	Scientists' authority is limited to a particular subdiscipline of science, but they are a strong authority within that domain of knowledge. Direct experience only applies to this particular topic.	Somewhat poorly aligned	Knowledge

Rachel	Primarily belief about lack of consensus, secondarily research scientists and NASA	Scientists are an authority because they conduct peer-reviewed research into global warming. Concern with accuracy, perceived lack of bias, and demonstrated honesty add to authority. Unwillingness to examine conflicting data detracts from credibility. Funding sources can contribute to bias. Authority is most enhanced by belonging to a consensus. Due to Rachel's belief that there is no consensus in the scientific community about global warming, authority of scientists and scientific community is greatly diminished.	Scientists are domain-specific authorities. Belief about lack of consensus is a domain-specific authority.	Scientists' authority is limited to a particular subdiscipline of science, but they are a strong authority within that domain of knowledge. Belief about lack of consensus only applies to this particular topic.	Somewhat poorly aligned	Knowledge
Rick	Primarily feelings about the environment, secondarily research professors	Research professors are seen as a source of authority. Credentials may or may not be important. Research experience is important, as is field of study; atmospheric scientists are considered more legitimate than other individuals. All authority, however, is overridden by Rick's feelings about the environment; more specifically, that that humans are constantly causing damage to it. No matter what credentials or evidence an atmospheric scientist can show, Rick's belief in anthropogenic causes is paramount.	Scientists are domain-specific authorities. Feelings about environment are a generalized authority.	Scientists operate as authorities only in the domain of science and are not authorities on any other topic. Feelings about the environment enter multiple domains of Rick's worldview.	Poorly aligned	Belief

Roy	Climatologists	Climatologists are seen as the only legitimate authority on global warming. Expertise is crucial; global climate change is too complex for anyone but an expert to comprehend it. Any authority must acknowledge the complexity of global climate change, and have breadth of knowledge with respect to factors affecting climate; for instance, geology is a necessary background for understanding global climate change. Although science does not have complete information on global climate change, climatologists have access to current information and the extensive background necessary to form a legitimate opinion.	Climatologists are domain-specific authorities.	Climatologists operate as authorities only in the domain of climatology and are not necessarily authorities on any other topic.	Very well-aligned	Knowledge
Sally	No discernible authorities	Sally clearly did not have any authorities with respect to global warming; she mentioned her AP biology teacher and father, but only in very general terms; e.g., "because just because he's smart and he knows a lot." Sally's lack of interest in global warming as a topic resulted in lack of authorities. Her position that global warming was anthropogenic seemed to be guesswork.	N/A	N/A	Poorly aligned	Belief

Theresa	Primarily scientists researching global warming, secondarily, belief about bias in global warming	Scientists researching global warming were considered authorities. However, the most important contribution to their authority was not credentials or experience, but a neutral source of funding. Past this, the data presented as evidence were the most important contribution to authority. Theresa's belief in bias almost overrode her view of scientists as authorities; however, she conceded that some scientists do not do research into global warming with an agenda.	Scientists are domain-specific authorities Personal belief is a domain-specific authority	Scientists operate as authorities only in the domain of science and are not authorities on any other topic. Theresa's skepticism about the bias of the scientific community seemed limited to global warming.	Well-aligned	Knowledge

Table 31. Key to combined evolution thematic maps.

Color	3x3 grid position(s) indicated	Position explanations
	AE	Accepts evolution
	AE + M	Accepts evolution + Attempts merging of evolution and religion
	M	Attempts merging of evolution and religion
	M + RE	Attempts merging of evolution and religion + Rejects evolution
	RE	Rejects evolution

Table 32. Key to combined evolution thematic maps.

Color	3x3 grid position(s) indicated	Position explanations
	AGW	Anthropogenic global warming is occurring
	AGW + U	Anthropogenic global warming is occurring + Uncertainty
	U	Uncertainty
	U + NA	Uncertainty + Anthropogenic global warming is not occurring
	NA	Anthropogenic global warming is not occurring

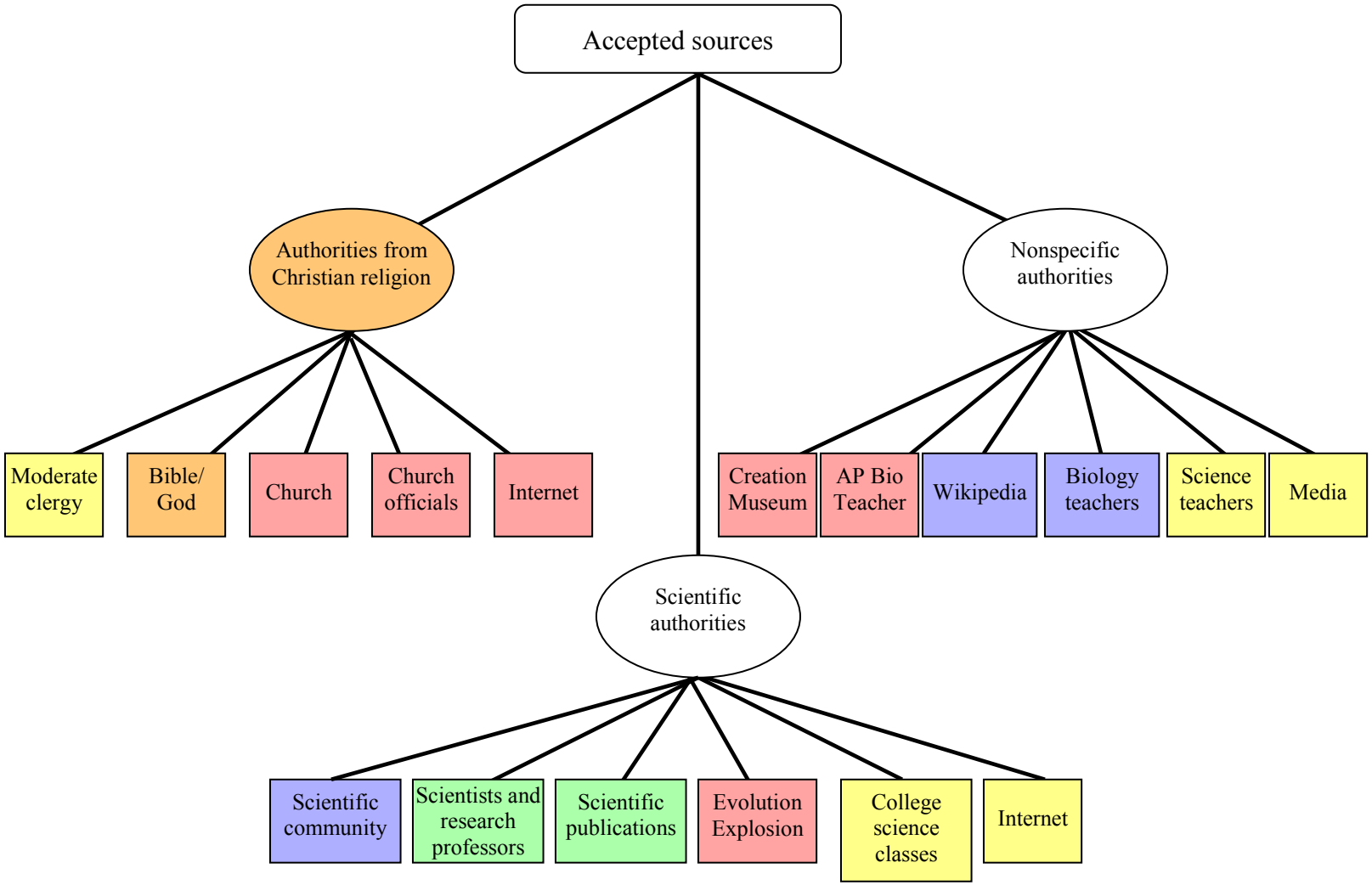

Figure 40. Thematic map, accepted evolution sources, all positions.

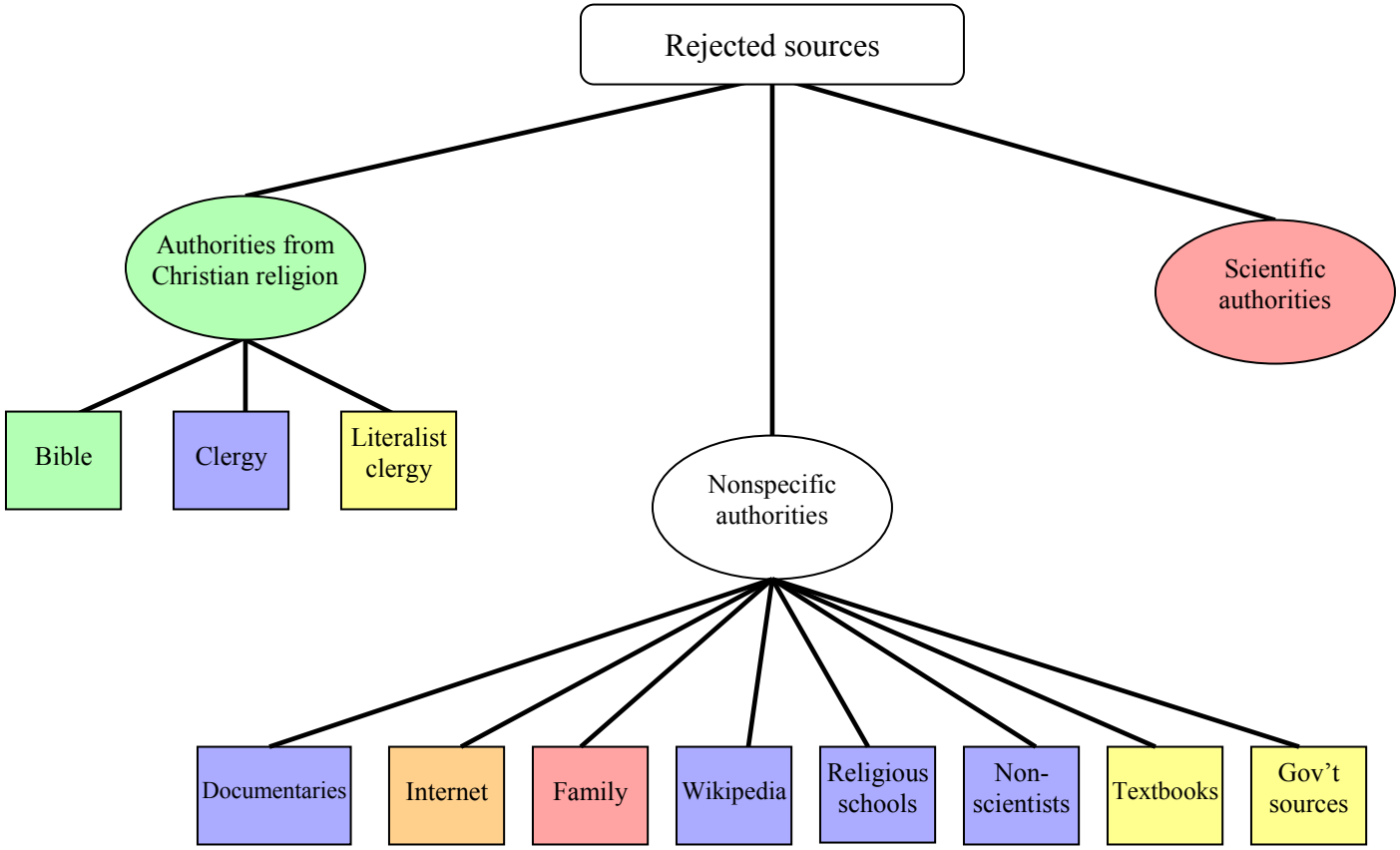

Figure 41. Thematic map, rejected evolution sources, all positions.

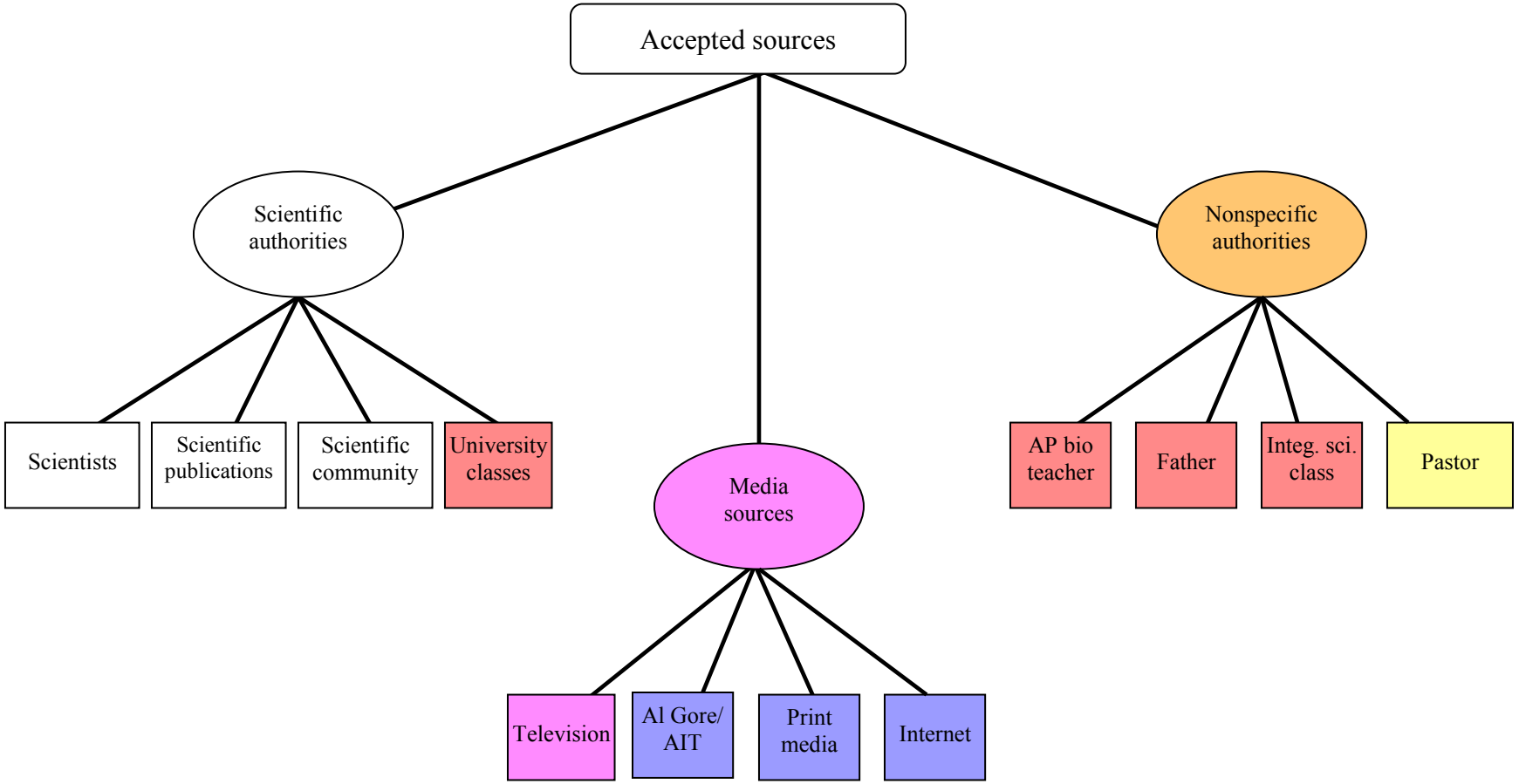

Figure 42. Thematic map, accepted global warming sources, all positions

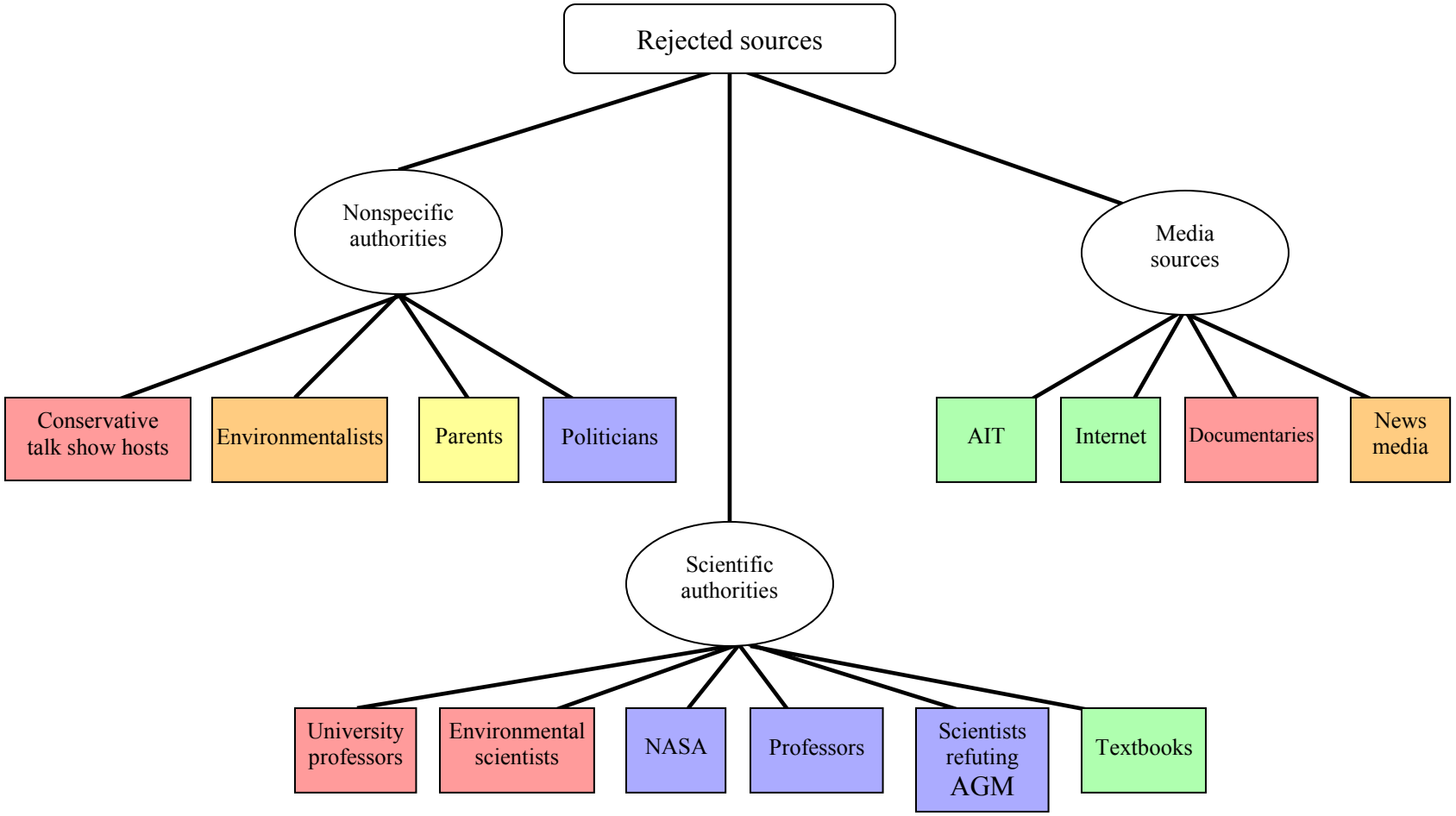

Figure 43. Thematic map, rejected global warming sources, all positions.

Epistemic Commonalities, Accepted Sources

An examination of Figures 40 and 42, which represent accepted sources of authority for evolution and global warming, respectively, shows few epistemic commonalities. Before continuing, it is important to note that the absence of authority sources on these maps does not denote rejection; it simply means that the participants did not specifically refer to sources as authorities. This was the rationale for including sources specifically rejected by participants in all thematic maps. For instance, it is highly unlikely that the participants at position M accepted scientists and scientific publications, but rejected the scientific community as an authority; they simply did not specifically mention the scientific community.

The first contrast lies in the acceptance of scientific authorities. Figure 42 shows that scientists, scientific publications, and the scientific community were all accepted sources in all global warming positions on the 3x3 grid. However, as Figure 40 shows, scientists were not specifically accepted as evolution authorities in the RE evolution position on the 3x3 grid. Additionally, the scientific community was not specifically accepted as an evolution authority in either the RE or M evolution positions on the 3x3 grid. The only scientific authority accepted by the RE position was the book Evolution Explosion, accepted by Sally; however, the book was apparently not a strong authority, as Sally retained her creationist beliefs. University classes were specifically mentioned as authorities on both maps, but only one of three categories on each map specifically accepted those classes. Despite the differences introduced by the RE evolution position, scientific authorities were present in all categories and therefore played a major role in

the construction of both evolution and global warming positions, with the exception of the RE category.

The second contrast lies in the role of religious authorities. Authorities from Christianity were specifically mentioned as accepted sources by two of the three evolution columns in the 3x3 grid. Contrastingly, only one participant mentioned her pastor as an authority on global warming, and this was when she was clearly struggling to elucidate any authorities at all. Authorities from Christianity, therefore, played a major role as authorities in construction of evolution positions, while they played virtually no role as authorities in construction of global warming positions. Within the construction of evolution positions, the Bible was mentioned by both M and RE positions, but organized churches and Internet Bible sources were limited to RE. Clergy played a role in constructions of both the RE and M positions, but RE participants relied on clergy espousing literalist positions, while M participants relied on more moderate clergy that did not espouse a literalist position.

The third contrast lies in the role of media sources. Although the media played a major role in the construction of global warming positions, especially television news media, the news media was only mentioned by one participant in the construction of her evolution views.

The fourth contrast lies in the role of nonspecific authorities. The only point of commonality between the nonspecific authorities was an AP biology teacher mentioned as a generalized authority by Sally. Even a more general category, science teachers, was only mentioned as an authority by the M evolution category. It appears clear that science

teachers did not play a major role at all in the construction of either evolution or global warming knowledge.

Epistemic Commonalities, Rejected Sources

An examination of Figures 41 and 43, which represent rejected sources of authority for evolution and global warming, respectively, shows some epistemic commonalities. Before continuing, it is important to note that the absence of authority sources on these maps does not denote acceptance; it simply means that the participants did not specifically refer to sources as rejected authorities.

The first contrast lies in the rejection of scientific authorities. Scientific authorities were not specifically rejected by any evolution positions other than RE, in which participants rejected virtually all scientific authorities (hence the lack of secondary theme elements in the figure). Contrastingly, all global warming positions rejected specific scientific authorities. One common thread runs through all of these rejected scientific authorities: the perception of bias by the participants.

The second contrast lies in the rejection of religious authorities. Religious authorities were not mentioned as rejected sources with respect to global warming, but were prominently mentioned as rejected sources with respect to evolution. None of the RE position rejected religious authorities in any fashion. The M position rejected literalist clergy and participants in the AE position rejected clergy as authorities altogether.

There were some commonalities in rejected sources, and both were media sources. The Internet was rejected as an authority by participants in two of the three global warming categories, and two of the three evolution positions. There was a

common rationale for this rejection: the participants found it difficult to discern which Internet sources were reliable sources of information and which were not. Documentaries were also rejected, and also rejected for common reasons. Participants rejected documentaries as knowledge sources because they felt that documentaries were made with motives other than the pure dissemination of information; they felt that documentaries were made to be entertaining and make money, as well as disseminate information. These two characteristics of documentaries introduced perceived bias by the participants.

Overall Commonalities

Scientific authorities were acceptable authority sources in all categories, both global warming and evolution, other than the RE position. The main reason for any rejection of a scientific source with respect to evolution was religion, while the main reason for any rejection of a scientific source with respect to global warming was perception of bias. Religious authorities played a major role in construction of authorities – both by being accepted and rejected – in two of three evolution positions, but were virtually unmentioned in the construction of global warming positions. The Internet and documentaries were rejected as sources in both the construction of evolution and global warming positions. Overall, the only epistemic commonality that could be discerned was that scientists were authority sources unless the participants had beliefs – either concerning religion or bias – that overrode that authority.

CHAPTER 5

DISCUSSION

The overall goal of this project was to discern the roles and characterizations of epistemic authorities in the construction of undergraduates' views of evolution and global warming. With a close examination of just fourteen participants, a wide array of roles and sources was elucidated. Participants had both generalized and domain-specific authorities that they used for general and specific purposes, respectively, and the characteristics of these authorities differed dramatically amongst the participants. This is not unprecedented; the literature on epistemic authorities has demonstrated that students select different epistemic authorities in different subjects, and that they differed in their selection (Raviv et al., 1993). One of the underlying questions in this project was whether students would select authorities in similar or different fashions when examining two different types of controversies – religious and political. The answer was clear: students select authorities in very different fashions when examining these two controversies. They assigned the same authorities different characteristics and different roles, and sometimes did so even within the same 3x3 grid position. One would hope that scientists and/or the scientific community would be the major epistemic authority with respect to both of these controversies; that, at least, was true. However, based on the thematic analysis of the interviews, this was virtually the only common ground. The relative lack of epistemic commonalities found in this study, however, does not omit the possibility of connections – or even correlations – between these two controversies.

Correlations, of course, are a statistical measure, and fourteen participants constitute a completely inadequate sample size for statistical analysis. However, 446 questionnaires were collected, and this is a sample size appropriate to statistical analysis. Before examining this possibility, it becomes necessary to examine the success of the questionnaire more closely.

First, interpretation of the questionnaire responses resulted in the correct placement of 12 of 14 participants on the 3x3 grid. These 14 participants, however, each had to be placed with respect to global warming and evolution positions – 28 analyses in all. Of these 28 analyses, 2 resulted in mischaracterizations of the respondent's actual position. This is a 93% success rate. In looking at the questionnaire numbers overall, more concerns arise. One-third of the questionnaires could not be used, as participants either attempted analysis of the cartoons themselves (~13.5%), or had positions that could not be determined from the questionnaire (about 20%). There are a number of ways that these concerns can be addressed. First, a different set of directions could be included on the questionnaire itself. The line "What are they saying?" probably needs to be omitted. Additionally, participants probably need some guidance as to how much to write; perhaps they could be told to write at least 3 or 4 sentences. This would save any researcher the aggravation of encountering a lot of one- or two-word responses. Second, the approach to collecting the data could stand some change; rather than simply asking the lab coordinator for permission to collect data in biology labs, it would probably be a good idea to work with the lecture instructor and see if this questionnaire could be passed out at the beginning of a semester during the first few lectures; it would probably benefit any biology lecture instructor to have a reasonable estimate of the number of creationists in

her class. Third, the contents of the questionnaire should probably undergo change. During analysis, the cartoons were tracked to see which ones were left blank and which cartoons received responses indicating confusion about the cartoons themselves. Cartoons 6 and 5 were left blank at over double and triple the rate of any other cartoon, respectively. The possibility that these cartoons were left blank simply because they were the last two cartoons in the questionnaire is diminished by another observation: respondents expressed confusion in writing about cartoons 6 and 5 at ten and five times the rate of any other cartoon, respectively. These cartoons are obvious candidates to be omitted or replaced. Despite these concerns, however, when the questionnaire succeeded, it did so to a high degree; respondents often reacted to the provocative nature of the cartoons with responses that made their categorizations quite easy. Additionally, the content of the responses often gave valuable insight into the personality of the participants before their interviews. In any case, to paraphrase a particularly odious political figure, one has to analyze the data one has, not the data one might want. In light of that, some interesting trends appear in the questionnaire data.

One possibility that was virtually regarded as a certainty before stating this project was that the questionnaire numbers would cluster in two different respects: that the category reflecting rejection of both evolution and a human role in global warming, and the category reflecting acceptance of both evolution and a human role in global warming, would show higher numbers than any other grid positions. The reason that this was anticipated was the close connections that have been established over the past 30 years between evangelical/fundamentalist Christianity and the Republican Party. Personal experience with fundamentalists has resulted in the strong impression that adhering to the

Republican Party's platform has almost become synonymous with religious beliefs for many fundamentalist Christians. As the Republican Party has been largely dismissive of human contributions to climate change (McCright & Dunlap, 2000), it was reasonable to anticipate that most respondents who rejected evolution would also reject a human role in global warming. This definitely was not the case – of respondents who rejected evolution, 41% assigned a role in global warming to humans, while 47% rejected a human role in global warming. This, however, does not constitute the entire story; of respondents who accepted evolution without accommodating religion, 71% assigned a role in global warming to humans, while 18% rejected a human role in global warming. With this kind of difference, it seems obvious that these numbers are being affected somehow. Does this mean that fundamentalist rejection of evolution has a spillover effect into the global warming controversy – that the rejection of evolution causes a general increase in skepticism about science and scientists? Or could it mean that when science – not scientists, but science – is seen as a generalized authority, that it results in a greater acceptance of any given consensus position, even in controversies? The answers to these questions cannot be determined in this study, but they are interesting questions, and lead into possible directions for future research.

One question that was initially included in this study, but was later omitted, was "What characteristics of the students are related to the perception of the source's authority?" This question was omitted for two separate reasons: first, the focus of the study was on the characterization of the epistemic authorities of the students, not the characterization of the students themselves. Second, an in-depth analysis of the students would require a different type of interview, one biographical in nature, rather than one

focusing on how students characterized their authorities. Although it is an interesting question, it proved impracticable to answer in the course of this study. A good model for answering this question might be a multiple biography approach, in which a few students were asked in-depth questions about their formative influences, initial experiences with education, initial religious experiences, and initial encounters with these controversies, and finally, the progression, if any, from their initial encounters to their current views. This approach could also serve to answer another interesting question – what is the strength of a particular epistemic authority? To what extent is this integrated into the student's religious, political, or overall self-identity? Another possibility for future research might be to conduct a quantitative survey; perhaps a series of questions based on the results of this study could be used to construct an instrument with the capability of drawing correlations between different religious and political or media authorities.

The last general question to be asked is: what implications does this study have for science education? A number of different contributions come to mind. The first is methodological. In planning the methods used for this study, a grounded theory approach was considered and rejected, as theory generation was not an objective of this study. Grounded theory has become a mainstay for qualitative research, but the emphasis on theory generation has, in my opinion, caused many a study to overreach with respect to implications and conclusions. Additionally, the resulting hodgepodge of "theories" muddies the waters – it seems somewhat problematic to investigate a few participants in a unique setting and then use the term "theory" to describe conclusions of the study. My personal bias and interests in science education also influence my views here; one of the major misconceptions with respect to evolution is that many people conflate the word

"theory" in the layman's sense with the scientific usage. I feel that it is incumbent upon science education and science educators to be more careful with this word, and as a discipline, I think we need to take steps to limit the use of "theory" to conclusions that have broad explanatory power. This study works towards that end by referring to the type of analysis used as, simply, inductive thematic analysis. There are no theories to be found here.

Another aspect of qualitative research that I find particularly troubling is the fuzziness with which methods are approached. At its heart, qualitative research is a subjective exercise. Codes and categories do not really "emerge" from the data (although I will admit to the hypocrisy of using that phraseology); rather, they are entirely dependent on the individual observing the data. Emergence is the equivalent of the old saw that "the data speak for themselves." No, they don't. Interpretation of data requires an interpreter. It is my opinion that this fuzziness is maintained in qualitative research to allow the impression of distance or objectivity by the researcher. I do not think that science's standard of verifiable and repeatable data can ever be applied to research that involves human communication instead of physical properties, but I do think that intellectual honesty should be applied to qualitative research. In each of my definitions for codes, categories, and themes, I have intentionally included the word "subjective." A code does not emerge from data. It is subjectively distilled from data by a researcher. I feel that my definitions for codes, categories, and themes represent an honest approach to qualitative analysis, and would like to see that spirit reflected in a standardization of research terms in science education. Here, science serves as my model. To wit: to a scientist, polymerase chain reaction is a specific technique. No matter which scientist

you ask, PCR involves the amplification of DNA, but it is a tool that can be used in an incredible variety of studies. Similarly, standardized definitions of codes and categories would not necessarily limit the variety of qualitative studies.

The second contribution that this study that I think this study can make to science education is the differentiation between knowledge and belief, and how those terms should be used in discussing conceptual frameworks. I will not restate the arguments that I made in Chapter 2, but I think it is quite important that lines be drawn between knowledge and belief in science education. How else can science educators justify what is taught in science classrooms? It is definitely the responsibility of science educators to teach scientific knowledge as defined in this study, but is it the responsibility to teach belief? One approach to science education currently being lauded is the "ecojustice" approach. What is being taught with an ecojustice approach? Facts about the environment? Explanations of phenomena in ecologies? Ecological activism? Is a teacher who uses an ecojustice approach teaching knowledge or belief? If it is indeed belief, that opens the possibilities of other beliefs being taught in the science classroom, and given the emphasis of this study, it probably comes as no surprise that creationism is the first belief that comes to mind. I think that science educators need to be very cognizant of the line between teaching and converting students to a cause. The first step to this cognizance comes in recognizing the difference between knowledge and belief.

Another contribution that I would like for this study to make to science education is the most practical: approach to instruction. Considering epistemic authorities in the teaching of evolution is helpful in two fashions.

First, teachers can devise strategies that will not bring them into conflict with students' authorities. A good example of the strength of epistemic authorities can be found in Richard Dawkins' "The Genius of Charles Darwin." In the first episode, Dawkins took a group of British secondary students to the Jurassic Coast in Dorset to search for fossils. Although the students were shown physical evidence, and were being taught by a very famous authority on evolution, some still rejected evolution in favor of their religion. When Richard Dawkins was not viewed as an authority equal to students' religious beliefs, how can a biology teacher compete? The solution to this lies in avoiding conflict with epistemic authorities. One suggested strategy is to acknowledge the conflict that some students feel, and inform those students that although they will be expected to learn about evolution because it is science's way of explaining biological phenomena, they will not be required to accept it. This sidesteps potential conflict, and students do not feel as if they have to choose between the teacher and their religion as authorities – a choice I feel that teachers will lose in the majority of cases.

Second, thinking of creationist students as students with different epistemic authorities removes the pro/anti dichotomy involved in this controversy, and provides a universal framework for viewing students. Students are no longer pro-creation, or anti-evolution; they are all simply students with different epistemic authorities that can be addressed using different strategies in the classroom.

Perhaps the most important aspect of epistemic authorities with respect to evolution, however, is that the concept gets to the root cause of the controversy. Individuals' stances on evolution are not the root cause; rather, their stances are dependent on the authorities they use to inform those stances.

I would like to express one final thought with respect to epistemic authorities. The Platonic definition of knowledge is "justified true belief." I have spoken of the arbiters of justification, but who or what determines truth? If an epistemic authority is a source upon which one depends for knowledge, then the presence of religion surely introduces a different sort of authority: a source upon which one depends for religious or fundamental truth. The root of "epistemic" is the Greek word "episteme"; if one uses – perhaps appropriately in this case – the *koiné*, or common, Greek in which the New Testament was written, the word "aletheia" refers to truth. Perhaps in addition to epistemic authorities, we should also discuss aletheic authorities.

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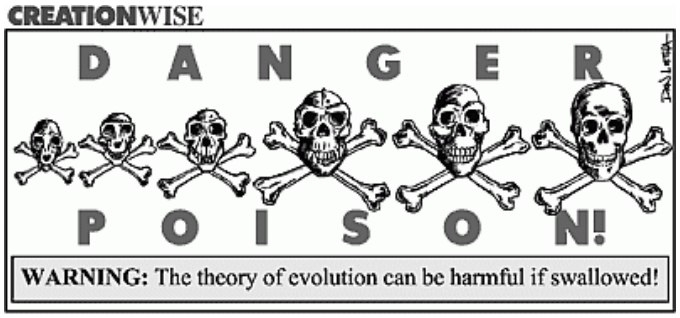
APPENDICES

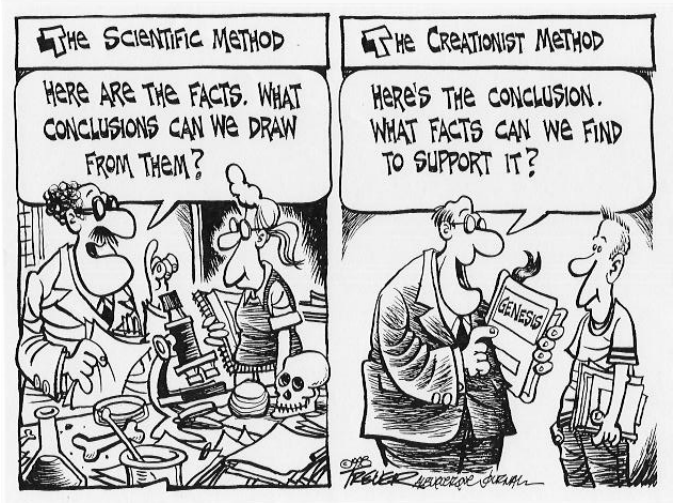
Appendix A

Questionnaire

Name_____ Contact email_____

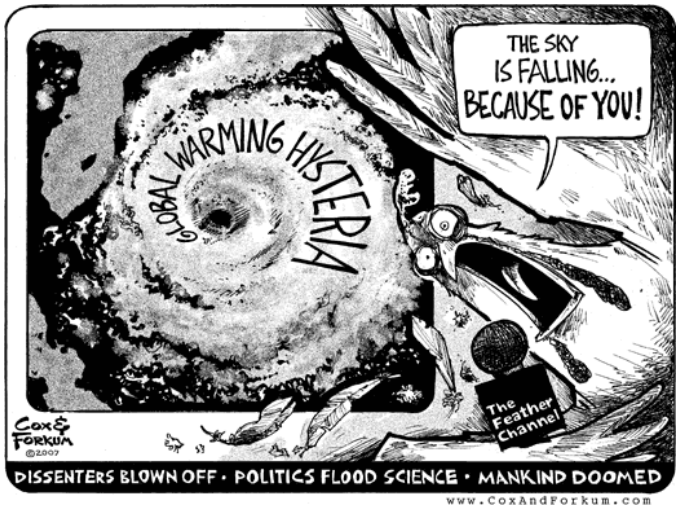
Please consider the following figures and write a reaction to them. What are they saying? **How do you feel about what they're saying?** Please do not tell me what you think I might want to hear. I am interested in **your** views.




The Scientific Method
Here are the facts. What conclusions can we draw from them?
The Creationist Method
Here's the conclusion. What facts can we find to support it?
GENESIS


AL GORE
GLOBAL WARMING... POLAR ICE CAPS MELTING... IT'S ALL JUST A BIG HOAX...
NEWS
© 2006 MONTE WOLVERTON
caglecartoons.com


SOOK
—So much for today's biology lesson on "intelligent design." Turning now to the subject of "intelligent geography..."


GLOBAL WARMING HYSTERIA
THE SKY IS FALLING... BECAUSE OF YOU!
The Feather Channel
COX & FORKUM ©2007
DISSENTERS BLOWN OFF • POLITICS FLOOD SCIENCE • MANKIND DOOMED
www.CoxAndForkum.com

Appendix B

CONSENT FORM

I, _____, agree to take part in a study titled "The Role and Characterization of Epistemic Authorities in the Construction of Undergraduate Students' Positions on Evolution and Global Warming", which is being conducted by Mr. Sam O'Dell (Doctoral Candidate) and Dr. Norman Thomson, (Associate Professor, Department of Mathematics and Science Education at the University of Georgia (706-542-4645. Participation in this study is **completely** voluntary. I can refuse to participate or stop taking part at any time without giving any reason, without penalty of any kind or loss of benefits to which I am otherwise entitled. I can ask to have the information related to me returned to me, removed from the research records, or destroyed, at any time, for any reason, without penalty of any kind.

- The reason for the study is to investigate the role of epistemic authorities (e.g., important sources of information, whether they are written sources, or people) in the formation of my views about evolution and global warming.

- The investigators have an absolute obligation to treat my views of evolution and/or global warming with respect, no matter what they are.

- Participants who take part in this study may improve their understanding of evolution and global warming, and may come to understand their own positions better. The researchers also hope to learn something that may help to more effectively teach evolution and global warming in the future.

- Participants will be asked to fill out a questionnaire, which will take no longer than 15 minutes. The researcher will answer any questions about the questionnaire as the participants take it. Follow-up interviews for selected participants will be requested within one week after the questionniare. The researcher will conduct between one to seven interviews with each selected participant. The duration of any of these interviews will not exceed one hour. Participants may be asked to verify accuracy of transcripts.

- The research is not expected to cause any harm or discomfort. My views of evolution and global warming and those sources which have helped me come to my views will not be degraded in any fashion. **Neither my grade nor my class standing will be affected** if I decide not to take part in any part of the research.

- Any data collected about me will remain confidential. My identity will be coded under a pseudonym, and all data will be kept on a password-protected computer at the University of Georgia, accessible only to the two researchers. All audio recordings will be erased by March 1, 2012.

- The researchers will answer any questions about the research, now or during the course of the project, and can be reached by telephone at the above listed numbers.

- No extra credit will be offered for participation in the study. Students who fill out a questionnaire will be entered in a drawing for a $10 gift certificate from the University bookstore. Students who agree to a first round of interviews will be entered in a drawing for a $25 gift certificate from the bookstore. Students who agree to further, in-depth interviews will be entered in a drawing for a $50 gift certificate from the bookstore.

- I understand the study procedures described above. My questions have been answered to my satisfaction, and I agree to take part in this study. I have been given a copy of this form to keep.

____ Initial here to give consent for quotes to be used in publications or presentations. *No actual audio will be used, only transcripts*. Any quotes will be attributed to a pseudonym, **not your actual name**.

Mr. Sam O'Dell
sro@uga.edu
706-542-4645

_____ Signature

_____ Date

Dr. Norman Thomson
nthomson@uga.edu
706-542-4645

_____ Signature

_____ Date

Please sign both copies, keep one, and return one to the researchers.

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199, email address IRB@uga.edu

Appendix C
Semistructured interview questions

1. What source(s) would you trust for accurate information on evolution?

2. Why you consider this (these) source(s) accurate? What is it about [source] that generates trust for you? How did you initially decide that this was an accurate source?

3. What do you mean by accurate? Trust?

4. What about the source -- what characteristics -- make it useful for your position on evolution?

5. What other topics have you found this source useful for?

6. What other sources would you consider useful for adding to your understanding of evolution?

7. How deep an understanding do you feel you have about evolution?

8. Why do you categorize yourself with this level of understanding?

9. Is there anything that comes to mind about [source] that you'd like to share with me? If so, what?

1. What source(s) would you trust for accurate information on global warming?

2. Why you consider this (these) source(s) accurate? What is it about [source] that generates trust for you? How did you initially decide that this was an accurate source?

3. What do you mean by accurate? Trust?

4. What about the source -- what characteristics -- make it useful for your position on global warming?

5. What other topics have you found this source useful for?

6. What other sources would you consider useful for adding to your understanding of global warming?

7. How deep an understanding do you feel you have about global warming?

8. Why do you categorize yourself with this level of understanding?

9. Is there anything that comes to mind about [source] that you'd like to share with me? If so, what?

Appendix D
Pre-interview position lists

I believe that a single creation event consisting of six 24 hour days literally occurred somewhere between eight to ten thousand years ago.

I believe that there are two separate creation events described in Genesis, and that these creation events are separated by a vast expanse of time. Creation confirms an ancient age of the earth, but one of the creation events was still the six 24 hour days.

I believe creation occurred, but each day mentioned in Genesis represents a much longer literal period of time - thousands, millions, or even hundreds of millions of years.

I believe in a series of separate creation events over hundreds of millions of years that account for different types of living creatures (e.g., trees, fish, reptiles, people, etc.)

I believe that the earth is ancient, but complex molecular machinery and complex structures, such as the eye, were a result of specific creation events; e.g., "design." I can accept microevolution, but mutation and natural selection are not adequate to explain macroevolution, such as evolution of reptiles from fish.

I believe that God uses evolution for creation and has specifically directed evolution's pathway.

I believe that God set up the rules of the universe at the beginning and let it go, resulting in evolution. God created the universe but allowed random chance in evolution.

I believe in evolution, and also believe in God. I think God played a role in evolution, but was so subtle that we can't detect that role.

I believe that evolution happened, and that the evolution of species can be explained without assigning a role to God in any fashion.

I believe that global warming is occurring, and is primarily caused by humans.

I believe that global warming is occurring, and is a natural cycle, but that humans have definitely accelerated and/or worsened it.

I believe that global warming is occurring, and is a natural cycle, and that humans have not affected it one way or another.

I believe that global warming is occurring, but I do not know whether humans have affected it or not.

I do not know if global warming is occurring.

I do not believe that global warming is occurring.

Appendix E
Recruitment email, scheduling webpage, and booking site

Thank you very much for participating in the "cartoon" questionnaire passed out in your 1103 lab. Based on your responses, I would like to interview you to further explore your views and how you came to hold them.

Each of you initialed the consent form indicating that I could contact you. If you do not wish to participate further, I would appreciate it if you would take just a couple of seconds and text your name and "no" to my cell at [redacted] so that I can contact someone else.

Again, if you participate further, you will receive $20 at the end of a second interview. I also want to reemphasize that both confidentiality and respect for your views, no matter what they are, will be strictly observed.

To participate further, please go to this page for more information and a link to set up an interview time that will be convenient for your schedule:

http://sro.myweb.uga.edu/Interviews.html

Thanks again,

Samuel R. O'Dell, Jr.
PhD Candidate
Department of Mathematics and Science Education
University of Georgia

Thank you for your further participation in my dissertation!

Interviews can be held at the Miller Learning Center (formerly the SLC) or Aderhold, whichever you prefer. When you get to Miller/Aderhold, contact me at 706-424-5353 and I will let you know which room I am in; this will change from day to day based on which room I can grab.

My available interview times for this semester are as follows:

Tuesday	Wednesday	Thursday
8:00AM - 8:30PM	2:00PM -8:30PM	8:00AM - 8:30PM
Friday	**Saturday**	**Sunday**
8:00AM - 1:00 PM 6:00PM - 8:30PM	10:00 AM - 7:00PM	1PM - 5:00PM

I am unable to schedule interviews for Mondays as I have a heavy teaching schedule that day. These are all start times; for instance, you'll be able to start an interview up to 8:30PM on Tuesday.

You can schedule your interview time by clicking the button just below, starting at 8AM on Tuesday, April 14. You will be given a couple of options; just choose "Interview." When you fill out the form, please indicate whether you want to interview in Aderhold or MLC in the "special request" area.

Online appointment scheduling for Personal Services
If some of these times do not show, then someone else has already booked an interview. Times for the interviews show as 90 minutes, but that is so I can have time between interviews to reset things. I do not intend for any interview to last longer than 60 minutes.

If you need to contact me for any reason about interviews, I have established an email account specifically for corresponding about them:
dissertationinterviews@gmail.com

Again, thank you very much!!!