The Politicization of Science in the Public Sphere

Gordon Gauchat, Ph.D.

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In 2009, the National Science Foundation and numerous allied scientific organizations celebrated the "Year of Science" – a nationwide program to promote "public understanding of science." The explicit purpose of the program was to combat a perceived decline in the cultural authority of science in the public sphere. Copious signs were present in popular media: increased antievolution activities, apparent confusion about stem cell research and climate change, and fears about expert "death panels" and H1N1 vaccinations. This dissertation systematically examines science's "legitimacy crisis" in U.S.: 1) whether it is supported by empirical data, 2) its root causes and consequences, and 3) how dispositions toward science shape and are shaped by socio-political cleavages in the public sphere. This study is also advantaged by the new biennial science and technology module that was added to the General Social Survey in 2006. This module combines questions that have been asked in previous surveys with new questions that probe different aspects of the cultural authority of science as well as a broad range of demographic, political, and cultural factors. Overall, this study finds a growing association between political orientation and public trust and acceptance of science, specifically, political party and ideology. Those identifying as conservative and moderate have strong reservations about science on a broad range of issues, especially, its relation to the state. However, conservatives' disenchantment with science has grown with time and has peaked in the most recent decade. Additionally, the "politicization of science" in the U.S. appears unique among other economically advanced countries. Finally, numerous interpretations of these results are explored along with their implications for the contemporary U.S.

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Gordon Gauchat

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Presented by
Gordon Gauchat, B.A., M.A.

Major Advisor ______________________________

Michael Wallace

Associate Advisor ______________________________

David Weakliem

Associate Advisor ______________________________

Simon Cheng

University of Connecticut

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INTRODUCTION

National Science Foundation celebrated 2009 as the "Year of Science," a nationwide program to promote "public understanding of science." A wide variety of scientific organizations managed the activities and events under an umbrella organization, the Coalition on the Public Understanding of Science (COPUS). This organization formed "in response to growing concerns about increased antievolution activities, apparent public confusion about stem cell research and climate change, and reports from the National Science Board that 'most Americans do not understand the scientific process' (COPUS 2009). This concern among scientific organizations in the U.S. echoes a similar "crisis" that occurred in the UK over two decades ago. During the 1980s, the UK's scientific establishment perceived a number of threats from the public and government (Yearley 2005). For the scientific establishment in the UK, public skepticism and perceived ignorance represented serious challenges to the cultural authority of science. It was in this environment that academic interest in public understanding of science (PUS) emerged in its present form.

In the U.S., the current "crisis" of public trust in science has unfolded in a similarly charged political and economic context. With very little effort, one can identify numerous signs that the cultural authority of science in the public sphere has weakened. In February 2009, a Gallup survey showed that only 39% of the public "believed in evolution." Comparing explanations of human origin, a similar Gallup poll conducted in 2008 showed that—44% of Americans believed in creationism, the idea that God created humans in their present form; 36% identified with intelligent design, the idea that "man developed, with God guiding;" and 14% said that "man developed but God had no part in the process." In addition, a 2009 *Pew Research Center* report shows that 2% of scientists agree that human beings "existed in their present form since the beginning of time." Republicans were far more likely than other political groups to endorse these views: 68% of Republicans indicated that they "don't believe in evolution," compared to 37% of independents and 40% of Democrats.

In a July 2010 ABC news interview, Republican Senator Jim Inhofe of Oklahoma declared that the earth, "all the scientists agree is going into a cooling period" and refused to pull back from his previous claims that climate change was "the greatest hoax ever perpetrated on the American people." Just days earlier, the National Oceanic and Atmospheric Administration had announced that, globally, 2010 was the warmest year on record since readings were first collected in 1880. Additionally, the Gallup reports a "reversal in Americans' concerns about global warming that began last year has continued in 2010." The agency reports that in 1997, when they began tracking this issue, 31% thought global warming's effects had been exaggerated; last year, 41% thought the same, and this year the number is 48%. Meanwhile, a 2009 *Pew Research Center* report showed that 84% of scientists in the U.S. agree that human activity is producing global climate change, compared to about 50% in the general public. Similar polls show sizeable and growing gaps by political party on this issue, with Democrats far more likely to see climate change as a serious problem than Republicans (Dunlap 2008).

Government funding of stem cell research also continues to arouse controversy in the public sphere. In a 2001 televised presidential address, President George W. Bush banned federal funding of embryonic stem cell research on stem lines created after August 2001, ostensibly, ending research on embryonic stem cells. Early in his administration, President Barack Obama ended the ban on federal funding of embryonic stem cells. In 2009, 41% of Americans support the government restrictions enforced under President George W. Bush or support stricter measures. Once more, attitudes about government funding of stem cell research varies by political party and ideology. National polls show that 57% of Republicans support government restrictions compared to 31% of Democrats. Similarly, 61% of conservatives support restrictions compared to 22% of liberals (Morales 2009).

Certainly, natural selection, climate change and stem cells remain the most visible public "science controversies" in the contemporary U.S. Thus, the fact that these issues are politicized is unsurprising. Yet, various minor and less enduring controversies have also challenged the credibility of the scientific establishment in the U.S. For example, in the context of the health care reform debate, prominent conservative commentators including Sarah Palin, Glenn Beck, and Rush Limbaugh accused congressional Democrats of legislating "death panels," unelected and unaccountable groups of medical experts that would decide which patients were worthy of living. Although these allegations were unfounded, numerous Republican politicians, most notably Senator Charles E. Grassley, echoed similar ideas in public speeches (Rutenberg and Calmes 2009). Controversy also followed the release of a Department of Health and Human Services 2009 report in which an expert panel recommended new guidelines for screening breast cancer for women under the age of 50. The public health establishment's attempts to vaccinate the public from the H1N1 swine flu were also met with widespread resistance and cynicism, including arguments that the vaccine was dangerous. Despite numerous reassurances from the Centers for Disease Control and Prevention (CDC), many families did not receive the vaccination in 2009, with some fearing harmful side effects and others feeling the threat from swine flu was exaggerated (Newport 2009; Whitelaw 2009).

Many of these controversies share a common theme: a strong relationship between political orientation and public trust in and acceptance of scientists and experts. Yet, few scholars in PUS or the broader field of science and technology studies (STS) have fully examined the influence of political views on the public's trust in science. On the one hand, STS has established that, in economically advanced societies, science and politics are inseparable (Cozzens and Woodhouse 1995; Irwin 2008). That is, science and politics are *co-produced* and viewing these entities as static and distinct institutions obscures "the often invisible role of knowledges, expertise, technical practices and material objects in shaping, sustaining, subverting or transforming relations of authority" (Jasanoff 2004:4). Jasanoff introduces the concept of co-production to draw attention to the explanatory power of "thinking of natural and social order as being produced together" (Jasanoff 2004:2). Yet, research on PUS has inadequately addressed how the boundaries between science and politics are then reconstituted in the public sphere or, more precisely, how political cleavages become intertwined with science and technology in the public sphere (see Waterton and Wynne 1996). Additionally, the relationship between political orientations and public trust in science poses larger questions about the unevenness of the cultural authority of science and the potential for deep socio-cultural divisions in the public sphere. Although, unlikely a "crisis" of the magnitude perceived by scientific organizations, public opinions about climate change and natural selection may be symptomatic of a broader cultural pattern in which public perceptions of science are increasingly polarized. In short, these issues are the main focus of this dissertation. However, before elaborating on these themes and outlining specific chapters, I introduce a number of key concepts and debates that require preliminary discussion.

Contested Concepts

Research on PUS has been fairly contentious, including the very idea of "public understanding." Although the earliest U.S. data on public attitudes and knowledge toward science was collected in the wake of the Sputnik launch in 1957, academic interest in PUS emerged in the 1980s. The main thrust of PUS research was to assess public interest, knowledge, and trust in science using nationally representative surveys. These surveys were collected almost exclusively by national science organizations such as the NSF in the U.S. and the Royal Society in the UK. Until the 1990s, the main focus of PUS was the measurement of public scientific knowledge what was later dubbed "scientific literacy" (Miller 2004). A key architect these surveys, Jon Miller, believed that few individuals actually possessed attitudes toward science, because these attitudes require attentiveness to science and scientific discoveries. Thus, attentiveness to science (or understanding of) became the focal point of Miller's research program and of the NSF's *Science Indicators Survey*. The explicit goal was to facilitate what he termed "scientific literacy," in essence, cognitive compliance with expert and authoritative knowledge or agreement with textbook facts. This, for Miller, produced three positive states: (1) pro-science attitudes, (2) support for public expenditure on science and science education, and (3) democratic decisions informed by the scientific establishment. Miller's early work in this area casts a long shadow, and many of the instruments designed during this period still regularly appear in national surveys on public attitudes such as the General Social Survey (GSS) , Eurobarometer, and World Values Survey (WVS).

Sociologists of science have been especially critical of PUS survey research (Wynne 1995; Yearley 2005). Defining concepts such as "science" and "public" have proven particularly complicated. Assumptions about the meaning of these key terms have become a source of deep disagreement. For instance, if "science" is assumed to reference superior knowledge, while the "public" connotes "laypersons" with inferior knowledge; it then follows that the public should show appropriate reverence to science and accept scientific knowledge as truth. Consequently, public ignorance and skepticism becomes the primary research problem. Numerous scholars in STS have charged that these unreflective assumptions about science and the public have impaired PUS research and the *Science Indictors Survey* (see Wynne 1995). The NSF's control over the collection and design of the Science *Indicators Survey* (1972-2001) has also elicited distrust, promoting a narrow research agenda centered on reducing public ignorance by funding science education appears self-serving.

The measurement of "scientific knowledge" in surveys also elicits strong criticism. Surveys routinely measure scientific knowledge using a true-false quiz format that asks respondents about basic textbook facts. For example, the quiz would include questions about whether an atom is bigger than an electron, whether viruses can be treated by bacteria, or whether the earth revolves around the sun. Yet, take for example questions related to natural selection, the "big bang," or belief in astrology, which were also included. A respondent might give the "wrong" answer to these questions while knowing what the scientists consider the "right" answer. In other words, these "false negative" responses might occur for a variety of sociological reasons unrelated to public ignorance such as, religious faith or general cynicism. Yet, as discussed in chapter 2, these quiz questions likely measure a worthwhile sociological phenomenon, without necessarily indicating ignorance or knowledge.

For the purposes of clarity and consistency, this dissertation defines science using Moore's (2008) description: science is not easily reduced to a single idea or thing but represents "simultaneously a body of knowledge, a group of people, and the means by which knowledge is acquired and disseminated" (Moore 2008:215). Most often, this dissertation will use science to refer to a "group of people," the organizations they belong to, and the professional boundary that central institutions in society agree is a source of credible expertise (Gieryn 1999). Thus, terms like scientific establishment or organized science are more appropriate and sometimes used; however, often these ideas are simply called science. Chapter 4 will show that the meaning of science in society (i.e., in the public) is not always consistent with the formal definitions provided here.

The concept of the public is also troublesome. Michael (2009) develops a useful distinction between Publics-in-Particular (PiPs), localized groups that engage with organized science about specific topics (e.g., HIV activism); and Publics-in-General (PiGs), which refer to larger amorphous groups (e.g., whole societies). Michael argues that analyzing both these types of publics present methodological challenges but neither should be neglected. Going forward, "public" will refer to Michael's PiGs, and the term "public sphere" will connote a similar concept. Although the idea of the public or public sphere is useful for thinking about large groups and societies, it is important not to obscure divisions in these entities (i.e., disadvantaged groups, inequalities, and categories of difference). In fact, much of this dissertation is about differences, particularly, across political cleavages. While dispositions toward science are shaped by people's lived experiences in their various social locations (e.g., race, class, gender, and sexuality), even these segments and divisions are larger than the "face-to-face" groups Michael refers to as PiPs.

The concept of politics or politicization also anchors this dissertation and requires discussion, but descriptions of these concepts are offered below. The next section identifies the major theoretical problems in the PUS research program. Like the previous section, it draws extensively on key insights from STS to clarify and expand the discussion. It then introduces the politicization thesis, which is at the center of this study.

Theoretical Problems

To simplify, I divide the broad range of issues relating to PUS into two main theoretical problems: the legitimacy problem and the democratization problem. The *legitimacy problem* refers to the declining trust in the political and cultural role of scientists and a general disenchantment with the potential of science and technology to identify and solve society's fundamental challenges. That is, large segments of the public no longer look to scientists and scientific knowledge to provide a set of cultural values and practical knowledge that would improve everyday life, enlighten political perspectives, or address moral issues (Collins and Evans 2007; Moore 2008). On the other hand, the *democratization problem* refers to the inadequate dissemination of scientific knowledge and the power dynamics inherent in the production of scientific knowledge. This second problem emphasizes the potential tensions between expert knowledge, technocratic authority, and democratic values, and points to various ways to transform the cultural boundaries between the public and organized science. Additionally, the democratization problem represents a series of reform strategies for improving the public engagement with science, which, in turn, would alleviate the legitimacy problem.

PUS research in the 1980s and 1990s assumed that the legitimacy problem could be reduced to a problem of public ignorance, often dubbed the "deficit model." Although, harshly criticized, one can easily interpret the "deficit model" as a naive version of the democratization problem. That is, the "deficit model" endorses improving science education to combat a perceived anti-science movement that is rooted in public disinterest and ignorance. Miller's concept of civic scientific literacy, for example, implies that democratic citizenship requires an understanding of the issues and that a new set of issues have emerged that require understanding of core scientific terms and concepts. Miller (1983, 1998, 2004) never strictly endorses the "deficit model" and often implies that the legitimacy problem is overblown. He argues that few people have developed solid attitudes toward science; instead, Miller claims that the problem is about public ambivalence, not hostility and distrust. The difficulty with PUS research relates more to its assumptions about society and the social world. That is, survey research has ignored the question of why the cultural authority of science in uneven in society as well as the social inequalities and power dynamics that produce ambivalence, distrust, and alienation. Moreover, it fails to recognize the socio-political cleavages that differentiate the public. In essence, it has largely failed to theorize society: how the social order obscures conflicts over social resources and power, and how social consensus is achieved through, often through ideology and hegemonic authority rather than "enlightenment." To use a familiar analogy in sociology, promoting "public understanding" is tantamount to arguing that improving public education can end poverty, while ignoring that solving poverty maybe necessary to improve public education. This study addresses these issues by carefully examining group differences in public receptions of science, both in terms of key demographic groups, but particularly political cleavages represented by political party and political ideology. However, the democratization problem has important differences from the deficit model, which are discussed below.

As mentioned above, scholars have proposed that the democratization problem is the leading cause of the legitimacy problem (Bucchi and Neresini 2008; Irwin 2008; Moore 2008; Wynne 1995). There are two strains of thought here. On one side, the democratization process ends with scientific experts in more public or activist roles in which they act as informants to the public and bypass other social interests (i.e., economic and political). The move to democratize the distribution of scientific knowledge emphasizes the role of scientists as educators: scientists should provide the public with facts (and habits for interpreting facts) rather than act as backroom advisers to elites. Furthermore, this view does not advocate democratizing the production of knowledge but, rather, amplifying the process of dissemination. Similar to the deficit model, this perspective views public understanding as the problem, but, in contrast to the deficit model, the public is not blamed. Instead, the issue is the disinterest of scientists themselves and the scientific establishment's attempts to remain "objective" arbiters in political matters. Contrary to the deficit model that endorses a public celebration of science (e.g., the year of science); this perspective endorses an expanded political role for scientists in the public sphere.

The second view of the democratization problem implies a more radical reconfiguration of society. In this version, the production of scientific knowledge itself is the source of the legitimacy crisis. Specifically, it is the bureaucratic organization of science, instrumental rationality, and proximity to the state apparatus that produces public alienation (Mills 1958; Moore 2008:41; Collins and Evans 2007; Giddens 1991; Wynne 1995). In order to temper this alienation, the public should directly participate in scientific debates, and "local" knowledge should be given equal weight with expert knowledge in the public sphere (Epstien 1996, 2008). This perspective endorses the idea that bureaucratic and expert authority should be greatly diminished, entirely reconfigured, or abolished completely. This version of the democratization problem opposes scientific organizations' dual role as producers and distributors of knowledge. Instead, it is the scientific establishment's dependence on and alliance with vested interests and power that undermine its legitimacy and place science in conflict with public interests. Thus, for large segments of the public, science is indistinguishable from power, rational-legal authority, and abstract bureaucracy.

Altogether, the legitimacy and democratization problems are analytically distinct but also overlap in numerous respects. Both problems imply that modern democracies face crises related to the cultural boundaries between the public and organized science. However, the democratization problem is a reform oriented issue, and the legitimacy problem is largely academic. To contextualize the research conducted in this dissertation, I place greater emphasis on the legitimacy problem; although, I also discuss arguments related to the democratization problem where relevant. However, the main theme of this dissertation is to inject a third perspective or thesis that builds upon both these ideas, but also expands upon them considerably: the idea of *politicization.*

Yearley (2005) articulates "politicization" succinctly. He contends that the scientific establishment is–so to speak–victimized by its own success; that is, the cultural authority of science has grown to the point that it must weigh in on numerous public controversies that are, by definition, polarized. Consequently, science is "increasingly seen as being politicized and not disinterested" (Yearley 2005:121). This implies a legitimacy paradox rather than a crisis, but it also means that the cultural authority of science is likely associated with social location, both in terms of access to resources as well as in terms of social identities and cultural and political values. Moreover, following the ideas of co-production (Jasanoff 2004), public trust and acceptance toward science *shape and are shaped* by individual worldviews, status-groups, social identities, and political cleavages (see Giddens 1991; Beck 1992). These ideas are explored in detail in chapter 2. However, it is important to note that the concept of *politicization* contrasts with the legitimacy problem, because the former suggests unevenness in the cultural authority of science–a decline in some segments of the public and growth in others. Politicization in the broadest sense refers to the idea that science is increasingly drawn into cultural conflicts that align it with some social groups and cultural values and distance it from others.

In this study, the politicization thesis also has a narrower meaning that applies to the political context of the contemporary U.S. Mooney (2005) claims that ideological conservatives in the U.S. have become increasingly disenchanted with the scientific establishment since the 1970s. He describes a confluence of socio-historical forces in the post-World War II U.S. that he argues fomented a potent "right-wing" movement. He argues that this conservative movement is driven by religious fundamentalism and libertarian business elites as well as populist anger targeted at the state and intellectual and cultural elite (see Hofstadter 1970 for a similar thesis). According to Mooney, the conservative identity in the U.S. has come to represent an "outsider" label that opposes the cultural, political, and economic "center." In this movement conservative framing, science and the state embody a singular entity, the abstract system of expert authority that challenges local and traditional knowledge and cultural values. This narrower version of the politicization thesis suggests that ideological conservatives in the U.S. will show increasing misgivings about science, particularly, in its relation to the state.

To summarize, politicization is conceptualized in two ways in this study. The first "broad" definition refers to a process in which the cultural authority of science extends to the point that it becomes entangled in polarized social conflicts (e.g., economic growth vs. environmental sustainability). Here "political" refers to contests between social groups and interests. When talking about this larger idea, it might be more convenient to talk about the *politicization problem*, because the latter implies a broad perspective that represents an alternative to the legitimacy problem (or an explanation of it). In the narrower sense, politicization refers to the process Mooney (2005) describes in which conservatives in the U.S. have become alienated from science. Here "politics" refers to political cleavages, particularly, political ideology and party. For the most part, this study uses politicization and politics to connote this narrower idea; although, chapter 5 will explore both meanings.

Chapter Outlines

In this section, I briefly describe each of the empirical chapters and the data used in these analyses. As mentioned above, the NSF has regularly collected nationally representative data about public attitudes toward and knowledge of science and technology. The NSF has changed its means of collecting these data over time. Until 2001 data were collected by telephone though a single-purpose "Survey of Public Attitudes Toward and Understanding of Science and Technology" or, simply, the *Science Indicators Survey*. Since 2006, the NSF has funded a science and technology module embedded within the biennial General Social Survey (GSS). The GSS is a nationally representative, face-to-face survey covering a broad range of socio-cultural factors and attitudes conducted by the National Opinion Research Center (NORC) at the University of Chicago. According to the NSF, researchers and government officials—particularly those responsible for scientific research and education—use the *Science Indicators Survey* "to monitor public knowledge of and attitudes toward a variety of science-related issues and topics" (NSF 2010). The GSS module combines questions that have been asked on previous *Science Indicators Survey* with new questions that probe different aspects of the cultural authority of science.

The GSS module offers numerous advantages over previous surveys that make this study possible. First, previous *Science Indictors Surveys* were narrowly focused on attitudes toward and understanding of science and did not include sufficient demographic variables to draw even basic conclusions about the relationship between socio-political cleavages and attitudes toward science. By contrast, the GSS includes a broad range of demographic, political, and cultural instruments that facilitate multivariate explanations.

Second, in 2006 and 2008, the GSS implemented a major initiative to incorporate new items, including questions about the meaning of science in society, questions about public trust in scientists in relation to other elites (i.e., economic and political), and expanded questions related to scientific knowledge. Thus, the 2006-2008 wave of the *Science Indicators Survey* is the most comprehensive data set ever collected on this topic. This data set makes this dissertation research possible, and, as a result, this study represents the most systematic quantitative study of variation in public trust in and acceptance of science by demographic groups, political cleavages, and cultural values. The GSS also includes items about "confidence in science" that extend back to the 1970s, allowing for analysis of time trends in attitudes by social group. Additionally, some of the *Science Indicators Survey* items have been added to international data sets, including the World Values Survey – the largest international survey of socio-cultural values. This study utilizes all three of these data sets, and various chapters provide detailed descriptions of the data. This dissertation is primarily focuses on the U.S.; although, chapter 5 compares the U.S. to other economically advanced countries.

Chapter 2 provides a theoretical framework for analyzing the cultural authority of science in the public sphere that moves beyond the previous PUS survey research and the assumptions of the aforementioned "deficit model." Specifically, it uses Bourdieu's familiar *theory of practice* to discuss the formation of dispositions toward science and how these dispositions correspond with social location and political cleavages. This chapter also introduces the concept of *scientific cultural capital*, which represents a key symbolic resource in advanced economic society and a key source of political and social conflict. Using data from the 2006-2008 GSS science modules, the chapter shows that scientific cultural capital is interrelated with social and economic power in the public sphere as well as political ideology – i.e., those identifying as liberal, moderate, or conservative.

Chapter 3 explores time trends in the politicization of science in the public sphere. This chapter uses the 1974-2008 GSS to examine group differences in public confidence in science over time. The analysis, specifically, tests Mooney's claim that conservatives have become more alienated from science in the U.S. The results of this chapter show that most group differences (i.e., demographic groups) in confidence in science are stable over the period, except for those identifying as conservatives. Conservatives begin the period (1974) with the most confidence in science relative to liberals and moderates and end the period with the lowest confidence (2008). This indicates that changes in public trust in and acceptance of science since the 1970s are driven by shifts in the conservative identity. Furthermore, this chapter also shows enduring differences in confidence in science by social class, ethnicity, gender, church attendance, and region.

Chapter 4 offers an in-depth analysis of attitudes toward science in the key years of 2006 and 2008. Building on the previous chapter, which showed an accelerating distrust in science among conservatives in the period ending in 2006-2008, this chapter goes beyond the public confidence in science question to examine a broader battery of questions about science and science policy in this key period. Thus, this chapter provides a more complete profile of public attitudes toward science by political party and ideology. The results show that both moderates and conservatives have serious reservations about science on a broad range of topics. However, the relationship between science and the state particularly alienates conservatives. In addition, conservatives characterize the meaning of science differently than other political groups, and feel that science's primary function should be to reinforce common-sense and traditional religious teachings. This chapter also examines policy issues related to science, such as climate change, federal funding of stem cell research, and genetically modified foods.

Chapter 5 examines the U.S. in an international context by comparing it to other economically advanced countries. This chapter also moves beyond right and left to examine socio-cultural differences in attitudes toward science. Using data from the 2008 wave of the World Values Survey, this chapter looks at the relationship between political ideology and public attitudes toward science in economically advanced countries. Building on Beck's and Giddens' theories of the "risk society," this analysis also examines other factors, such as confidence in political institutions, trust in others, and locus of control (i.e., how much people feel they control what happens in their lives). The results show that political ideology has a weak effect across national borders, but the effect is in the opposite direction of what was found in the U.S. That is, those who identify with the political "right" are more likely to have positive attitudes toward science. However, other factors have a stronger effect on public trust in and acceptance of science, particularly, confidence in political institutions and locus of control.

The sixth and final chapter explores the implications of these findings for many of the themes discussed above. It revisits the legitimacy problem given the results of this study and discusses its relationship to the politicization thesis. Some further interpretations of the results are also given. Furthermore, the broader ramifications of this research are discussed, particularly, what these results mean in the political context of the contemporary U.S.

CHAPTER 2: SCIENCE HABITUS AND SCIENTIFIC CULTURAL CAPITAL: A THEORETICAL REORIENTATION

INTRODUCTION

It is difficult to overstate the cultural changes that science and technology has wrought in the 20th century and new millennium. Yet, for all these transformations, social scientists and scholars sharply disagree about the impact that science's institutional ascendance has had on the general public. On the one hand, there is widespread agreement that the reach of "science and reason" into public discourse has yet to produce the panacea promised in the enlightenment. The dispute, instead, centers on why the promise remains unfulfilled. These questions about the reach of science's authority into the public sphere revive longstanding debates about the "nature" of science and its meaning, the scope and utility of public skepticism, and the limits and tensions implied in the relation between rational authority and democracy. Rather than wade into these portentous waters or wait for these enduring issues to be resolve, this chapter attempts to bracket them. Toward this end, this chapter reaches for a coherent sociological account of the relationship between the public sphere and organized science.

Unfortunately, research and theory on the cultural authority of science in the public has lagged behind advances in the broader field of Science and Technology Studies (STS). Divisions in the public understanding of science (PUS) research program are so deep that various names have been offered to describe and redefine it, including "public engagement," "public participation," and "science and technology in the public sphere" (STEPS). Each of these appellations corresponds to its own journals, methodologies, and academic networks. Given this context, this chapter hopes to develop a conceptual toolbox that will theoretically reorient the PUS program toward a well-known sociological framework. The purpose here is to provide a baseline vocabulary that will guide subsequent chapters and analyses of the cultural authority of science in the public sphere.

In short, this chapter explores the idea that in advanced capitalist democracies individual and group dispositions toward organized science and expert knowledge increasingly divides the public sphere. At the center of this analysis is a fairly straightforward Bourdieuian thesis that institutional or structural level norms and values translate into cultural forms of distinction in everyday life (i.e., the public sphere). In essence, if scientific rationality is valued among central institutions (e.g., economic and political), public dispositions toward science will loosely reflect these structural arrangements and distinguishable social groups will emerge based on these dispositions. Drawing on Bourdieu's theory of practice, this chapter explores how public dispositions toward science have become intertwined with the structural locations and political identifications of individuals in the U.S. The final sections develop the concepts of *science habitus* and *scientific cultural capital* that correspond with each of Bourdieu's key terms (i.e., habitus and capital).

Bourdieu generally describes habitus as "systems of disposition" that act as cognitive and motivating structures (1990). But rather than a set of conscious strategies and preferences, habitus represents an unconscious or embodied sense of the world and one's place within it––a tacit "feel for the game" (Bourdieu 1984: 114; Bourdieu & Wacquant 1992: 128–35; Sallaz and Zavisca 2007:24-25). Similarly, "science habitus" describes a disposition or orientation toward science that fundamentally shapes how one understands the contemporary social world. Bourdieu's theory of practice also emphasizes the concept of capital, which represents various material and symbolic social resources, and particularly, cultural capital – the ability to "demonstrate competence in some socially valued area of practice" (Sallaz and Zavisca 2007:23). Borrowing from Bourdieu, this chapter introduces the concept of "scientific cultural capital" to refer to a specific type of cultural capital and, more specifically, a set of attitudes and experiences related to science that confer social status to groups and individuals in contemporary societies. Drawing on Bourdieu's analysis in *Distinction* (1984), this chapter uses survey data to identify and measure scientific cultural capital.

The following sections describe how approaches in Science and Technology Studies (STS), Public Understanding of Science (PUS), and sociological theory have addressed the cultural authority of science in the public sphere and, where these approaches are inadequate, how they might be further developed. I then argue for a theoretical reorientation of PUS research that employs Bourdieu's theoretical toolbox.

Science as Culture: From Boundary Work to Public Participation

STS has theorized the cultural authority of science using the concept of boundary work (Gieryn 1999). *Boundary work* refers to cultural negotiations that demarcate "where science is located" and thus who in society has the authority to make credible truth claims (i.e., to speak with authority about nature, climate change, business cycles, disease, etc). Gieryn (1999:22) identifies the three key players in boundary work: 1) those who seek the label "scientist" in order to establish epistemic authority and credibility for their claims; 2) institutional authorities who rely on scientific experts to make and legitimate bureaucratic decisions (the users of the cultural maps); and 3) the public, those affected by the cultural cartography but who lack the resources and power to participate in the cultural negotiations.[1] The boundary work approach offers two major theoretical contributions. First, it articulates a framework for thinking about "science as culture" rather than remaining mired in epistemological or philosophical concerns. Second, it describes how science's credibility is socially constructed in political and economic institutions and, in reverse, how scientific knowledge provides these institutions with legitimate authority.

Recently, STS has become more attentive to the various institutional interfaces between organized science and society. These approaches share the basic assumptions of boundary work but emphasize particular cultural boundaries between organized science and politics, the economy, and the public (see Jasanoff 2004; Frickel and Moore 2006; Moore 2008). For example, Jasanoff (2004:2) articulates the concept of *co-production* as a "...shorthand for the proposition that the ways in which we know and represent the world are inseparable from the ways in which we choose to live in it." On the surface the co-production approach appears directly relevant to the cultural authority of science in the public sphere: how science relates to lived experiences. Yet, studies of co-production have focused exclusively on "how knowledge-making is incorporated into practices of state-making, or of governance more broadly, and, in reverse, how practices of governance influence the making and use of knowledge" (Jasanoff 2004:3). Thus, in practice the co-production framework has emphasized the reciprocal relationship between organized science and political and legal institutions (see Jasanoff 2008). The "new"

[1] Importantly, boundary work does not imply that the cultural borders of science are in permanent flux. Particular social/cultural locations, like prestigious universities, laboratories, and institutes become stable markers of credible knowledge production. Instead, boundary work assumes that the boundary of science is contested around the edges, in areas such as intelligent design, UFOlogy, or semiotics.

political sociology of science (NPSS) framework more explicitly marks the interface between organized science and power and "...considers the intersection of rules and routines, meanings, organizations, and resource distributions that shape knowledge production systems" (Frickel and Moore 2006:7). As relayed in this passage, NPSS never explicitly theorizes the cultural authority of science in the public sphere as a separate area of inquiry where power dynamics play out. In short, the boundary work, co-production, and the new political sociology of science perspectives are all chiefly concerned with knowledge-production. The main idea offered in this study is that science and technology have cultural consequences well beyond points of production, even beyond the economic and political institutions that consume these knowledges. Nonetheless, these theoretical perspectives have failed to address the ways in which the cultural authority of science shapes and, conversely, is shaped by social cleavages in the public sphere.

Studies of "public participation" in science have emphasized reforms that would expand the public role in the production and implementation of scientific knowledge (see Bucci and Neresini 2008; Epstein 2008 for reviews of this literature). This line of research has examined various cases in which "lay people" such as patient groups, health-related social movements, and environmental activists have contributed to and acquired science expertise, often facing resistance from formal experts and scientists (Epstein 1996).[2] Other case studies of public participation have investigated failed or contested interactions between scientific authorities and non-experts (see Wynne 1991). However,

[2] Emerging from the public participation literature is the contentious concept of "public experts," which refers to non-credentialed scientists who successfully challenge scientific experts, explore new procedures and contribute to the production and delivery of scientific knowledge (see Collins and Evans 2007 for a critical review of public expertise).

Collins and Evans (2007) have criticized the idea of "public experts," arguing that the complete democratization of scientific expertise denies any function for specialized knowledge and discounts the complexity and scale of knowledge production (e.g., particle colliders). Moreover, public participation appears to focus on a small group of engaged citizens in advanced democracies; however, little is known about the general public and the conflicts that arise over science in society separate from locations of knowledge production.

Above, I have argued that STS has not sufficiently theorized the cultural authority of science in the public sphere. The broader public remains a theoretical "black box" in the sociology of science, activated when scientists interfere in their lives but otherwise assumed to be ambivalent. Michael (2009) develops a useful distinction between Publics-in-Particular—localized groups that engage with organized science about specific topics (e.g., HIV activism)—and Publics-in-General—larger nebulous groups (even whole societies) that rarely directly engage science. Michael urges careful analysis of both Publics-in-Particular and Publics-in-General because each pose numerous methodological challenges, but neither should be ignored. Yet, studies of public participation have almost exclusively investigated Publics-in-Particular and relegated Publics-in-General to secondary or even illusory status. Thus, the endpoint of social scientific investigation has been cartoonish caricatures of the boundary between the public and science: the activist, the fearful and willfully ignorant, the dejected sheep farmer, the disinterested expert, the reflexive non-expert, and the curmudgeonly scientist. Consequently, no theoretical framework has appeared that relates to how scientific rationality shapes and is shaped by social inequalities, identities, cultural values, and political cleavages. Towards this end, the concepts science habitus and scientific cultural capital immediately evoke the vocabulary of cultural differentiation, inequality, and symbolic dimensions of power. I will return to these concepts in the final sections of this chapter.

The next section discusses the idea of "scientific literacy," a concept that scientific organizations such as the National Science Foundation (NSF) have targeted in their investigations of the cultural authority of science in the public sphere.

Scientific Literacy and the "Deficit Model"

Much of what is known about the general public's dispositions toward science is intellectually rooted in Jon D. Miller's concept of "scientific literacy" (1983; 1992, 1998; 2001; 2004). This concept refers to a "cultural stock of knowledge" that includes: 1) knowledge of basic textbook science facts, 2) an understanding of scientific methods (e.g., experimental design and probability), 3) an appreciation of the social benefits that result from science and technology, and 4) the dismissal of superstition and folk mythologies such as astrology or numerology. Miller (2004) has also described scientific literacy as the ability to read and understand the science section of the *New York Times*, emphasizing the public's ability to make policy judgments related to science. Miller designed numerous surveys and scales to measure scientific literacy, many of which were incorporated into national public opinion surveys in the U.S. and U.K., and continue to appear in surveys all over the world. Generally, studies and reports using these items have suggested that the populations in the U.S. and Europe do not exhibit a high degree of scientific literacy; one estimate suggests that only 17% of the U.S. population is "scientifically literate" (Miller 2004). In the 1990s, the survey research agenda shifted away from scientific literacy and toward public attitudes (i.e., levels of trust in and favorability towards organized science); and this shift helped solidify a distinct quantitative PUS research program.

Since then, the concept and measurement of scientific literacy has become entangled in a fierce debate over the "deficit model," a controversy that has dominated the PUS program. The main thesis of the deficit model is that insufficient levels of scientific literacy leads individuals (or social groups) to revert to premodern or anti-modern worldviews; these worldviews are characterized by superstition, conspiracy, fear and even hostility toward scientists and organized science (see Holton 1993). Although numerous studies have found a weak relationship between scientific literacy and more favorable attitudes (Allum et al 2008; Evans and Durant 1995), the deficit model has elicited sharp criticism. The main objection has centered on the assumption that organized science offers inherently superior knowledge and that the public should politically comply with scientific/expert recommendations (Wynne 1991; 1995; Yearley 2000). Following Habermas, critics of survey research have claimed that categories such as expert/lay person or scientific knowledge/lay knowledge operate to depoliticize the public by differentiating actors in terms of superior or inferior knowledge. Consequently, critics have argued that survey research on scientific literacy and public trust has reinforced the idea that skepticism in the lay public is tantamount to "misunderstanding" science and irrationality.

A Bourdieuian interpretation of scientific literacy is that it measures cultural dispositions or orientations toward science and a special type of cultural capital (Bourdieu 1984). From this perspective, textbook knowledge of science and favorable attitudes represent unique cultural experiences and forms of cultivation. This "science habitus" would emerge from exposure to "popular science" (e.g., college courses, popular science magazines, science museums, NOVA), which often presents simplified and professionally idealized representations of scientific work and its benefits. In sum, scientific literacy likely has little connection to "doing" science, but with performing cultural competence in a socially valued practice of science, yet, the latter may have profound social consequences. I explore this idea further below, but first I briefly address how sociologists have theorized relations between science and Publics-in-General.

Science in the Lifeworld: Habermas and Giddens

Outside of STS and PUS, contemporary sociological theory has addressed science and technology in the public sphere. In particular, science and expertise play a prominent role in the theories of Habermas and Giddens (see also Beck 1992). To use Harbermas' terms, both theorists describe the ways in which the cultural authority of science in the system (institutional domain) is reproduced in the lifeworld (everyday experiences). Yet, each theorist emphasizes different aspects of this relationship: Habermas stresses the depoliticizing and alienating force of science as an ideology. Giddens, in contrast, illuminates the social psychological effects "the susceptibility of most aspects of social activity, and material relations with nature, to chronic revision in the light of new information or knowledge" (Giddens 1991:20). Nonetheless, each theorist is germane to the present discussion, because they articulate the potential consequences of scientific authority in the public sphere.

In *Technology and Science as "Ideology"* (1989), Habermas contends that the "science ideology" emerged in the wake of the failed laissez-faire ideology and was used to politically justify interventionist policies into the economy and broader society (e.g., the New Deal). Habermas charged that the science ideology enabled government bureaucrats and technocrats to claim authority over social activities that were once in the hands of private citizens and markets. This meant that public trust in technocratic authority—experts who advised democratically elected officials but who were not themselves elected—rendered the political engagement of the public outmoded and even detrimental to the social system. To summarize the critique, if technocrats and experts could claim superior knowledge, this implied a public "deficit" of knowledge. This, in turn, suggested that public opinion and democratic processes are only "rational" when participants posses knowledge. Consequently, the science ideology that Habermas envisions undermines democratic values and public engagement in the political sphere.

Unfortunately, Habermas never articulates the form that the science ideology would take apart from a general and amorphous "faith" in scientific and technological progress. However, it seems to boil down to trust in expert decisions and rational authority as opposed to the economic rationality of individuals. That is, science ideology implies confidence in the rationality of bureaucratic systems to make decisions, especially, expert systems arranged based on stocks of specialized knowledge (see also Giddens 1992). Thus, Habermas' account leaves a strong impression that public dispositions toward science are fundamental to the legitimacy of modern society, but also leaves open the possibility that multiple dispositions toward science might emerge and compete in the context of a legitimacy crisis. A Bourdieuian analysis would interrogate the cultural form of the science ideology and its translation into particular dispositions toward science (i.e., habitus). Therefore, a Bourdieuian analysis of public dispositions would also necessitate a broader conceptualization with multiple components, including trust in experts, scientific credentialing and socialization, and an interactional competence relating to science. And, like artistic and literary fields, the scientific form of cultural capital need not translate into contributory expertise—the ability to perform art, scientific analysis, or literary feats—but the ability to articulate a taste and proficiency for this cultural form (see Collins and Evans 2007).

Habermas also failed to recognize that market fundamentalism (i.e., economic rationality) would reemerge in the 1980s during the "Reagan revolution" and exist alongside and often in opposition to the science ideology. This conflict would be rooted in competing beliefs and values about "rationality" – technocratic authority and expertise vs. authority of markets and entrepreneurs. Along these lines, Hofstadter (1970, 1965) placed the ideological conflict between technocratic rationality vs. market rationality at the center of politics in the U.S., a thesis that has received little attention among social scientists. In short, Habermas recognized the consequences that the cultural authority of science may have on the public sphere, but failed to elucidate the form public dispositions would take, leaving room for the type of analysis proposed here.

Giddens provides a more concrete picture of the cultural forms that scientific authority would produce in the public sphere, drawing a sharp contrast between scientific and traditional worldviews (Giddens 1991:28). Because scientific knowledge and expertise is constantly subject to revision and fallibility, Giddens concludes that scientific rationality engenders high levels of doubt, skepticism, and uncertainty about the future. At the same time, Giddens proposes that trust in scientific expertise is essential to psychological security in late modernity. This is because the public possesses "limited technical knowledge" but is exposed to high-consequence risk—publicized catastrophes that no person on the globe could escape (e.g., oil spills, nuclear war, financial crises, pandemics, climate change). In this context, the public's faith that experts have the requisite knowledge to manage these risks becomes a collective defense mechanism. In short, Giddens envisions cultural landscapes saturated with latent existential anxiety, uncertainty and risks that public faith in science and expertise helps to contain.

Most importantly, Habermas and Giddens reinforce the basic Bourdieuian premise at the core of this chapter: *because scientific rationality is fundamental to the institutional arrangement of modern social systems, some public dispositions toward science are likely to be culturally valued over others, providing individuals and groups who possess those valued dispositions symbolic power over other groups*. Yet, neither Giddens nor Habermas articulate how the science ideology translates into observable dispositions toward science in the public, although each assumes these dispositions are fundamental. Analyzing the consequences of this basic premise involves not only theoretically developing the concept of *public dispositions toward science,* but also developing empirical instruments to measure them. The next section utilizes Bourdieu's main theoretical tools—habitus and capital—to theoretically reorient the PUS program in the direction of public dispositions and their consequences.

A Theoretical Reorientation

In Bourdieu's body of work, habitus and capital represent "thinking tools" that allow the researcher to "step back" from a problem and reorient it. As argued above, STS has made little progress in analyzing Publics-in-General beyond the relationship between scientific literacy and attitudes toward science.[3] Consequently, the study of Publics-in-General is in need of a significant reformulation and theoretical reorientation. Throughout his career, Bourdieu eschewed dichotomies and was especially critical of categories like deductive/inductive or empirical/theoretical that areoften employed in social science research. Instead, he argued for "orienting concepts" that ground empirical analysis and facilitate the exploration of complex and often obscured forms of authority and power. Although unconventional, this section follows Bourdieu's approach by mixing theoretical and conceptual discussions with data analysis.

As mentioned, Bourdieu's theory of practice is composed of two fundamental concepts: habitus and cultural capital. Bourdieu used habitus to describe dispositions or "strategies" that are generative of particular attitudes, practices, beliefs, behaviors, and competencies (Bourdieu 1984). To put another way, habitus is the embodied and unconscious product of socialization and inculcation that engenders group-like qualities among those sharing particular dispositions. Bourdieu's major insight, here, is to recognize that social cleavages can emerge absent volition and collective awareness.

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[3] To oversimplify somewhat, there appear to be two critical postures toward Publics-in-General in STS: a more radical deconstruction on one hand, and a more focused critique of the "deficit model" on the other. The former argues that Publics-in-General are largely abstractions, created by researchers and scientists for their own purposes and, thus; survey research on public understanding is unfounded. The latter argues that research on Publics-in-General has been crude and atheoretical. The second critique is largely supported by the inflexibility of survey research on public dispositions toward science. The first critique, meanwhile, is mired in metaphysical and ontological claims about what constitutes "real" social phenomena and thus is beyond the scope of this chapter and the larger dissertation.

Habitus, therefore, liberates the concept of "social class" from its material constraints so that it can take purely cultural forms. Public dispositions toward science are excellent examples of this type of formation, because individuals and groups do not consciously mobilize in relation their "understanding" of science, but rather, because "science" is valued in the larger social system (mainly in economic and governments organizations). In this context, the term science habitus refers to a privileged disposition towards science among numerous, and possibly, competing dispositions toward science. Thus, dispositions toward science have consequence in everyday life because they shape our understandings of the world around us, our social values, the types of interactions and knowledge we view as legitimate, and our experiences of institutions such as education, politics, and the economy.

However, the concept of habitus is incomplete absent the concept of "cultural capital." Bourdieu argues that habitus generates observable social consequences because it translates into social resources, often symbolic, that can be exchanged for various other kinds of resources such as financial capital, educational capital, and most notably, authority and power (see Moore 2008). Thus, Bourdieu does not suggest that habitus can be measured directly but instead uses the concept of cultural capital to represent the accumulation of social resources valued in a field. Likewise, s*cientific cultural capital* describes a type of cultural capital and specifically those social resources related to science such as trust in organized science, basic knowledge of textbook scientific facts, and participation in college science courses. Altogether, science habitus and scientific cultural capital are familiar to sociologists and yet unique theoretical tools for analyzing public dispositions toward science as well as for examining the conflicts and struggles that underlie the cultural authority of science in the public sphere.[4]

ANALYSIS

Particularly in *Distinction*, Bourdieu used survey data to identify habitus and cultural capital. Bourdieu's data consisted of life-style questions related to leisure practices. Using these data, he identified what kinds of social activities and preferences "went together" and using a technique similar to factor analysis developed a measure of cultural capital based on numerous elements such as attending opera, literary habits and tastes, and artistic preferences. He then examined how cultural capital was associated with fundamental economic and political categories such as occupation, party identification, and political ideology. Fortunately, the NSF has regularly collected nationally representative surveys of public activities and attitudes about science including general trust in science, textbook knowledge of science, and participation in college science courses since the 1970s.

Based on Bourdieu's various statements about habitus and cultural capital, reorienting these data to measure science habitus and scientific cultural capital requires two minimum empirical justifications:

1. Favorable attitudes toward science, knowledge of science, and college science courses are interrelated: they "go together" to represent scientific cultural capital.
2. Scientific cultural capital corresponds with other dimensions of social class and power (e.g., education, family income, socio-economic status, etc).

[4] To clarify, scientific cultural capital need not be contributory knowledge of the type scientists in university laboratories would possess, but a general cultural competency.

The first criterion can be confirmed using a factor analysis to examine whether various measures of scientific practices, knowledge, and attitudes correspond with a single concept. Table 1 shows a factor analysis of the relevant science items using data from the 2006-2008 *Science Indicators Survey.* [5] This analysis indicates a strong relationship between favorable attitudes toward science (general attitudes scale), textbook knowledge of science (Oxford scale), self-reported knowledge of science, and the number of science courses taken in college.[6] Consistent with the conventional criteria of retaining only factors with eigenvalues greater than 1, the factor analysis results in a one factor solution (Factor I. in Table 1). This single factor explains approximately 91% of the variance, suggesting a strong relationship among the four items. The factor analysis shown in Table 1 provides adequate evidence for the first justification that the science variables interrelate and can be used to measure scientific cultural capital.[7]

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[5] The data for this analysis come from the 2006-2008 General Social Survey (GSS) a nationally representative sample of non-institutionalized adults age 18 and older that is selected using multistage probability sampling. The GSS is funded by the NSF and conducted biannually by the National Opinion Research Center. The 2006 GSS survey is unique in that it incorporates for the first time many of the items from the NSF's *Science Indicators Survey* as a special module in the GSS. Because the *Science Indicators* is nested within the GSS, it has many advantages over previous versions and includes extensive demographic, economic, cultural variables along with comprehensive coverage of science-related issues.
[6] The first two items used in the factor analysis are well-established measures. The general attitude scale contains four questions such as asking about whether "science changes life too fast;" "is beneficial or harmful;" "scientific research should be supported by the government;"and "science is too speculative and theoretical." The Oxford scale was developed by Miller in the late 1970s to measure the "general textbook knowledge" component of scientific literacy. The other two items measure other aspects of an orientation toward science. Self-reported knowledge of science and technology relates to one's confidence in their cultural competence in "science." College science courses measure participation in activities related to science and the acquisition of professional scientists' viewpoints on what constitutes science.
[7] The scientific cultural capital variable was created using the four items in Table 1. Each of the items were first standardized and then combined into a scale using the ALPHA command in STATA. The summative score is divided by the number of items over which the sum is calculated. Cases were deleted if more than one item was missing. The identification of habitus and capital employed here are somewhat different from those Bourdieu outlines in *Distinction,* but the factor analysis described above produces very similar results (see Crossley 2008).

-- Table 1 and 2 about here –

The second justification, the idea that scientific cultural capital should correspond with conventional measures of social class, can also be straightforwardly tested. Table 2 shows the associations between scientific cultural capital and various approximations of social class. The first column shows the bivariate correlations between scientific cultural capital and various measures of social class; the second column shows these associations after controlling for education—measured in years of schooling and highest degree. The positive associations in the first column (bivariate correlations) are statistically significant and indicate that scientific cultural capital is related to other dimensions of social class.[8] Not surprisingly, the strongest associations are between scientific cultural capital and education. The second column also indicates an association between scientific cultural capital and the various dimensions of social class even after controlling for education. These associations indicate that scientific cultural capital has a positive relationship with each dimension of social class independently of education. According to Bourdieu's discussions of habitus and cultural capital, these moderate relationships would indicate that scientific cultural capital corresponds with other dimensions of social class but is also distinctive (a semi-autonomous field). Moreover, Bourdieu would suggest that the relatively strong relationship between education and scientific cultural capital signifies that formal education is the social resource most easily exchanged for scientific cultural capital (and vice versa).

[8] A one-way analysis of variance shows that there are statistically significant differences in levels scientific cultural capital when individuals are grouped according to self-identified social class. Similar results are found when individuals are grouped according to "highest degree earned." As might be expected, the groups divided on highest degree account for a far greater proportion of the variance in scientific cultural capital.

The idea that the *Science Indicators Survey* instruments (and their interrelatedness) represent science habitus constitutes a significant theoretical reorientation of these data. Yet, as discussed above, the use of survey instruments to measure public understanding of science is mired in controversy. Many STS scholars have questioned how scientific literacy instruments should be interpreted (see Wynne 1995). As mentioned, these concerns with the scientific literacy concept are most often associated with the "deficit model." The controversy over the scientific literacy concept boils down to two primary concerns.

First, survey researchers rarely clarify exactly what kind of knowledge their instruments measure. Is it (1) privileged knowledge of the facts? (2) Is it practical knowledge that allows non-experts to understand science debates? (3) Or, is it culturally privileged knowledge that is valuable because scientific rationality is valued in modern institutions? The science literacy concept presumes either the first or second interpretation of knowledge and thus seems to imply that survey instruments measure knowledge of the "truth." For most STS scholars, this position is untenable. In contrast, the idea of science habitus assumes the third type of knowledge: privileged cultural knowledge that is significant because it reflects the norms and values of powerful actors and institutions in society.

The second concern raised in opposition to the scientific literacy concept is that it presumes that public ignorance of textbook scientific knowledge engenders public distrust in organized science. The science habitus concept (i.e., public dispositions), again, reorients textbook scientific knowledge and favorable attitudes toward science to represent measures of the same concept: a culturally privileged disposition toward science. The achievement here is to provide an analytical framework for studying the dispositions of Publics-in-General while overcoming the pitfalls STS scholars have associated with scientific literacy.

Alternatively, a Bourdieuian framework has its own assumptions that are best laid bare (Harraway 1999). First, the concept of science habitus assumes that dispositions toward science represent an increasingly important dimension of social class/power that sociologists have yet to fully appreciate and inspect. STS has already established the importance of organized science at the institutional level (the field of power). The argument put forward here is that the value of science in the popular culture (the popular science field) is a reflection of this "system level" authority. This is consistent with Bourdieu's basic assumption that social fields are homologous—all cultural fields are similar because each field ostensibly represents a struggle for power and resources. He writes:

...a structured social space, a field of forces, a force field. It contains people who dominate and people who are dominated. Constant, permanent relationships of inequality operate inside this space, which at the same time becomes a space in with various actors struggle for the transformation of preservation of the field. All the individuals in this universe bring to the competition all the (relative) power at their disposal. It is this power than defines their positions in the field and, as a result, their strategies (Bourdieu 1998:40-41).

In other words, social fields are stratified and positions are distinguished based on the accumulation of resources (capital) particular to a field: for example, in the education field dominant or powerful actors are likely to possess various credentials as well as cultural capital. Additionally, there are exchanges between social fields, making them interdependent and semi-autonomous social spaces. For example, the acquisition of scientific cultural capital may yield benefits in the economic field in the form of higher paying and more autonomous jobs. Furthermore, social fields are contained within a broader social field, the field of power, so that each cultural field does not wield equal influence, some are dominant and others are subordinate. Bourdieu particularly emphasizes the dominance of the economic field over most cultural fields like art or music. These ideas have clear implications for the cultural authority of science in everyday life. If scientific rationality and knowledge are "dominant" or valued among powerful institutions (the field of power), then those with positive dispositions toward organized science would likely hold a dominant position. In this way, the distribution of scientific cultural capital would represent a dimension of social class/power as long as scientific rationality was central to the legitimacy of powerful institutions and networks. Moreover, the distribution of scientific cultural capital would reflect the inequalities in the broader society.

Building on this last point, the idea that science habitus and scientific cultural capital are indicators of social class also represents a key shift away from the deficit model. In short, the idea of scientific literacy offers a fairly unsophisticated view of the public as unenlightened without considering the individual motivations and social factors that produce "literacy" or "illiteracy." Approaching public trust and knowledge as a habitus emphasizes how cultural experiences and access to capital (both symbolic and material) produce enduring dispositions and social locations. Possession of scientific cultural capital is, therefore, a complex and manifold phenomenon that relates to various social fields, institutional forces, and individual biographies.

One endpoint of the analysis of the popular science field would look something like Figures 1 and 2.[9] These figures show how scientific cultural capital corresponds with economic position in the form of occupation and political identifications in the form of party identification and political ideology. Again, the dataset used to generate these figures come from the 2006-2008 *Science Indicators Survey* and closely resemble figures presented in Bourdieu's *Distinction* (1984) and later works. To represent a social space or field, Bourdieu used three dimensions: overall social status or volume of capital, income or economic capital, and cultural capital. Similarly, Figures 1 and 2 present three variables: socio-economic status (volume of capital), family income (economic capital), and scientific cultural capital. I will forgo a technical discussion of how these figures were derived and focus on how they represent a social field (see footnote 8 for basic method). The vertical axes in Figures 1 and 2 represent a group's average socio-economic status, total rank in society, or total volume of capital across all social fields. Groups in the lower part of the figures have below average volumes of capital (low rank) and those in the upper part possess higher volumes of capital (higher rank). The horizontal axis indicates the composition of a group's capital: whether they possess more (or less) financial capital (family income) relative to scientific cultural capital. Thus, the left side of the graph indicates that most of a group's social resources are in financial form; and the right side indicates that most of their resources take the form of scientific cultural capital. In terms of the four quadrants of the social field, the upper left quadrant

[9] Figures 1 and 2 were created using group means for each category. For example, Fgure 1 is organized according to occupation and the location on the graph represents the mean scores for a particular occupation on each of the variables. The Y-axis is the Duncan Socio-Economic Status index and the X-axis is the difference between family income and scientific cultural capital (see footnote 3). For the X-axis, each variable was standardized, then the difference was computed, and finally, a mean score was computed for each group.

represents high volume/low scientific cultural capital; the upper right quadrant represents high volume/high scientific cultural capital; the lower left quadrant represents low volume/low scientific cultural capital; and the lower right quadrant represents low volume/high scientific capital.

-- Figure 1 about here --

Figure 1 shows individuals grouped by occupation and describes the locations of different occupations in the popular science field.[10] In the top right quadrant of Figure 1 are the "technocratic elite," a group of occupations that include medical specialists, natural scientists, engineers, computer scientists, postsecondary teachers, and social scientists. This group has high overall status in the U.S. and higher levels of scientific cultural capital relative to financial capital (although scientific cultural capital varies considerably among this group of occupations). Additionally, the technocratic elite roughly correspond to the organized science subfield, although other occupations would likely be included such as lab technicians and other research specialists. The "business elite" or upper management occupations (indicated by a dotted border) are located in the upper-left hand quadrant. This group has a high volume of capital and high levels of financial capital relative to scientific cultural capital. Below the business elite are the "middle management" occupations that include various types of lower level supervisors and professionals. Similar to the business elite, most of the middle management's resources take the form of financial capital. Below the middle management group are

[10] Bourdieu groups individuals into occupations to simplify the graphs. Yet, there is an important empirical question here. How much are individuals shaped by their individual dispositions toward science or by the dispositions of the groups they belong to, for example, occupational groups? Although this question is beyond the scope of this chapter, future chapter examine this question in more detail.

"production workers." This grouping has lower volumes of capital (these occupations fall below the horizontal axis) and diverse capital composition. On the left side of the vertical axis are manual labor intensive and crafts occupations, including mechanics, farmer operators, and precision production. The right side of vertical axis contains mostly low-paying service occupations (lower right quadrant).

Altogether, Figure 1 provides a cursory picture of the popular science field and identifies various key social locations in the field. Using Bourdieu's terminology, Figure 1 depicts the popular science field *vis-à-vis* field of power (volume of capital). There are a number of discernable patterns worth noting. First, there are ostensibly two elite groups in the U.S., the technocratic elite and the business elite. The technocratic elite possess high concentrations of scientific cultural capital and represent a little less than 5% of the adult working population. The business elite have their holdings in financial capital and this group represents about 7% of the adult working population.[11] Figure 1 shows that the socio-cultural distance between these two high status groups is substantial. Table 3 provides a similar picture and shows the capital compositions of a number of elite occupational groups. Each elite group has some indicator of status, but their compositions vary predictably. Scientists and engineers show a greater proclivity for science compared to public or private executives and managers. However, private executives and upper

[11] The occupations shown in the figure are somewhat broader than the 1980 Census Occupations codes available in the GSS. I collapsed some of the categories based on the IPUMS USA groupings in order to reduce the total number of occupations and to increase the number of individuals in each occupation (see IPUMS 2009). Given that Figure 1 shows the results for larger occupational groupings, it is important to note that the category "Executive, Administrative, and Managerial Occupations" contains both private and public sector jobs. Intuitively, the financial elite would represent only private sector workers. I report these differences in Table 3 and the relative frequencies reported here reflect only the private sector workers.

management have higher incomes. According to Bourdieu, these types of cultural distances are likely to influence other social fields, especially the political field.

-- Table 3 about here --

This cultural distance becomes clearer when examining Figure 2. This figure is nearly identical to Figure 1 but instead individuals are grouped according to political ideology and party identification. Because these groups are much larger and more diverse than occupations, there is less variation between the political groups in terms of socio-economic status (volume of capital), so the scale of the vertical axis is smaller than in Figure 1 (the scale of the horizontal axis is nearly identical to Figure 1). In general, political parties tend to vary according to capital volume (SES) whereas political ideology tends to vary according to capital composition. Looking first at political ideology, notice that self-identified liberals fall mostly in the upper right quadrant. This suggests that "liberals" tend to have higher than average levels of overall social standing (capital volume) as well as higher levels of scientific cultural capital relative to financial capital. Those who identify as "extremely liberal" have the lowest social status, yet, their status is highly concentrated in scientific cultural capital. On the other hand, those identifying as conservative have most of their capital in financial form (on the left side of the figure) and their levels of social status are more diverse than liberals. Those identifying as "extremely conservative" have below average social standing while those identifying as "slightly conservative" and "conservative" have above average standing. Interestingly, those identifying as "extremely conservative" and "moderate" are very similar in terms of the type of capital they posses and their capital volume. In summary, Figure 2 shows that in the U.S. capital composition, whether you posses most of your social standing in scientific cultural capital or financial capital, corresponds with different political ideologies. Those identifying as conservative having more of their social status tied to financial capital relative to scientific cultural capital and those identifying as liberals have more of their status tied to scientific cultural capital. Figure 2 also provides baseline confirmation of Habermas' basic observation that there is an essential relationship between dispositions toward science in the general public and political ideology. Thus, one interpretation is that "liberals" posses much greater faith in "technocratic" authority and the rationality of expert systems than conservatives. Overall, the cultural distance between dispositions toward science is clearly associated with divergent political worldviews.

-- Figure 2 about here --

When grouped by political party, all major parties trend towards the center and left side of the figure. Although party identification is far from a perfect indicator of political power, the location of various political parties has important implications for what kind of views are being represented in the electoral process. First, according to Figure 2 the Republican Party tends to represent the financial elite: those above the horizontal line and on the left side of the vertical line. On the other hand, the Democratic Party represents the middle of the field—those groups who have average or slightly below average social standing and trend slightly toward scientific cultural capital on the horizontal axis. Surprisingly, those who identify as pure "independents" (the largest party identification group representing roughly 20% of the adult population in the U.S.) have very low social standing relative to the other groups. Moreover, those identifying as "independent" have no tendency toward either financial or scientific cultural capital.

Altogether, Figure 2 indicates that the mainstream political parties in the U.S. appeal to those groups with higher shares of financial capital relative to scientific cultural capital and those with average or above average social standing. Independents appear alienated from all political parties as are extreme liberals, extreme conservatives, and moderates. Interestingly, the "technocratic" elite and "liberals"—those with high socio-economic status and high concentrations of science capital—are not represented by the major political parties to the same degree as the financial elite.

The distribution of political groups based on scientific cultural capital and financial capital may also account for the perceived politicization of science (Mooney 2009). One interpretation of Figure 2 is that for many Americans scientific cultural capital is strongly associated with left leaning political views. So, the public cognitively attaches the various sides of science controversies with political ideology and then position themselves on these issues based on their own political dispositions. For example, climate change in the popular science field might be associated with Al Gore and the Democratic Party, and thus, becomes connected with individual's political affiliations. Alternatively, dispositions toward science maybe inextricably tied to political ideology, which returns us to the questions raised above relating to the cultural conflict between technocratic rationality and economic rationality and their ancillary ideologies. Consequently, future chapters will explore the politicization of science in greater detail. I examine the relationship between dispositions toward science and political identifications in the U.S. over time to see if the politicization of science is increasing or decreasing in the public sphere. Future research should examine the potentially deep-rooted cultural conflict over public dispositions toward "free markets" and dispositions toward organized science. Additionally, research could compare political structures by examining the association between political parties and ideology and dispositions toward science cross-nationally.

To summarize, Figure 1 describes the basic economic scaffolding of the cultural authority of science by showing the capital volume and capital compositions of various occupational groups. Figure 2 provides a more robust picture of how scientific cultural capital and science habitus are associated with ideology and the ways different groups see the social world. This analysis demonstrates that Bourdieu's primary "thinking tools" – habitus and capital – provide an effective and distinctive system for studying the reproduction of the cultural authority of science in the public sphere.

Discussion and Conclusion: Science Habitus vs. Scientific Literacy

This chapter theoretically reorients the PUS research program by drawing on the work of Pierre Bourdieu and developing the concepts of science habitus and scientific cultural capital. The former describes dispositions toward science in the Public-in-General that potentially compete and conflict with one another. The latter constitutes a concrete and observable consequence of these dispositions that confer symbolic power to those who posses it. Together, science habitus and scientific cultural capital explicitly orient the study of public dispositions toward science in the direction of social inequality, political conflict, and cultural authority. That is, possession of scientific cultural capital corresponds with various forms of social standing, economic class, and political ideology, producing discrete social positions within the Public-in-General. Yet, it is worth noting that a Bourdieian analysis of habitus and capital is not reducible to simple high/low continuum (e.g., high scientific cultural capital vs. low scientific cultural capital). That is, understanding of the world. Furthermore, this group would likely have more critical views of technocratic authority and adhere more to the "free market" ideology than their cultural elite counterparts. These ideas are also appear consistent with Bourdieu's discussions of cultural fields as well as with the current political landscape of the U.S.

Finally, on the dimension of capital volume, there is likely a disposition towards science that relates to what Bourdieu calls "conditions of existence." Here Bourdieu means that dispositions are shaped by an agent's relative distance from material necessity, with those possessing meager stocks of capital being nearer to its demands and urgencies (Atkinson 2010; Bourdieu 1990, 2000). This social location is likely alienated from all abstract systems, and is likely particularly alienated from technocratic elites and expert authority. As Giddens (1991:137) observes: "Alienating, because the intrusion of abstract systems, especially experts systems, into all aspects of day-to-day life undermines pre-existing forms of local control." That is, Bourdieu and Giddens echoe a longstanding thesis that subordinated groups, with little symbolic or material power, wholeheartedly reject symbolic power because it weakens their locus of power by devaluing, deconstructing and disenchanting the mundane. Moreover, this location adapts to their lack of capital by making a "virtue of necessity" and, in turn, devaluing intangible and symbolic cultural forms, including scientific and expert knowledge, as irrelevant to immediate lived experiences. In terms of Figures 1 and 2, these dispositions would correspond roughly with the upper right, upper left, and lower middle portions, respectively.

Overall, the framework outlined above provides a baseline interpretive framework that will guide this dissertation: what kinds of research questions I will examine and the broader context in which I will view the results. Although theoretical work like this is often superfluous in fields of study more developed and less contested, the PUS program is still formulating theoretical perspectives that will drive future research. Thus, the especially weak theory driving survey research on public dispositions toward science made this exposition necessary. Additionally, subsequent chapters will use the terminology developed here, particularly public dispositions toward science, science habitus, and scientific cultural capital, although, not every chapter will center on these ideas or use the exact instruments developed here. In some sense, the PUS program was in need of a reboot in order to clear the way for the theoretical assumptions that motivate this dissertation research. And, I contend that the perspective outlined here is a genuinely novel way to look at the relationship between science and the public.

Table 1. Iterated Principle Factors for Scientific Cultural Capital Measure, N=1747

Item	F.I	F.II	Commonality
General Attitude Scale	.546	-.243	.356
Oxford Scale (Textbook Knowledge)	.757	-.060	.576
Number of College Science Courses	.483	.138	.252
How informed about Science and Technology	.494	.224	.294
Eigenvalue (λ)	1.348	.132	
% Explained Variance	91.09%	8.91%	

Table 2. Associations between Scientific Cultural Capital and Various Proxies of Social Class

	Bivariate	
Standardized		
Dimension	Correlation	
Coefficients		
Socio-Economic Status	0.463*	0.187*
Occupational Prestige	0.409*	0.166*
Family Income	0.305*	0.156*
Individual Income	0.264*	0.138*
Education (yrs.)	0.588*	_
Highest Degree	0.577*	_

Note: *XY*-Standardized Coefficients reported in the second column show associations after controlling for Education (yrs).
* $p < .001$

Table 3. Capital Composition by Elite Occupation

Indicators	Engineers & Natural Scientists	Teachers Postsecondary	Public Exec./Man.	Private Exec/Man.
General Attitude Scale (favorable)	.168	.131	.328	.203
Textbook Knowledge	.245	.167	.002	.140
College Classes	12.297	3.724	2.800	2.762
Scientifically Informed	4.195	3.478	3.727	3.524
Income (real dollars)	48705.80	38320.80	53971.70	55863.80
% Top Income Decile	22%	11%	23%	38%
% 99^{th} Percentile of Income	8%	4%	10%	16%

Note: General Attitude Scale, Textbook Knowledge, Scientifically Informed, College Classes, and Income compare means for different groups.

Figure 1 Popular Science Field by Occupation

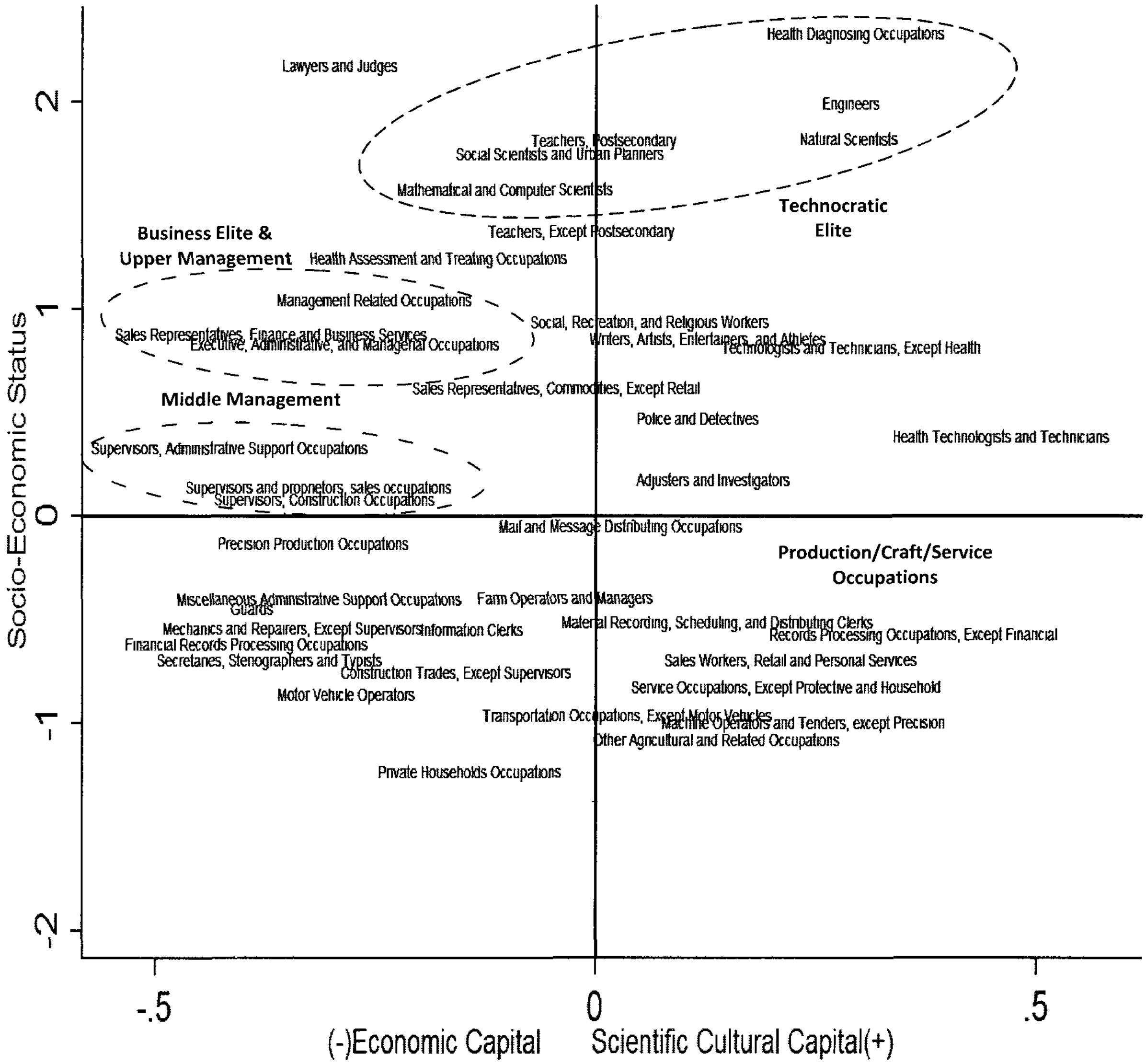
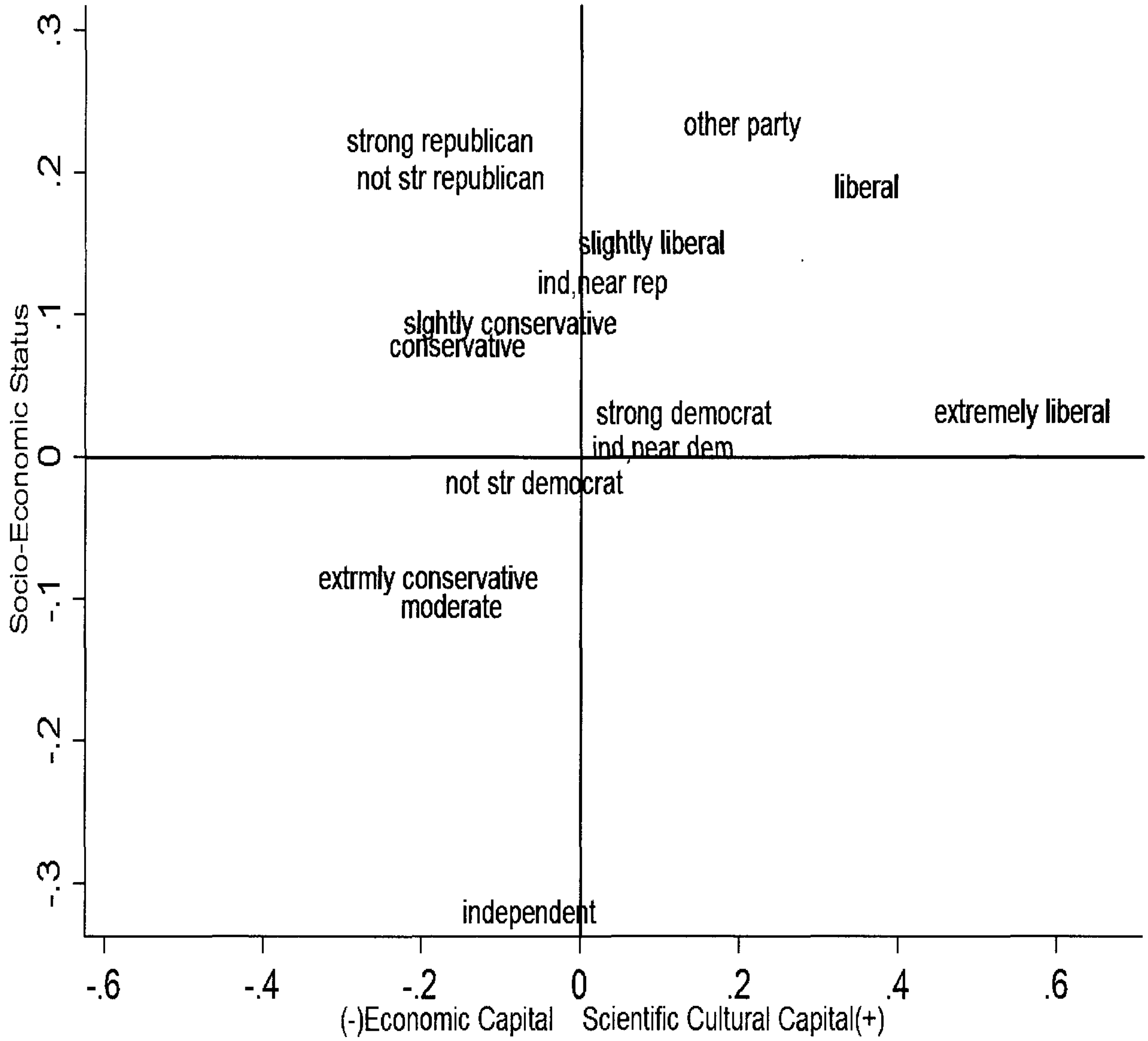


Figure 2. Popular Science Field by Ideology and Party



CHAPTER 3: THE POLITICIZATION OF SCIENCE IN THE U.S., 1974-2008

INTRODUCTION

In the first months of his presidency, Barack Obama addressed the National Academy of Sciences to speak about U.S. science policy and a renewed commitment to fund scientific research. In this speech he charged: "We have watched as scientific integrity has been undermined and scientific research politicized in an effort to advance predetermined ideological agendas" (White House 2010). Along with the executive order lifting the ban on stem cell research, President Obama's speech was intended to reassure the "scientific community" and present a clear indictment of the previous administration under George W. Bush. The Bush presidency was widely seen as "unfriendly" toward the scientific community due to a range of controversies including the stem cell research ban, climate change policy, the theory of natural selection, and the Endangered Species Act (Union of Concerned Scientists 2008).

The perceived "politicization" of science during the Bush administration awakens an enduring problem in Science and Technology Studies (STS) concerning the relationship between politics and science. On the one hand, STS has established that science and politics are inseparable (Cozzens and Woodhouse 1995). More precisely, STS research has shown that scientific knowledge embodies the interests of various actors and social institutions including scientists, departments, professional organizations, universities, funding agencies, and governments (Barnes 1977; Bloor 1976), and that social actors construct the objectivity of scientific knowledge, and thus its credibility, through social processes and negotiations (Gieryn 1999; Knorr Cetina 1983; Latour and Woolgar 1979). The political interests of social actors and powerful funding organizations are, therefore, assumed part and parcel of the production of scientific knowledge. Simply put, *science has always been politicized.* Yet, unsettled questions remain about the "politicization of science" including the dynamics of public opinion across political parties and ideologies. That is, research has yet to approach the politicization of science in the public sphere or how the political legitimacy of science might influence the production of scientific knowledge. This chapter addresses this gap and examines differences and changes in public trust toward the scientific community by political party and ideology as well as changes during particular social movements and cultural shifts. This chapter explores three distinct theories related to public trust in science. These theories are discussed below.

THEORIES OF CHANGE

There are three general perspectives on public trust in science that translate into specific propositions about change over time. The *modernization thesis* begins with the idea that public trust in science is a key element of a "modern worldview" (expressed most concisely by Holton 1993; see also Miller 2004). This modern worldview accepts that scientific rationality and rational-legal authority are the cornerstones of modern civilization and democracy (Parsons 1971; see also "deficit model" in Chapters 1 and 2).[1] Moreover, at the aggregate level, the portion of the public that embodies the modern worldview is assumed to indicate a general cultural movement towards a modern society.

[1] Critics of the "deficit model" have charged that it makes ideological assumptions about the "public" and "science" that are not confirmed in STS research. One of the most controversial assumptions is the idea that knowledge of science is necessary for responsible civic and political engagement in contemporary societies (see civic scientific literacy in Miller 1998; Shen 1975). Thus, the deficit model, which is often articulated as a straw man in the PUS literature, stands for the general idea that greater knowledge and trust in science is an endpoint and the underlying goal of "public science" and science education. And, the idea that public acceptance and trust in science is an essential element of a modern society.

Thus, industrial societies should exhibit higher rates of trust in science relative to industrializing or pre-industrial societies, which empirical studies confirm (Allum et al 2008; Inglehart 1997). Also assumed here is a long-term trend toward greater trust *within* industrial societies. Holton (1993) identifies numerous disjointed segments of society that are what he terms "anti-science," but argues that the general trend is toward greater faith in modernity and increased public faith in science. Evidence for expanding trust within the U.S. and other advanced democracies is far less straightforward. Some studies have shown increases in favorable attitudes toward science overtime in the U.S. (National Science Board 2008); other studies find mixed trends over time depending on the question item (Miller 2004). In the post World War II U.S., the modernization thesis implies an incremental increase in public confidence in organized science as larger numbers of citizens adopt the modern worldview.

The *alienation thesis* draws from critiques of the modernization thesis and is intellectually tied to the social theories of Habermas (1989), Giddens (1991) and Beck (1991). Contrary to the notion of modernization, which implies parallel increases in trust across segments of society; the alienation thesis points to a general discontent with modernity, what Habermas terms the *legitimacy crisis*. To summarize, knowledge economies, complex bureaucracies, and technological innovation require increased public dependence on experts. These technocratic elites—possessing the power to make truth claims—interpret social and cultural events, diagnose and manage risks, and recommend measures to sustain economic growth (Habermas 1989; Beck 1991). Yet, the public feels alienated from scientific experts and institutional authorities, because they directly experience the consequences of expert knowledge (i.e., the risk and uncertainty), but are detached from the deliberations of abstract systems such as "science" and "government." This (possibly growing) gap between the influence of expert systems and the capacity of the public to shape and control these systems engenders alienation. The alienation thesis can be translated into the basic proposition that distrust in science is a leading symptom of a broader legitimacy crisis; one that relates directly to cultural reservations about bureaucratic authority and expertise. Therefore, the alienation thesis implies an incremental decline in trust in science over time that is consistent across a majority of social groups.

The *politicization thesis* is a more nuanced approach to public trust in science that applies mostly to the postwar U.S. Mooney (2005) contends that after World War II there was an "innocent" period in which political parties and ideologies were neutral and even deferential to the scientific community. In the 1964 Goldwater presidential campaign, a "new right" began to form that was skeptical of scientific authority, the scientific community and the intellectual establishment in colleges and universities (see also Hofstadter 1970). The new right often linked with the "religious right," promoted limited government, strong national defense and the protection of traditional values against what were seen as the encroachments of a permissive and often chaotic modern society (Crawford 1980; Conover 1983; Jenkins and Shumate 1985). Mooney (2005) and others argue that the new right firmly seized control of the conservative identity during the election of President Reagan, eventually moving the Republican Party and mainstream public discourse to a more adversarial posture towards organized science. These arguments imply two potential cultural shifts in public trust in science. The first occurred as the result of the election of President Reagan in 1980 and the second shift was the result of the election of President George W. Bush in 2000.

There is some overlap between the politicization thesis and the alienation thesis, because both ideas point to a general decline in the credibility and legitimacy of science in the public. However, the difference is the mechanism driving the decline. For Mooney, the politicization of science has undermined the cultural authority of science by associating scientific claims with particular political viewpoints. To give an example, conservative leaders and politicians have labeled climate change as "junk science" or leftwing propaganda (Mooney 2005). Moreover, conservative "think tanks" such as the Heritage Foundation and the Project for a New American Century provide considerable resources and discursive power for conservative experts who will challenge organized science. Mooney argues that these political disputes diminish the credibility of science—which STS research has shown is socially constructed by large institutions such as political parties and government organizations. Mooney argues that when conservative leaders and intellectuals challenge prominent landmarks of the scientific community such as the National Science Foundation and National Science Board, science loses its perceived autonomy from party politics and ideology in the public sphere.[2] To put another way, this view posits that science has become politicized in the public view, because conservative activists and leaders have associated scientific claims and the scientific community with the leftist agenda. Mooney's claims echo those proposed by

[2] This is not to imply that the production of scientific knowledge is apolitical and objective, but rather that science's discursive credibility depends on institutional claims of objectivity and unbiased empirical evidence. Therefore, Mooney is arguing the more nuanced point that the cultural authority is undermined when powerful institutions publically challenge its "monopoly" on objective truth and superior knowledge.

the historian Richard Hofstadter in the 1960s. Hofstadter's (1970; 1964) thesis centered on the idea that the contemporary right-wing politics represents a mobilization of populist anger against cultural elites and technocrats. In Hofstadter's view, the contemporary right-wing challenges the cultural authority of science to score political points with dispossessed voters who feel alienated from the cultural elite, government, and scientific community.

To summarize, the politicization thesis argues that shifts in conservative values have led to group-specific distrust in science among conservatives that has grown over time. Moreover, changes in general public trust toward science since the 1970s have been driven by the cultural shift that accompanies the rise and growth of the new right. These cultural shifts roughly correspond to the post Reagan era (after 1980) and the Bush era (2001-2008). The perspectives discussed above imply distinct models of change, which are identified below.

MODELS OF CHANGE

The modernization thesis and alienation thesis each generally correspond to the "spirit of the times" model (House and Mason 1975; Weakliem and Borch 2006), which suggests that change over time would apply equally to all political groups. The modernization thesis predicts growing trust in science across all groups over time. In contrast, the alienation thesis predicts a uniform decline in trust in science among all groups. Period effects refer to associations that are constant over time and could represent either a broad cultural climate or reactions to specific events or social movements. One can also conceptualize period effects as the "average" effect of a group or characteristic over time. The model may be expressed as follows:

$$Y_{it} = \alpha_t + \beta\delta_i + e_{it} \qquad (1)$$

where the subscript t refers to time. In the models used in this analysis, α_t represents a separate dummy variable for each year to represent the period effects specific to a survey year. The variable δ_i is a dummy coded 1 if person i is a member of the group and 0 otherwise (e.g., a member of a political party). The above example uses only a single group effect, but any number could be added. The model may include numerical values as well as dummies. The term β represents group differences and does not vary over time.

The politicization thesis describes alternative models of change in which political groups exhibit group-specific changes over time. For example, consistent with previous scholarship, political conservatives in the U.S. may exhibit increasing alienation from science. Alternatively, liberals' trust in science may have grown relative to conservatives. Furthermore, shifts in the attitudes of conservatives and liberals may influence the political parties that each ideology corresponds with. These ideas imply a model of long-term shifts in patterns of trust in science among political groups. A simple model for gradual, long-term change in group differences is

$$Y_{it} = \alpha_t + \beta\delta_i + \eta t\delta_i + e_{it} \qquad (2)$$

where t is time in years since some starting date. The model also implies that the difference between group δ_i and the reference category at a give time will be $\beta + \eta t$. To put it another way, long-term group-specific changes can be expressed with a series of interaction effects between the relevant demographic or political group and time. Another model for a sudden change or "break" in socio-cultural climate may be expressed as

$$Y_{it} = \alpha_t + \beta\delta_i + \eta\tau\delta_i + e_{it} \qquad (3)$$

here τ is a dummy variable equal to 1 for all years beginning with the break date and 0 for all years before the break date. For example, the years after the election of President Reagan or after the election of George W. Bush may represent "cultural breaks" in which trust in science is diminished. Long-term and sudden shifts can occur together, so the multivariate models used in this chapter combine forms expressed in Eq. 2 and Eq. 3.

HYPOTHESES

The demographic characteristics examined in this chapter are gender, ethnicity, education, income, region, church attendance, cohort, and age. The modernization thesis does not preclude period effects (i.e., constant over time) for demographic characteristics nor does it predict the direction of these effects, only that there is uniform change toward greater confidence in science among all groups. The alienation thesis, however, implies enduring demographic differences as well as parallel change toward less trust in science. Previous research on alienation has shown that disenchantment with central institutions is generally higher among disadvantaged groups such as females, non-whites, and those with lower family incomes (Weakliem and Borch 2006). Research on attitudes towards science have found mixed results related to gender, ethnicity and socioeconomic status, with recent studies showing no relationship after controlling for other factors such as textbook scientific knowledge, education, and income (Hayes and Tariq 2000; Bak 2001; Sturgis and Allum 2004; Gauchat 2008; Gauchat 2010). These studies have also shown that education is a more robust predictor of trust in science, even after controlling for demographic and explanatory variables. Research on attitudes toward science has also shown a consistent relationship between religiosity and attitudes toward science (Ellison and Musick 1995; Hayes and Tariq 2000; Sturgis and Allum 2004; Gauchat 2008;

Gauchat 2010). The effects of age and cohort are less clear. Some studies have shown that that older individuals are less favorable toward science (Ellison and Musick 1995; Bak 2001; Sturgis and Allum 2004); while other studies have shown no effect for age (Hayes and Tariq 2000; Gauchat 2008; Gauchat 2010). Cohorts may be affected by what Elder (1999) calls *contextualism* or life course experiences that are shaped by historical, institutional, and cultural events. Those born in the 1960s, for example, became eligible to vote during the "Reagan Revolution," which may have deeply impacted their political outlooks as they entered political life (Elder 1999).

The politicization thesis implies that political group-specific changes will occur over time, but that demographic period effects will not vary with time. That is, changes in confidence in science since the 1970s are associated with changes in political ideology and party and not demographic shifts. Specifically, the politicization thesis suggests a divergence of confidence in science between conservatives and liberals, with conservatives moving away from liberals. Moreover, the politicization thesis is not incompatible with the idea that political ideology and party will show constant period effects. That is, it is also possible that political groups have different levels of trust in science throughout the period, but that these differences remain largely stable. For example, political groups like moderates and independents may have lower confidence in science than liberals and Democrats (see Chapter 2 Figure 2), but these attitudes maybe constant over the period. Thus, the politicization thesis translates into three main hypotheses: First, political groups will differ by levels of trust in science, with conservatives and moderates showing less trust than liberals, and Republicans and independents showing less trust than Democrats. Second, the differences among groups are growing over time, particularly between conservatives and liberals and between Republicans and Democrats. Third, public distrust in science is associated with two cultural shifts that occurred at the beginning of movement conservatism in the post Reagan era and during its intensification in the Bush era. Moreover, the latter hypothesis suggests not only a shift among conservatives, but a cultural break in the general public as movement conservatism transformed the public dialogue.

DATA AND MEASUREMENT

The data for this analysis comes from the General Social Survey (GSS), 1972-2008. The GSS has been administered annually between 1972 and 1994 (except 1979 and 1992) and bi-annually since 1994. This analysis uses a repeated cross-sectional sample for 26 years between 1974 and 2008 (some questions used in the analysis were not asked in 1972 and 1973). Additionally, the GSS uses a "split-ballot" design with ballots typically given to a random two-thirds of the sample, which allows the measurement of more trends within the allotted interview time. Even with these limitations, the final sample includes 29,544 cases. The advantage of the GSS is that it contains repeated measures of demographic characteristics and political party identification and political ideology over time, as well as questions relating to public confidence in the scientific community starting in the early 1970s.

Measurement of Trust in Science

"Confidence in Institutions" questions have appeared in the GSS since 1974. Respondents were asked the following question:

I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them [Scientific Community] (GSS 2010)?

They were then given the choice to respond "a great deal," "only some," or "hardly any" (they could also choose "don't know" or "refuse"). Over the 34 years of the GSS, 43.6% expressed a "great deal" of confidence in the scientific community, 49.3% responded "only some," and 7.1% expressed "hardly any." To simplify the analysis, this variable was recoded into a binary outcome comparing those with "a great deal" of confidence to those with "only some" and "hardly any." Although this item has its limitations (Smith 1981; Peterson 1985), it is the most frequently asked question relating to science in the GSS and the only repeated science item going back to 1974. Since 2002, the GSS has added a question about science as a "national spending priority," but this brief period is insufficient for looking at trends over time. The Harris Poll (Louis Harris and Associates 1966) contains a similar confidence in science item along with the relevant demographic and political variables going back to 1966, however, significant changes in the question wording over time make the Harris Poll less desirable (see Smith 1981).

Measurement of Independent Variables

To identify group-specific political changes in confidence in science, this analysis examines a number of political categories related to party identification and ideology. Political parties are categorized as "Republican," "Democrat," and "Independent." 1.2% of respondents identify with "other party;" this category was excluded from the analysis. Political ideologies are categorized as "conservative," "liberal," and "moderate." Respondents who did not identify with a political ideology were excluded from the multivariate analysis. A number of cultural break effects are considered in the analysis. The politicization thesis indicates that the conservative movement, starting with the presidency of Ronald Reagan and intensifying in the presidency of George W. Bush, has significantly damaged the legitimacy of science in the U.S. (Mooney 2005). A variable "post Reagan era" (1981-2008) is measured 1 for every year after the election of President Reagan and 0 otherwise. Additionally, a structural break variable was also created for the Bush era: coded 1 for every year of the Bush Administration (2001-2008) and 0 otherwise. Again, these variables may operate in the general public, indicating that the conservative movement has transformed the public dialogue, or; they may operate only for particular groups such as conservatives, which would suggest that conservatives moved away from the general public during these cultural breaks.

Demographic factors may mediate group-specific political trends, so, numerous demographic controls were also added. Gender is represented by a dummy variable for female. Ethnicity is represented by a dummy variable for non-whites. Education is measured in two ways because of its potentially strong interrelation with the political variables and confidence in science. First, education is represented by a count variable for years of schooling. Second, it is represented by three dummy variables: high school degree and Junior College; four-year college degree; and graduate training. Family income is measured in real dollars. However, 13.2% of the cases for this measure were missing. Given the large number of missing cases, the missing values for this measure are imputed based on regression estimates. The GSS has a code for all 9 U.S. Census divisions. Analysis of the GSS data shows lower levels of confidence in science in the four divisions in the Southern U.S., thus, a dummy variable is included for "South."

Religion may also factor into the relationship between politics and confidence in science (Gauchat 2008; Gauchat 2010). The strength of religious faith is measured by how often respondents attend religious services. Cohorts are measured using six dummy variables for those born before 1940, those born in 1940-1949, 1950-1959, 1960-1969 1970-1979, and 1980-1990. To distinguish between cohort and age effects, age is represented in years.

ANALYSIS

Aggregate Change

Figure 1 shows changes confidence in science over time by political ideology. Conservatives' confidence in science has clearly declined over the period: they begin the period with the highest levels of confidence and ended it with the lowest. The patterns for liberals and moderates are less definitive; however, liberals end the period with the highest levels of confidence among ideological groups due to consistently low levels of confidence among moderates and a decline among conservatives. Moderates' confidence in science appears to decline from 1974-1980, but after this period there is no discernable pattern for this group. One could summarize the changes by saying that moderates show the lowest levels of confidence among ideological groups for most of the period, that conservatives close the gap with moderates around the millennium, and that a large gap opens up between conservatives and liberals after the 1980s.

Figure 2 shows the changes in confidence in science over the period by political party. Although independents do not actually constitute a political party, they are treated as such here for the sake of comparison. Interestingly, Republicans report the highest confidence in science throughout the period, although there is a decline in confidence for this group. From 1974-1985 Democrats and independents show very similar levels of confidence in science. After the 1980s, Democrats and independents diverge, and Democrats show slightly greater confidence in science than independents by the end of the period. By the end of the period, Democrats and Republicans have converged. Among the groups, independents consistently show the lowest levels of confidence. In the period from 1990-2005, a slight break appeared between independents and both major parties. One possible explanation for these patterns is a movement of independents toward the Republican Party and away from Democratic Party, which has reduced Republicans' confidence in science but increased confidence among Democrats.

Overall, Figures 1 and 2 provide some superficial evidence for the politicization thesis. First, Figure 1 shows a clear decline among conservatives relative to other ideological groups. Second, Republicans show a slight decline. This is consistent with the idea that the politicization of science is rooted in changes among ideological conservatives, which, in turn, have influenced members of the Republican Party. However, further analysis is needed to corroborate these patterns before more definitive interpretations can be put forward.

Demographic Differences and Constant Period Effect

Table 1 shows the parameter estimates from the logistic regression models for the confidence in science measure on the independent variables discussed above. The results represent the "spirit of the times" model (House and Mason 1975; Weakliem and Borch 2006), in which the effects of the independent variables are constant over the period. Dummy variables for each year are also specified in the model, but these estimates are omitted from the table to save space. In model 2, without the post-Reagan and Bush era effects (which are discussed later), these show a clear decrease in confidence over the entire period. This is consistent with previous research related to increased alienation in the public (Weakliem and Borch 2006).[3] After experimenting with various transformations, a squared polynomial was added to represent age effects. The first column shows the estimates for the demographic variables; the second column adds the political ideology and party measures; and the third column adds the cultural break measures for the post Reagan era and Bush era. The parameter estimates reported in Table 1 represent the logged odds of reporting a "great deal" of confidence in science.

Consistent with previous research, education and church attendance have strong effects on confidence in science. As expected education has a strong positive effect, and church attendance has a strong negative effect. Age has a strong nonlinear effect: with confidence in science declining until about age 50 and then increasing. Generally consistent with the alienation hypothesis, underprivileged groups show lower levels of confidence in science: Gender has a strong negative effect on confidence in science. According to the estimates of the full model (model 3), the predicted probability of reporting a "great deal" of confidence in science is about .40 for women compared to about .47 for men, holding all other variables at their means. Non-white also has strong negative effects. A non-white's predicted probability of reporting a "great deal" of

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[3] When a parameter for general institutional alienation is included in the model (analysis not shown here), the trend remains negative but is less pronounced. The general institutional alienation measure is an index of confidence in central institutions items excluding science. These include10 items about confidence in congress, the executive branch, the judicial branch, big business, large banks, education, medicine, the press, the army, and labor unions. Notably, the period effects for conservative and moderate are not influenced by the addition of the institutional alienation index, however, the effect for independent disappears. This suggests that independents lack of trust in science is a symptom of a general disenchantment with society's central institutions.

confidence in science is about .34 compared to .45 for whites, holding all other variables at their means. Similarly for social class, family income has a strong positive effect on confidence in science. There are also regional differences: southerners report lower levels of confidence in science compared to other Americans. The dummy variables for cohort are not statistically significant, but generally show that people born after 1960 are more confident in science after controlling for age.

In model 2, the dummy variables for political party and political ideology also have strong effects on confidence in science. For political ideology, the reference category is liberal and, for political party, the reference category is Democrat. The conservative and moderate dummies each show negative effects on confidence in science. The predicted probability of reporting a "great deal" of confidence in science is .47 for liberals, compared to .42 for moderates and .41 for conservatives, holding all other variables at their means. The effects for political party are less straightforward. The effect for Republican is positive, but not statistically significant. However, the independent dummy has a strong negative effect. The predicted probability of reporting a "great deal" of confidence in science is .38 for independents, compared to .44 for Democrats and .45 for Republicans, holding all other values at their means. The cultural break effects, measured by the post Reagan era and Bush era, indicate a strong negative shift in confidence in science in the U.S. after 1980 that again shifted negatively after 2000. Though, the effect for the Bush era is not statistically significant here with a $p = .118$. When a linear term for time is included in the model (results not shown here), the Bush era and post Reagan era variables are statistically significant $p < .05$, but these effects become difficult to interpret. Given these findings, there is evidence that a cultural break occurred for the general public around the election of Ronald Reagan, but an additional break did not occur during the Bush era. Analyses presented below will examine if group-specific breaks occurred during these eras for both political ideology and party.

Altogether, these period effects show that confidence in science does vary by political ideology and party as well as by demographic factors such as gender, ethnicity, and social class. These results generally support both the alienation and politicization perspectives. Consistent with the alienation hypothesis that disadvantaged groups will express less confidence in central institutions, low-income individuals, women, and non-whites show lower levels of confidence in science. Additionally, the dummy variables for each year suggest growing disenchantment with science over the period after controlling for demographic and political effects. This result straightforwardly contradicts the modernization thesis and provides further evidence for the alienation thesis. The results in Table 1 also provides key baseline support for the politicization thesis by showing differences in confidence in science based on political ideology and party. However, the politicization thesis also predicts growing politicization over time. The cultural break variables, the post Reagan era and Bush era effects, support this politicized trend argument by indicating that the ascendance of movement conservatism into mainstream political discourse is associated with a negative shift in confidence toward science. To illustrate, the predicted probability of reporting a "great deal" of confidence in science for conservative Republicans before the 1980s is .54, for conservative Republicans in the period from 1981-2000 it is .41, for conservative Republicans in the Bush era it is .37, holding all other variables at their means. Liberal democrats show a similar decline based on these models. Confidence in science for liberal democrats prior to the Reagan era is

.57, .45 in the post Reagan era, and .40 in the Bush era. Thus, the period effects are also consistent with the politicization argument that movement conservatism would influence other social groups by undermining the legitimacy of science in public discourse more broadly. To test the politicization thesis predictions related to change in more detail, the next section provides more comprehensive analysis of change over time.

Interaction Models

Table 2 shows the results when interactions between political variables and time and political variables and the cultural break variables are added to the models. Interactions cohort-time interactions were also included in the models, but are not reported in the table. Model 1 shows the ideology-time and party-time interactions along with the main effects. The main effect for conservative is positive but not statistically different from zero, suggesting that conservatives do not begin the period with lower confidence in science but become untrusting with time. Only the conservative-time interaction is statistically significant, although all the effects of political variables are negative. That is, conservatives show group-specific change over time that is statistically different from liberals. These findings are largely consistent with Figure 1. Model 2 shows the interactions with post Reagan era and Bush era and the political variables. In this model the main effect for conservative is negative but not significant. Again, only the Conservative-Bush era interactions are statistically different from zero. This suggests that the Bush era marks an abrupt shift in confidence in science for conservatives. Thus, the Bush era represents a cultural break for conservatives but not for the population in general. To summarize the results, changes in confidence in science are not uniform, and conservatives are moving away from liberals over time. Thus, Table 2 provides further evidence in support of the politicization thesis. Interactions with time and demographic factors were also examined in supplementary analyses not shown here. Only the church attendance-time interactions were statistically significant and negative. These results are worth mentioning because they indicate that only conservatives and those who attend church regularly exhibited group-specific change in confidence in science over time. It is also important to note that the dummies for each year no longer reflect a downward trend and only two years of the 22 years estimated are statistically significant (1975 and 1978). Altogether, these results provide preliminary evidence for the claim that the growing distrust in science in the U.S. has been driven by two main factors: 1) a decline among conservatives and, 2) the cultural ascendance of the new right.

Table 3 examines the interactions with cohort and the political variables. The models reported here also include interactions between cohort and time as well as age and time, which were omitted from the table. The first column shows just the conservative-cohort interactions. The second column adds the Republican-cohort interactions. Interactions with moderates and independents were also examined, but none of these interaction effects were statistically significant. Model 1 again shows a shift in conservative trust in science over the period. The main effect indicates that at people born before 1940 have high confidence in science compared to liberals. However, subsequent age cohorts move toward less trust in science, and those conservatives born after 1980 have the least confidence in science. The smaller effect for those Born 1970-1979 is due to lower mean confidence for all groups, including liberals in this cohort and an slight increase in mean confidence among conservatives.

Model 2 shows that adding Republican-cohort effects account for some of the conservative-cohort effects. First, notice that only Republicans born from 1960-1969 and 1970-1979 show less confidence in science relative to the oldest cohort. The Republican × Born 1980-1990 effect is larger than those for the two subsequent cohorts, but due to a much larger standard error, this effect is not statistically significant. According to these results, conservative cohorts are losing confidence in science after 1940, Republicans, on the other hand, lose confidence after 1960. Again, these results are consistent with the cultural break argument discussed above. Republicans born in the 1960s would have come of age at the height of the Reagan Revolution in the 1980s. Consistent with a contextualist interpretation of cohort effects (Elder 1999), Republicans who entered political life during or after the Reagan Revolution have lower confidence in science. According to this perspective, these changes reflect a shift in cultural values brought about by the new right. These models also suggest that conservatives moved earlier and more abruptly away from confidence in science and; after the 1980s, these changes became part of the political mainstream as movement conservatism transformed the Republican Party. Another possibility relates to the prominence of Evangelical Christians in the conservative movement and ultimately the Republican Party during this period. Unfortunately, these "leading or lagging" changes are beyond the scope of these particular models, but can be examined using unrestricted models that estimate separate parameters for each year. However, the results from unrestricted models show no disenable patterns.

An additional question related to the politicization of science is whether the educational composition of conservatives has changed over the period, particularly given the strong relationship between education and confidence in science. Simply, are conservatives as a group more or less educated than they used to be? First, the percent of conservatives who receive a high school degree is greater than the percent for liberals. Second, the percent of conservatives and liberals who receive bachelor's degrees is nearly identical, approximately 17%. Moreover, the data suggest that more liberals and conservatives are receiving bachelor's degrees over time and that the time trend slope for each group is approximately the same. However, liberals are statistically more likely to receive a graduate degree compared conservatives and the gap between the groups grows over the period. However, this growing gap is due to an increase in the percentage of liberals receiving graduate degrees and not a decline among conservatives. Thus, the data provide no evidence for the idea that group-specific differences in confidence in science are attributable to changes in the educational composition of conservatives.

The results in Table 4 explore an alternative hypothesis: one that suggests educated conservatives are becoming less confident in science over time. To put another way, this model examines whether changes in confidence in science among conservatives is uniform by level of education. The main effect for conservative, which would represent conservatives with less than a high school education, is negative but not statistically significant. All of the conservative-education effects are positive, indicating that more educated conservatives have more confidence in science. Yet, only the effects for the conservative-bachelor degree and conservative-graduate degree are statistically significant. The three-way interactions with conservative, education, and time show that educated conservatives are becoming less confident in science over time. The effect for conservatives with bachelor's degrees becomes negative around 1980. The effect for conservatives with graduate degrees becomes negative around 1987. For a conservative Republican with a bachelor's degree, the predicted probability of reporting a "great deal" of confidence in science was .61 prior to the 1980; for a conservative Republican after 2001, the predicted probability is .45 (holding other variables at their means). Again, these results point to a cultural shift in the meaning of conservatism that affected educated as well as uneducated conservatives. This culture shift among conservatives is related to less confidence in science relative to other political groups.

In summary, the results in the change models (Tables 2, 3, and 4) do not support the "spirit of the times" model – the idea that groups have exhibited uniform change in confidence in science. Furthermore, the analysis above provides little support for the modernizations thesis, which suggests that trust in science (a key component of the modern worldview) will increase over time. This analysis does support some of the predictions of the alienation thesis, which predicts a uniform decline in trust in science over time and that disadvantaged groups will show less trust in science. Altogether, the findings in this chapter provide strong evidence for the politicization thesis, especially as proffered by Mooney (2005). Particularly, this perspective proposes that conservatives have become increasingly skeptical of science since the Reagan Revolution and that this skepticism had intensified under President George W. Bush.

CONCLUSION

The empirical analysis above shows an unambiguous shift in conservatives' trust in science over time as well as a general decline in public opinion after 1980. Yet, there are numerous explanations for this shift beyond those discussed above. Moreover, there are numerous implications of these findings for future research and for the socio-political landscape in the U.S. First, although the evidence supports the idea that movement conservatism produced the shifts observed here, there is no definitive test of this interpretation. An alternative explanation is that moderates have become more attracted to the conservative ideology over the period. Examining trends of ideological identifications over time shows slight declines in the number of moderates and liberals but a clear increase in the number identifying as conservative. Supplementary analysis also supports the idea that moderates are moving toward the category conservative and away from the category liberal over the period. Because moderates show consistently lower levels of trust relative to other groups, an ideological migration from moderate to conservative may have produced the changes observed here. Even so, these shifts in ideological identification do not explain why groups have realigned in this way or why moderates have found conservatism more palatable. In fact, one could view this evidence as further support for the politicization thesis, because a shift in moderates' perspectives may correspond with the effect of the new right on popular discourse. It is also possible that the shifts observed here were produced by changes in scientific community that alienated conservatives. Or, it is possible that the association between liberal ideology and the scientific community became more salient and divisive during this period. Many of these explanations and their implications are revisited in future chapters and in the conclusion.

Future research should examine longer periods of time and other democratic societies. One possibility is that political structure – particularly, the two party "winner-take-all" system in the U.S. – may influence the shifts observed here. For example, in countries where political cleavages center on economic conflict between finance capital and labor, science maybe viewed as aligned with elite institutions in banking and industry. Under these circumstances, left political ideology may be more adversarial toward science. In countries like the U.S. where technocratic and financial elite must mobilize disadvantaged populations in order to win majorities (see Chapter 2 Figure 2), politicized swings in public opinion of science maybe more frequent and severe. On the other hand, the relationships observed in the U.S. (see also Chapter 2) may represent general cleavages across cultures, national borders, and institutional contexts.

Subsequent chapters examine some of these issues. Particularly, whether or not the politicization of science observed here is unique to the U.S. or if other countries exhibit similar trends. There are numerous possibilities here; in some countries left ideologies may be less trusting in science, and in other countries public trust in science may not be politicized at all. These differences may be affected by country level phenomenon such as party structure, post-materialist worldviews (Inglehart 1997), general confidence in institutions, and economic characteristics. In the U.S., I will examine the relationship between political identifications and public understanding of science using multiple instruments. Although, these instruments are only available in 2006-2008 GSS, they do provide an opportunity to verify the results shown here. Additionally, analysis of the 2006-2008 GSS will allow for a more complete study of the relationship between political ideology and party and public opinions toward science.

Table 1. Effects of Demographic and Political Variables on Public Confidence in Science

	Model 1		Model 2		Model	
3						
Female	-0.262***	(0.025)	-0.263***	(0.025)	-0.263***	(0.025)
Non-White	-0.467***	(0.035)	-0.478***	(0.036)	-0.478***	(0.036)
Education (yrs)	0.064***	(0.009)	0.061***	(0.009)	0.061***	(0.009)
High School	0.086	(0.045)	0.093*	(0.045)	0.093*	(0.045)
Bachelor	0.413***	(0.074)	0.400***	(0.074)	0.400***	(0.074)
Graduate	0.352***	(0.095)	0.336***	(0.096)	0.336***	(0.096)
Family Income	0.000***	(0.000)	0.000***	(0.000)	0.000***	(0.000)
South	-0.117***	(0.029)	-0.114***	(0.029)	-0.114***	(0.029)
Church Attendance	-0.041***	(0.005)	-0.041***	(0.005)	-0.041***	(0.005)
Born 1940-1949	-0.075	(0.053)	-0.082	(0.053)	-0.082	(0.053)
Born 1950-1959	-0.020	(0.068)	-0.030	(0.068)	-0.030	(0.068)
Born 1960-1969	0.143	(0.089)	0.136	(0.089)	0.136	(0.089)
Born 1970-1979	0.189	(0.116)	0.185	(0.116)	0.185	(0.116)
Born 1980-1990	0.301	(0.155)	0.293	(0.156)	0.293	(0.156)
Age	-0.224***	(0.058)	-0.215***	(0.058)	-0.215***	(0.058)
Age^2	0.022***	(0.005)	0.021***	(0.005)	0.021***	(0.005)
Conservative			-0.180***	(0.033)	-0.180***	(0.033)
Moderate			-0.220***	(0.031)	-0.220***	(0.031)
Republican			0.048	(0.029)	0.048	(0.029)
Independent			-0.193***	(0.039)	-0.193***	(0.039)
Post Reagan Era (1981-2008)					-0.495***	(0.099)
Bush Era (2001-2008)					-0.168	(0.108)
Log likelihood	-19417.41		-19372.07		-	
19372.07 Cox-Snell R^2	.054		.057		.057	

Note: Standard Errors in parentheses. Estimates for year are omitted for space. Birth year 1939 and under is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. Age^2 is a squared term.

* $p < .10$; ** $p < .05$; *** $p < .001$

Table 2. Change in the Effects of Political Variables on Public Confidence in Science

	Model 1		Model 2	
Main Effects				
Conservative	0.022	(0.065)	-0.040	(0.063)
Moderate	-0.214***	(0.060)	-0.181**	(0.058)
Republican	0.135*	(0.055)	0.082	(0.054)
Independent	-0.143	(0.076)	-0.124	(0.074)
Interactions				
Conservative × Time	-0.011***	(0.003)		
Moderate × Time	-0.003	(0.004)		
Republican × Time	-0.005	(0.003)		
Independent × Time	-0.000	(0.003)		
Conservative × Post Reagan Era			-0.140	(0.076)
Conservative × Bush Era			-0.242*	(0.099)
Moderate × Post Reagan Era			-0.057	(0.071)
Moderate × Bush Era			0.013	(0.089)
Republican × Post Reagan Era		-0.031	(0.065)	
Republican × Bush Era			-0.025	(0.085)
Independent × Post Reagan Era		-0.117	(0.091)	
Independent × Bush Era			0.079	(0.103)
Log likelihood	-19352.93		-19358.06	
Cox-Snell R^2	.058		.058	

Note: Models also include demographic variables from the previous models, cohort-trend and age-trend interactions, as well as dummy variables for each year.
* $p < .10$; ** $p < .05$; *** $p < .001$

Table 3. Cohort Effects of Political Variables on Public Confidence in Science

	Model 1		Model 2	
Main Effects				
Conservative	0.643*	(0.272)	0.491	(0.285)
Moderate	-0.218***	(0.031)	-0.217***	(0.031)
Republican	0.055	(0.029)	0.395	(0.275)
Independent	-0.197***	(0.039)	-0.199***	(0.039)
Interactions				
Conservative × Born 1940-1949	-0.236**	(0.087)	-0.219*	(0.092)
Conservative × Born 1950-1959	-0.328***	(0.096)	-0.278**	(0.102)
Conservative × Born 1960-1969	-0.497**	(0.112)	-0.417***	(0.118)
Conservative × Born 1970-1979	-0.355*	(0.144)	-0.269	(0.152)
Conservative × Born 1980-1990	-0.780***	(0.225)	-0.668**	(0.253)
Republican × Born 1940-1949			-0.064	(0.093)
Republican × Born 1950-1959		-0.170	(0.102)	
Republican × Born 1960-1969		-0.272*	(0.117)	
Republican × Born 1970-1979		-0.299*	(0.150)	
Republican × Born 1980-1990		-0.395	(0.245)	
Log likelihood	-19357.85		-19352.81	
Cox-Snell R^2	.058		.058	

Note: Models also include demographic variables from the previous models, cohort-trend and age-trend interactions, as well as dummy variables for each year.
* $p < .10$; ** $p < .05$; *** $p < .001$

Table 4. Models with Education Interaction Effects and Conservative

Main Effects		
Conservative	-0.163	(0.108)
Moderate	-0.221***	(0.031)
Republican	0.062*	(0.029)
Independent	-0.197***	(0.039)
Interactions		
Conservative × High School	0.194	(0.126)
Conservative × Bachelor	0.406*	(0.177)
Conservative × Graduate	0.560*	(0.244)
Conservative × Time	-0.002	(0.006)
High School × Time	-0.004	(0.004)
Bachelor × Time	0.004	(0.005)
Graduate × Time	0.009	(0.007)
Conservative × High School × Time	-0.009	(0.007)
Conservative × Bachelor × Time	-0.024**	(0.009)
Conservative × Graduate × Time	-0.028*	(0.011)
Log likelihood	-19348.30	
Cox-Snell R^2	.059	

Note: Models also include demographic variables from the previous models, cohort-trend and age-trend interactions, as well as dummy variables for each year.
* $p < .10$; ** $p < .05$; *** $p < .001$

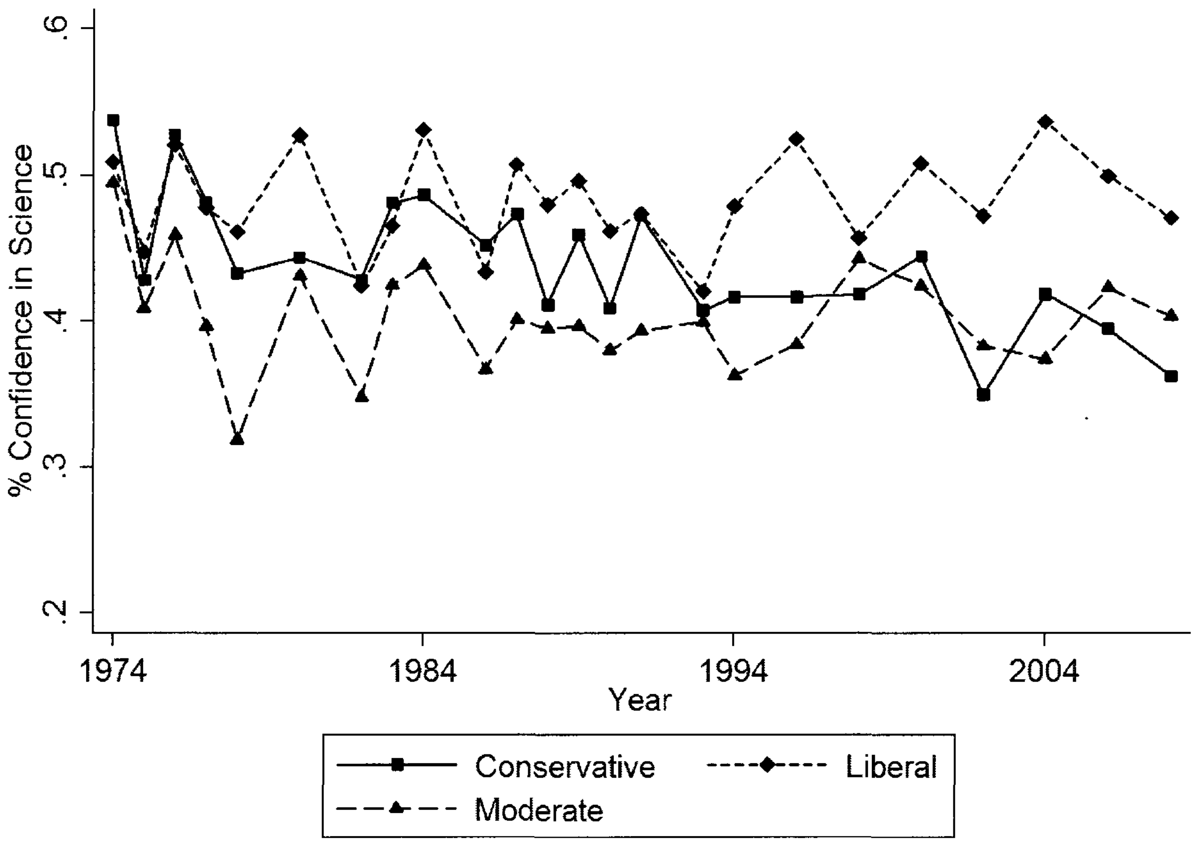

Figure 1. Confidence in Science by year and political ideology

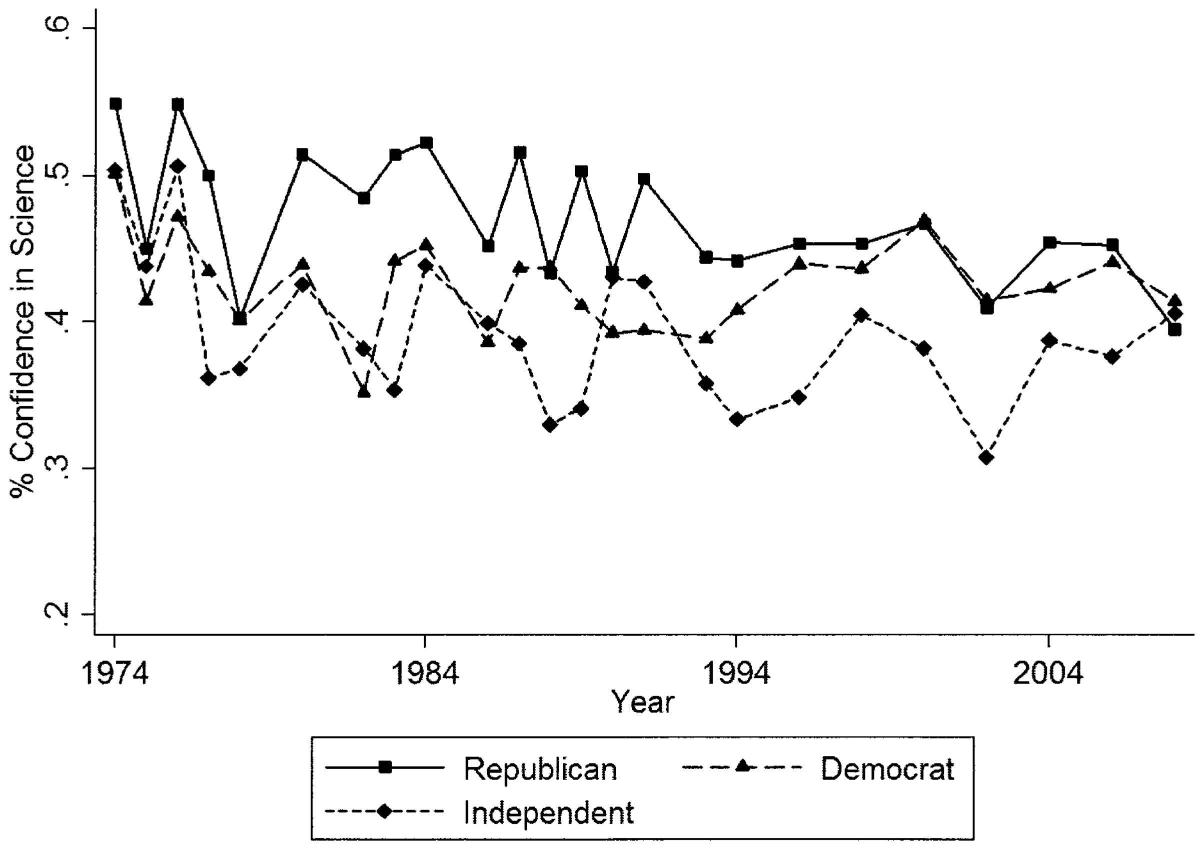

Figure 2. Confidence in Science by year and political party

CHAPTER 4: THE POLITICIZATION OF SCIENCE IN THE U.S., 2006-2008: AN IN-DEPTH EXAMINATION OF ATTITUDES TOWARD SCIENCE

INTRODUCTION

The purpose of this chapter is to examine the politicization thesis in greater detail. Specifically, this analysis utilizes a battery of public opinion instruments related to general attitudes toward organized science and science policies, as well as questions related to public knowledge of basic scientific facts, in the years 2006 and 2008. Analyzing this multitude of outcomes accomplishes two general research goals. First, it offers a more rigorous test of the politicization thesis by examining outcome variables on a range of topics. Consistent differences among political groups would provide further evidence for the hypothesis that public opinion toward science is associated with political ideology in the U.S. If the political differences are less pronounced, inconsistent across outcome measures, or contradictory to those found in the period 1974-2008, then the results of the previous chapter should be viewed with considerable caution.

Second, this analysis can elucidate the scope and form of conservatives' and moderates' discontent with organized science. That is, with a variety of outcome measurements, this chapter can provide a more complete profile of conservatives' and moderates' views of organized science relative to liberals', and what particular elements of organized science engender concern among conservatives and moderates.

The results of the previous chapter clearly show that differences in trust toward science by political ideology peaked in the years 2001-2008, with conservatives and moderates exhibiting low-levels of trust compared to liberals. Based on these trends, the current analysis should show differences in trust in science by political ideology and, particularly, considerable reservations about science among conservatives and moderates when compared to liberals. Similarly for party identification, independents showed weak confidence in science relative to Republicans and Democrats; at the same time, there was no evidence of differences between Republicans and Democrats. Thus, if the current analysis is consistent with the previous chapter, it would show that independents have more pronounced reservations about organized science than Democrats and Republicans. It should also show that Democrats and Republicans exhibit similar attitudes toward science.

The outcomes examined include scientific cultural capital (see Chapter 2) and its components, attitudes toward science (e.g., "does science change life too fast" and "governments should fund basic scientific research"), cultural definitions of science (i.e., "what makes something scientific"), and attitudes toward science-related policies (e.g., climate change, stem cell research, and genetically modified foods). The model specifications are nearly identical to those presented in the previous chapter. The numerical measures of age were excluded because these effects can no longer be distinguished from cohort effects in cross-sectional data analysis. Instead, age is measured using six categories representing decade of birth. For each of the outcomes observed below, the effects of the political variables, political ideology and party, are estimated after controlling for demographic factors. The analysis below is divided into several sections. Because so many outcomes are reported, a detailed description of each outcome measure and the statistical method used to estimate the models are provided at the beginning of each section. Generally, the analysis confirms the results of the previous chapter and provides a more detailed profile of the relationship between ideology and attitudes toward science. The final section reviews the results and discusses various explanations and implications of the findings.

DATA

The data for this analysis come from the 2006-2008 General Social Survey (GSS) a nationally representative sample of non-institutionalized adults age 18 and older that is selected using multistage probability sampling. The GSS is funded by the National Science Foundation (NSF) and conducted biannually by the National Opinion Research Center (NORC). The 2006-2008 GSS survey is unique in that it incorporates for the first time many of the items from the NSF's *Science Indicators Survey* as a special module in the GSS. Because the *Science Indicators Survey* is nested within the GSS, it has many advantages over previous versions. Notably, it includes extensive demographic, economic, and cultural variables along with comprehensive coverage of science-related issues. Each section provides a brief description of the outcome variables and technique used to estimate them.

ANALYSIS

Confidence in Institutions

To bridge the longiitudinal analysis in the last chapter with the current analysis, the first models compare public confidence in three major social institutions with confidence in science. The institutions examined here are major companies, medicine, and education. These institutions were chosen because they likely differ in their degree of politicization. Confidence in major companies is likely to be politically charged; however, confidence in medicine and education imply no clear political patterns. The "major companies" outcome was selected for comparison, simply, is ideology or party more predictive for this outcome? It also serves to reinforce some of the ideas in Chapter 2, which suggested that location on Chapter 2, Figures 1 and 2 should correspond with different dispositions toward social institutions. According to Chapter 2, Figure 2, Republicans should show the most support for big business, then conservatives, and then moderates; however, independents are the most alienated from the "system" and should have more negative attitudes toward institutions compared to Democrats. The education and medical institutions provide interesting test cases, because there are no predictable political patterns. Thus, one key question related to the relationship between political ideology and confidence in science would be: *are the patterns for science just capturing general patterns of institutional discontent among conservatives and moderates, or are the patterns for science distinct?*

Recall, respondents were provided the following:

> I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?

They were then given the choice to respond "a great deal," "only some," or "hardly any." Similar to the previous chapter, these items were recoded into binary outcomes comparing those with "a great deal" of confidence to those with "only some" and "hardly any." Public confidence in science, major companies, medicine, and education are compared to establish if the political patterns observed for science are parallel across social institutions because political ideology is associated with a general institutional alienation, or, if the pattern for science is unique. To simplify, the discussion of the results below focuses on the main political variables and does not discuss the effects of demographic variables in detail.

First, it is important to note that confidence in the scientific community is quite high compared to the other three institutions: 41.7% express a "great deal" of confidence in the scientific community next to 16.6% for large businesses, 38.6% for the medical community, and 28.3% for education. This reaffirms the cultural authority of science – its cultural credibility relative to other central institutions (see Chapter 2). Given the relatively low credibility of other institutions, it gives some indication as to why institutional elites seek credibility for their claims from the scientific community, and, at the same time, it shows that the scientific community holds surplus cultural stock in this resource. Although the cultural stock of science appears high, the issue of political and ideological differences is a separate matter.

Table 1 shows the parameter estimates from four logistic regressions estimating public confidence in the four major institutions discussed above. The results for confidence in science are somewhat consistent with those reported in the previous chapter. The signs of the effects are nearly identical (comparing these results to the period effects in Chapter 3, Table 1); however, fewer demographic factors are significant. Although, this is partially explained by smaller effect sizes in the 2006-2008 sample (smaller absolute values for the coefficients), these differences are attributable to the sensitivity of the significance tests to sample size (the standard errors for the 2006-2008 estimates are substantially larger than for the 1974-2008 estimates). Consistent with the 1974-2008 estimates, the effect for conservative is statistically significant and negative. Additionally, the effect size is larger here (-.363, compared to -.180 in Chapter 3, Table

1), which supports the thesis that conservatives have grown more detached from science. However, here the effects for moderate and independent are not statistically significant; yet, the effect sizes are comparable and only slightly smaller than the 1972-2008 analysis. Again, the non-significance of these effects is due to the larger size of the standard errors, which are inversely related to sample size. Another key difference is the effect for Republicans, which has switched signs and is negative here, possibly indicating that the shift among conservatives' attitudes is beginning to influence the Republican party. However, this conclusion must await further evidence.

-- Table 1 about here --

Notably, the parameter estimates for the other confidence outcomes show that public confidence in major institutions is not uniform across social groups. The results for confidence in major companies show that conservatives, moderates, and Republicans have greater confidence, yet, only the effects for conservatives and Republicans are statistically significant. Thus, confidence in major companies is politically charged in the opposite direction of science. As expected, medicine and education are comparatively less politically charged. The effect of conservatives is negative in both models but not significant. The effect for moderates is negative for medicine but positive for education, but these effects are not statistically different from zero. Republicans show greater confidence in medicine compared to Democrats. The effect of independents is negative for both medicine and education, but these effects are relatively small compared to the other outcomes. In summary, Table 1 shows that the patterns observed for confidence in science are not consistent for other social institutions and that conservatives have a particularly strong dissociation from science. The following sections examine this dissociation in greater detail.

Scientific Cultural Capital

Recall from Chapter 2 that scientific cultural capital refers to a specific type of cultural capital that is related uniquely to science, and specifically, those social resources related to science including (but not limited to) favorable attitudes toward organized science, basic knowledge of textbook scientific facts, participation in college science courses, and a self-reported knowledge of science. A factor analysis (reported in Chapter 2, Table 1) shows that general attitudes, textbook knowledge, college courses, and perceived knowledge represent a latent factor. Based on these results, the four items were converted to z-scores and then averaged to create a *scientific cultural capital index*. Table 2 shows the models predicting the scientific cultural capital index along with models predicting the four components of the index: *general attitudes*, *textbook knowledge*, *college courses*, and *perceived knowledge*. Given the variety of outcomes, different techniques were used to estimate the models here. To simplify, the models in Panel A were all predicted using ordinary least squares (OLS) regression. The models reported in Panel B use different techniques, which will be noted for each outcome. The analysis in both panels address two key questions. First, how does scientific cultural capital vary by socio-demographic and political groups? Second, are relationships observed for the scientific cultural capital index consistent with those observed for its components or, for example, are some components of the index particularly politicized?

-- Table 2 about here --

In Panel A, the results of the first model show that scientific cultural capital varies across socio-demographic groups. Consistent with previous studies of public understanding of science, women and non-whites have smaller stocks of cultural resources related to science compared to males and whites. Scholarship in the history of science and sociology of science would attribute these results to the set of social and cultural experiences that are specific (and sometimes shared) among disadvantaged groups (e.g., differential socialization, relative access to social resources more generally, stereotype threats etc) (Collins 2010). Not surprisingly, education—measure in years and highest degree – and family income are positively and significantly associated with stocks of scientific cultural capital. Social scientists often use these two variables to approximate social class; thus, after controlling for various factors; this model provides further evidence that scientific cultural capital is at least partly class-based in the general public. Scientific cultural capital also varies with age (shown here in categories). The age categories show that respondents born after 1939 have higher stocks of scientific cultural capital. Further, the youngest age group reports the highest stocks of scientific cultural capital, after controlling for other factors. Also consistent with previous research, those who more regularly attend religious services show smaller stocks of scientific cultural capital (Gauchat 2008; 2010).

The models also show key differences by political party and political ideology. Consistent with the findings in Chapter 2, scientific cultural capital varies strongly with political ideology and less with political party. Conservatives and moderates report lower stocks of scientific cultural capital when compared to liberals. This finding not only reinforces the arguments and evidence proffered in the previous chapters, it provides further context for the relationship between public opinions toward science and political ideology. One interpretation is that lower stocks of scientific cultural capital among conservatives and moderates may explain lower confidence and trust within these groups. Consistent with Bourdieu's theory of practice (see Chapter 2), Chong (2000) introduces a form of "status politics" that are "based on subjective calculations of self interests," which represent "the history of one's choices, including the values, identifications, and knowledge that one has acquired through socialization" (Chong 2000:6-7). Conservatives and moderates may, therefore, question the credibility of science to promote their own self-interest, because those who have accumulated scientific cultural capital tend to hold contrary views and identify with conflicting political ideologies. This would suggest that public perceptions of science would potentially have little to do with understanding, engaging with, or participating in "science," but with the distribution of scientific cultural capital among political cleavages. For example, Chong and Bourdieu would argue that because conservatives acquire less scientific cultural capital throughout their lives than liberals, conservatives as a group come to value scientific expertise and distrust organized science (i.e., a sort of cognitive dissonance).

This explanation may be preferable to psychological explanations that ascribe "status anxiety" to conservative politics rather than to examine the structural and institutional causes of these positions (see Bell 1964; Hofstadter 1965, 1970; Wolfinger et al. 1969). These theoretical questions will be addressed in greater detail in the concluding chapter.

Model 2, which predicts the general attitudes index, is consistent with the estimates for the cultural capital index. Notably, general attitudes toward science vary less with age and gender than the total index. However, the direction and statistical significance of the political variables are comparable. Again, general attitudes vary with ideology but not with political party. Conservatives and moderates express less favorable attitudes compared to liberals, but Republicans, Democrats and independents report statistically similar attitudes toward science. Model 3 predicting textbook knowledge shows a similar pattern. Here the effect for conservatives and moderates is weaker but still statistically significant. The effect for independents is also significant in this model, although this effect is likely attributable to the larger sample size in this model and smaller standard errors.

Because all three outcomes are standardized, the effects for the political variables represent standard deviation changes in the dependent variables that result from membership in each group. Consequently, one can compare effect sizes for the political variables across the models, particularly, for each component of the scientific cultural capital index. This comparison indicates that general attitudes vary more with political ideology when compared to textbook knowledge. In a supplementary analysis not shown here, the general attitudes model was estimated with textbook knowledge added as a predictor. This model shows that the effects of conservatives and moderates on general attitudes are somewhat mediated but still negative and statistically significant ($p < .001$). Thus, the differences in favorable attitudes by ideology reported here are not reducible to differences in textbook knowledge.

The first model in Panel B (model 3), predicting the number of college science courses a respondent has taken, was estimated using negative binomial regression. This technique is used to estimate count variables that are believed to be generated by a Poisson-like process, except that the variation is greater than that of a true Poisson distribution (assumed to be the mean or μ) (Long and Freese 2006). This extra variation is called overdispersion. Overdispersion was detected by comparing the Poisson estimates (with only the constant as a predictor) to the actual distribution of the outcome variable, which showed that the Poisson estimates under-predict the number of zero counts. In addition, a likelihood ratio test comparing the Poisson model to the negative binomial model suggests that there is strong evidence of overdispersion ($G^2 = 6854.5$, $p < .001$). The effect for education in years is not estimated because of the strong relationship between this variable and the outcome variable. Instead, education is measured with highest degree. Altogether, the results shown in model 3 are very similar to those for the overall index. Focusing on the political variables, conservatives and moderates report taking less science courses, even after controlling for highest degree. Notably, the effect for Republicans is positive and statistically significant. Therefore, conservatives and Republicans have opposing experiences with science in higher education. To examine the sensitivity of these results, an alternative model was estimated that included education in years from the model (results not shown here). This model shows that the political effects above were in the same direction and still statistically different from zero ($p < .01$).

The final model in Table 2 predicts an outcome measuring respondents' perceived knowledge of science (i.e., how well-informed they think they are about science). The model is predicted using ordinal logistic regression, which is appropriate for ordinal outcome variables. A Brant test was performed to test the parallel lines assumption—the idea that the estimated slopes are consistent across the estimated cut points. The Brant test showed that the slope estimates for the education dummies were not parallel across the cut points, but the parallel lines assumption was not violated for any other predictors, including the political variables (results available upon request). Overall, this model is consistent with models predicting other components of the scientific cultural capital index shown in Table 2. First, it shows that conservatives and moderates report less confidence in their knowledge of science compared to liberals. Additionally, Republicans report that they possess greater knowledge of science than Democratic respondents.

To summarize, the results in Table 2 show that stocks of scientific cultural capital are not equally distributed across demographic and political groups. In particular, they show that conservatives and moderates have less scientific cultural capital when compared to liberals. At the same time, political party shows no consistent pattern. Republicans report taking more college science courses and having greater knowledge of science than Democrats, but in the model predicting the overall index, the effects for Republicans and independents are not statistically different from Democrats. Overall, the results of the scientific cultural capital index are consistent with the results for its components and are not driven by any particular component. The next section decomposes the general attitudes index shown in model 2 in to its components in order to examine the relationship between political cleavages and public attitudes toward science in more detail.

General Attitudes toward Science

The 2006-2008 GSS surveys contain a range of questions about general attitudes toward science. Table 3 examines four general attitudes toward science. The four outcomes examined here were used to create the "general attitudes" scale[1] reported in the previous table and have been used in previous studies to measure a general attitude toward science (Bak 2001; Pardo and Calvo 2002; Sturgis and Allum 2004; Gauchat 2010). The outcomes are coded so that higher values represent more favorable attitudes toward science.

The first outcome represents a benefit-harm evaluation of science. Respondents were given the following: "People have frequently noted that scientific research has produced benefits and harmful results. Would you say that, on balance, the benefits of scientific research have outweighed the harmful results, or have the harmful results of scientific research been greater than its benefits?" About 26.8% of the respondents believe that the harmful results exceed or are equal to the benefits, 25.0% chose "slightly in favor of benefits," and 48.2% chose "strongly in favor of benefits." Respondents were also asked whether they strongly agree, agree, disagree or strongly disagree with the statement: "Science makes our way of life change too fast." Approximately 48% strongly agree with this statement, 9.5% agree, 45.0% disagree, and 8.9% strongly disagree. Similarly, respondents were given the statement: "Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government." Around 11.0% strongly disagree or disagree with this statement, 60.0% agree, and 29.0% strongly agree. Respondents were also given the statement: "Science is too concerned with theory and

[1] A factor analysis using a polychoric correlation matrix indicates that the questions correspond with a latent factor (eigenvalue= 2.11). This factor explains 42% of the total variance. The Cronbach's Alpha for the scale is .60, which is below conventional standards but consistent with prior research (see Pardo and Calvo 2002).

speculation to be of much use in making concrete government policy decisions that will affect the way we live." About 5.8% strongly agree with the statement, 32.5% agree, 49.2% disagree, and 12.2% strongly disagree. The advantage of looking at these four items separately is that they represent two types of general attitudes.

The purpose of this analysis is to determine if the effects of the key political variables on the general attitudes variable are the same for the four components. The "benefits vs. harms" and "changes life too fast" outcomes represent abstract evaluations of science, and the "supported by federal government" and "too speculative and theoretical" outcomes represent attitudes about the relationship between science and the state. Therefore, this comparison may provide greater insight into the relationship between political ideology and public attitudes toward science. Specifically, it can address whether the less favorable attitudes of conservatives and moderates are confined to either of these two domains – the abstract evaluations of science or the relationship between science and the state.

Table 3 shows the results of four ordinal logistic regression models. Ordinal logistic regression is preferred over OLS regression, because an ordinal dependent variable violates the parallel lines assumption linear regression models, which can lead to incorrect conclusions (Long and Freese 2006). A Brant test was performed for each of the ordinal logistic models to test the parallel line assumption (discussed above), and these tests showed that the parallel lines assumption was not violated for the key political variables. The first model presents the results for the "benefits vs. harms" outcome, the second model presents the results for the "changes life too fast" outcome, the third shows the results for "should be supported by federal government" outcome, and the fourth model predicts the "too speculative and theoretical" outcome.

Starting with the demographic variables, non-whites, lower educated individuals, and lower income individuals report less favorable attitudes toward science. These findings are consistent with previous research (Gauchat 2008; 2010). However, it is important to note the results for income and education are not uniform across the attitudes. Notably, the effect for income is positive and significant in the first two models, which predict abstract evaluations of science (i.e., is it good or bad), but not the last two, which predict attitudes about the relationship between science and government. These results somewhat reinforce the ideas discussed in Chapter 2 relating to status groups. Status groups with a high volume of social resources in financial capital (family income) appear to view science favorably, but these attitudes do not translate into greater support for a prominent relationship between the scientific community and the federal government. Religion represents another key category of difference in the U.S. (Collins 2010). The negative effect for church attendance is the most consistent in Table 3, indicating that the conflict in the public sphere between science and religion has not abated.[2]

-- Table 3 about here --

The political variables also show clear patterns. The effect for conservatives is negative in all four models and is statistically significant in three of them. The effect for

[2] The conflict between religious conservatives and "science" could be topic of an entire dissertation. In the previous chapter, models not reported showed that public trust in science among the most frequent church attendants was eroding over time. The results of this supplementary analysis, along with those shown here, indicate that the tension between science and religion in the public sphere remains a fundamental source of cultural conflict in the U.S.

conservatives is strongest in the last model predicting the "too speculative and theoretical" outcome. This suggests that, compared to liberals, conservatives have less favorable attitudes toward science in the more general evaluative sense, but the acute concern among conservatives is with science's relation to public policy. To put it another way, the distance between liberals and conservatives appears greatest when organized science is related to the state, both in terms of its financial dependence on the government, but also its ability to inform public policy. This pattern is also observed for moderates, although, this group reports stronger reservations about science more generally. The differences between Republicans and Democrats are not statistically significant in Table 3, which is consistent with previous findings in this chapter as well as in Chapters 2 and 3. However, when compared to Democrats, Republicans show somewhat more favorable attitudes toward science in the abstract, but are less favorable toward science in relation to the state. The effect for independents is negative in all four models. Yet, the differences between independents and Democrats are negligible with the exception of model 1. Altogether, these results show that public attitudes toward science are politicized, but these differences are observed for ideology and not party. They also show that conservatives and moderates have particular concerns about science's relationship to the state and its role in shaping public policy.

There are several interpretations of these findings. First, from a status group perspective (Weber 1946; Bourdieu 1984, 1990; Chong 2000), conservatives and moderates may view liberals as more closely aligned with the scientific community, and thus, are threatened by the close relationship between the state and organized science due to their perceived cultural disadvantage in this respect. On the other hand, the unfavorable attitudes of conservatives and moderates may be explained by their distinct worldviews and value systems when compared to liberals. For example, conservatives' and moderates' reservations may relate to each group's abstract anxieties about state power, the size of government, and the proper role of government. That is, moderates and conservatives may share a populist view that organized science is closely aligned with the intrusiveness of government and the center-establishment (Mouffe 2005). To further elucidate the interrelations between political ideology and public attitudes, the next section examines attitudes toward science that were not included in the general attitudes scale.

Other Attitudes toward Science

This section examines attitudes that are distinct from the general attitudes above, because they do not necessarily represent evaluative (i.e., "good-bad") attitudes toward science. Table 4 shows the estimates for three distinct outcomes related to science. The first outcome measures respondents' interest in science (model 1). This is measured using a z-score standardized scale created from the sum of four items related to interest in scientific discoveries, medical discoveries, space exploration, and technological discoveries. Loadings for an iterated principle factor analysis show that the "interest in scientific discoveries" item has the strongest relationship with the latent variable.[3] The one factor solution explained 91% of the variance and the Cronbach's alpha for this scale is .77. The "interest in science" model is estimated using OLS regression.

-- Table 4 about here --

[3]The factor loading for "interested in scientific discoveries" was .77, the next highest was "interest in technological discoveries," .73. This suggests that the latent variable is most closely related to interest in scientific and technological developments.

The estimates in model 1 show that females, less-educated individuals, and lower-income individuals report less interest in science. However, the effects for education are unexpectedly weak. Likewise, the age variables, measured in ten year generations, show no effect except for those born from 1970-1979, but the effects for all the categories are negative (compared to those born before 1940). Notably, all the political variables are negative, but only the effects for moderates and independents are statistically significant. This suggests that liberals and conservatives show statistically similar levels of interest in science, but moderates show significantly less interest than both of these groups. Similarly for political party, Republicans and Democrats show about the same levels of interest, but independents are statistically less interested than both of the main political parties. Thus, differing levels of trust and favorability among political groups are not necessarily reducible to varying levels of interest in scientific developments. That is, the negative effects for conservatives observed in the previous sections cannot be attributed to variation in interest. However, the relative lack of interest in science among moderates and independents may account for some of the negative attitudes observed for these groups.

The second outcome in model 2 measures the public faith in the ability of science to provide opportunities for the next generation. Respondents were asked whether they strongly agree, agree, disagree, or strongly disagree with the statement: "Because of science and technology, there will be more opportunities for the next generation." About 39.3% strongly agree, 52.2% agree, and only 8.4% disagree or strongly disagree. The "science and next generation" outcome was estimated using generalized ordinal logistic regression, because a Brant test showed that the parallel lines assumptions was violated for key political variables. Generalized ordinal logistic regression estimates a separate slope for each cut point in comparison to the lower ordered responses, in this case producing three models (e.g., "strongly agree" compared to lower responses, "strongly agree" and "agree" compared to other responses, and "strongly disagree" compared to three higher ordered responses). For simplicity, the model reported in this analysis compares "strongly agree" to all other categories, although the results for the other comparisons are discussed when relevant. Model 2 can thus be interpreted like a logistic regression that compares "strongly agree = 1" to "all other responses = 0." Theoretically, this outcome corresponds somewhat to what Habermas (1989) termed "science ideology," which supposes that scientific and technological innovation are major engines of growth and prosperity in contemporary social system.

Model 2 shows that few demographic factors are statistically significant predictors of science and the next generation. For example, the effect for education is surprisingly weak and almost non-significant in the model reported. However, the generalized ordinal estimates suggest that dummies for bachelor and graduate are statistically significant and positive when comparing those who "agree" and "strongly agree" to those who "disagree" (results not shown). The effects for conservatives and moderates are both negative, as expected, but only the effect for moderates is statistically significant. Again, moderates appear more disenchanted with science than both conservatives and liberals. The effect for Republicans is positive but not statistically significant, suggesting that there is no statistical difference between the major political parties. Similarly, the effect for independents is negative, but it is not statistically significant. Overall, moderates are the least likely to strongly endorse the idea that science and technology will drive future opportunities. These findings reinforce those presented in Chapter 2, Figure 2, which showed that moderates and independents were the most alienated from the institutional and social benefits of organized science. Moderates, especially, showed low levels of SES as well as low stocks of scientific cultural capital; thus, it is not surprising that this group is the most skeptical about the socio-economic benefits of organized science.

The third outcome examined in Table 4 represents respondents' understanding of what makes something scientific, or, how they define science in society. The GSS included a battery of eight questions to measure how respondents defined science. Specifically, they were asked to say which factors they thought made something scientific. For example, they were asked if they thought it was important that science "is done by scientists employed in a university setting," "is done by those with advanced degrees in their field," "involves repeated experiments that find the same result," and "examines different interpretations of results." A total of eight questions were included in the survey. Using an iterated principle factor analysis, three factors were obtained from the eight items.

The three factors that emerged from the analysis correspond to different public beliefs about "what makes something scientific" (see also Gauchat 2010). Each of the three factors had eigenvalues greater than one and the factors explained 28.1%, 23.7%, and 19.3% of the total variance, respectively. An oblique rotation was used to test the null hypothesis of independence among the factors, and the null was rejected indicating that the extracted factors are interrelated. However, these correlations are relatively small, ($r < .30$). The first factor represents the idea that science is differentiated by its "method."

This belief is consistent with the idea that replication, unbiased interpretations, and solid evidence culturally demarcate science from other ways of knowing. The second factor captures the idea that science is differentiated by its "social location." Those who support this definition believe that science is culturally demarcated by the university setting and professional credentials (i.e. having advanced degrees in a scientific field). The third factor identifies that science should culturally "accord" with other forms of knowledge in society such as common sense and religious tradition. To put it another way, some segments of the population believe that science should reinforce other forms of knowledge.

Thus, three variables were created based on the results of the factor analysis discussed above: *method, social location*, and *accord.* For each factor, the items that corresponded to the latent variables were z-score standardized and then averaged. Then, a nominal variable was created based on which factor a respondent scored highest on, thus, the final measure represents which definition of science a respondent felt was dominant.[4] Approximately 34.1% demarcate science in relation to its method, 29.3% demarcate science as a professional and institutional location, and 36.7% suggest that science should accord with other forms of knowledge. The "meaning of science outcome" is measured using multinomial logistic regression; in this case, a two-model system of equations with "method" and "location" as the focal depdent variables and "accord" as the reference category. This model can be interpreted like two logistic regression models that compare

[4] Many alternative models were examined in this analysis including a number of models that predicted the method, social location, and accord variables as continuous variables. The results are nearly identical to the multinomial logistic regressions shown in this analysis. Ultimately the multinomial format was chosen because it has the advantage of representing which definition of science is dominant among respondents.

two responses (i.e., method = 1 vs. accord = 0 and location = 1 vs. accord = 0). The remaining comparison, method vs. location, is not shown as it simply represents the difference between the other two sets of estimated coefficients.

Model 3 shows the results of the multinomial logistic regression predicting the "meaning of science" outcome. The table shows the estimates for two comparisons, method-accord and location-accord. The method definition is likely the most idealized of the three ways of understanding science, and consequently, it has the strongest relationship with general positive attitudes (see Gauchat 2010). To summarize the demographic effects in the method-accord comparison, whites, those with bachelor and graduate degrees, those with higher family incomes, and younger respondents are statistically more likely to demarcate science in terms of method. Those respondents living in the south are more likely to demarcate science in terms of its accordance with common sense and religion. Not surprisingly, church attendance has a strong negative effect, suggesting that those who frequently attend church feel that science should accord with common sense and religious teachings.

Notably, conservatives are also more likely to demarcate science in terms of its compatibility with common sense and religious doctrine than in terms of method, and this effect is statistically significant. The effect for moderates is also negative but not statistically significant. Consistent with previous results, the effect for Republicans is negative, but not statistically significant. However, the effect for independents is negative and statistically significant. The results for conservatives and independents indicate that these groups view science very differently than many scientists, philosophers of science, and sociologists of science view it. The accord definition of science may also be interpreted as a kind of "populist" view, in the sense that those who hold it might feel that scientific knowledge should not contradict everyday (i.e., non-esoteric) knowledge. These results are also noteworthy, because previous research has shown that those who adhere to the method definition possess more favorable attitudes toward science while those who adhere to the accord definition possess less favorable attitudes (Gauchat 2010). Thus, conservatives' and independents' cultural definitions of science may help to explain their discontent.

The effects in the location-accord comparison show a similar pattern as the method-accord comparison. Specifically, non-whites, more educated individuals, and higher income individuals are more likely to define science in terms of location rather than accord. The effect for church attendance is also strongly negative and statistically significant, but unlike the previous method-accord comparison, the negative effect of south is not significant for location-accord. The effects for the political variables on location-accord show some minor differences. Similar to the method-accord model, the effect for conservatives is statistically significant and negative, as expected. The effect for moderates is also negative, but the effect is weaker here than compared to the method-accord comparison and is not significant.. Republicans appear more likely to define science in terms of social location, but this effect is not statistically different from zero. Independents, again, seem more likely to define science in terms of accord, but the effect is weaker for this comparison and is not statistically significant.

To summarize, the unfavorable attitudes among conservatives are not attributable to disinterest in science relative to liberals, or less faith that science can provide opportunities for future generations. Instead, the differences between liberals and conservatives appear to center how these groups understand and define science as a source of cultural knowledge. Conservatives are far more likely to view scientific knowledge as supplementary to common sense and religious beliefs when compared to liberals. Moderates' disassociation with science, on the other hand, is not related to the way they understand it. Instead, this group is generally disenchanted with science in society, in terms of its ability to provide opportunities, its overall benefits vs. harms, and in terms of the changes science has produced in everyday life. Republicans are slightly less receptive to science's connection to the state compared with Democrats, but overall, consistent with the results of the 1972-2008 analysis in Chapter 3, the two major political parties in the U.S. exhibit similar attitudes toward science. Independents, in contrast, display consistently negative attitudes toward science, but these effects may stem from the material and cultural vulnerability of independents relative to other political groups (see Chapter 2, Figure 2). Comparing SES across the political groups examined here, independents have the least collective power (in terms of both average SES and levels of political organization), and therefore, are likely alienated from social institutions in general and not necessarily uniquely estranged from science.[5] These results generally support those shown in the previous chapter, and thus, provide further evidence for the politicization thesis.

The next section examines the effects of political ideology and party on attitudes about science-related policy. This analysis can illuminate whether or not the attitudes

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[5] In supplementary analyses, the effects of ideology and party were estimated with a predictor for institutional alienation added (a scale of distrust in the central institutions of society). When added to the models, the effect of independents on a variety of outcomes is effectively reduced to zero. However, the effects for conservatives and moderates remained statistically significant.

examined above translate into concrete differences in policy positions, or conversely, whether general attitudes toward science are purely abstract elements of the separate worldviews that underlie political ideologies.

Attitudes toward Science Related Policies

This section examines three science-related public policies: climate change, stem cell research, and genetically modified foods. For each "science policy," four separate attitudes are examined. First, respondents were asked how well they thought scientists understood each issue. Second, respondents were asked how much influence various groups, including scientists, should have in deciding what to do about the issue. Third, they were asked about how much scientists "would support what is best for the country as a whole versus what serves their own interests." Finally, respondents were asked about their support for a particular policy relevant to each issue. For example, they were asked how much they favored or opposed emissions standards on cars and trucks, federal funding of abortions, and whether they would eat genetically modified foods. These questions were only asked in the 2006 GSS, which accounts for the lower sample sizes in this analysis. For each policy, the four outcomes are estimated using ordinal logistic regression. Brant tests show that these models do not violate the parallel lines assumptions for the key political variables.

A growing body of research on public attitudes toward science has shown that public attitudes "in general" are not comparable with attitudes toward specific science policies (Evans and Durant 1995; Allum et al 2008; Gauchat 2010). Thus, this section provides an opportunity to test two versions of the politicization thesis: The soft politicization thesis would suggest that politicized public attitudes toward science would be reflected in abstract or general attitudes, but would not necessarily translate into attitudes related to specific science policies. The strong politicization thesis, on the other hand, would suggest, that political ideology affects both general attitudes as well as policy-specific attitudes. A third possibility is that the effect of ideology depends on the policy. For example, attitudes toward science related to climate change may be more politicized than attitudes toward genetically modified foods.

Table 5 shows the four models predicting attitudes toward global warming. The first model predicts the "understand" the (global warming) outcome; the second predicts the "influence policy" outcome; the third predicts the "national vs. self-interest" outcome; and the final model predicts support for a specific policy recommendation, i.e., "fuel standards." Remarkably, over 70% of Americans "strongly support" imposing fuel standards on auto-manufactures and another 21% support the standards. Looking at the results across all four dependent variables, women tend to have more favorable attitudes than men: they have greater faith in scientists' understanding, believe scientists should have greater influence over policy, and are more likely to believe scientists support the national interest over their self-interest. Women also seem to favor fuel standards, but the effect is not statistically significant. The effect for non-whites is negative in all four global warming models, but is only statistically significant in the first model. Interestingly, education appears to have no effect on attitudes toward science in relation to global warming. Neither education measured in years nor by degree shows consistent results across all four dependent variables, and none of the education variables are statistically significant. Younger individuals are also more likely to believe that scientists understand the causes of global warming compared to older respondents (see model 1);

however, age is not a significant predictor for any other outcome. The effect of church attendance is negative but not statistically significant in any of the models.

-- Table 5 about here --

The patterns for the political variables vary somewhat across the outcomes. The effect for conservatives is negative in all four models and statistically significant in three of the four outcomes. Specifically, conservatives display negative attitudes about scientists' role in the global warming debate when compared to liberals; yet, conservatives and liberals are not statistically different in their support for fuel standards. Interestingly, on these four variables, moderates show no consistent pattern and are not significantly different from liberals. The effect for Republicans is negative in all four models and is statistically significant in the "understand" and "fuel standards" models. In fact, in the model predicting the fuel standards outcome, the Republican coefficient is the only statistically significant effect among the political variables. Overall, attitudes toward science in the context of the climate change debate are politicized, and conservatives clearly have less trust in environmental scientists compared to liberals. Yet, support/opposition to fuel standards is not ideological, but partisan, with Republicans less likely to support these policies. For example, the predicted probability that a Republican "strongly supports" fuel standards is .63; the predicted probability for a Democrat is .79, holding other variables at their means. From another perspective, despite politicization of public views toward climate science, there is remarkably strong support for government regulation of fuel standards across ideology and party.

Table 6 shows the results for the stem cell research outcomes. As mentioned above, each model is predicted using ordinal logistic regression. Again, the first three outcomes are nearly identical to those relating to global warming discussed above. The last outcome represents whether or not respondents support federal funding for stem cell research. Overall, the public is in favor of federal funding of stem cell research, with approximately 73% supporting this policy. Similar to the results for global warming, females tend to have more positive attitudes about stem cell research than men. However, this effect is only statistically significant in the "influence policy" model, which suggests that women are more open than men to the influence of organized science on stem cell policy. This adds to a growing body of research which shows that women's attitudes toward science are no different than men's after controlling for differences in education (Gauchat 2008; Hayes and Tariq 2000), and that women are often more supportive of science in relation to specific policies (Gauchat 2010) – seen here for stem cells and in the previous analysis for global warming. Non-whites are more skeptical about scientists' understanding of public policies (see model 1). However, non-whites are also more likely to believe that scientists have the national interest and not self-interest in mind when making policy recommendations (see model 3). Once more, the effects for education are weak and not statistically significant; similarly, effects for income, region, and age are not statistically different from zero. Not surprisingly, church attendance has a strong negative effect on attitudes about science related to stem cell research, and those who frequently attend church are less likely to support federal funding of research.

-- Table 6 about here --

Interestingly, the effects of the political variables are relatively weak. The effect of conservatives is consistently negative across the models, but conservatives' attitudes about the science of stem cells (see models 1-3) never achieve statistically significance.

On the other hand, conservatives strongly oppose federal funding of stem cell research. This suggests that conservatives' opposition to federal funding are not necessarily linked to their attitudes about science. One interpretation of these results is that conservatives view stem cells research as a "moral issue" that is beyond the purview of the state and "scientific reason." The effect of moderates is not statistically different from zero in the first three models, but moderates are less likely to support federal research on stem cells. The effect for Republicans is also somewhat inconsistent. It is positive but not significant for the "understand" outcome, but negative and significant for the "influence policy" outcome. Yet, Republicans are not statistically different from Democrats in their support/opposition to stem cell research. The effect for independents is also consistently negative, but is only significant for the outcome related to support/opposition to federal funding. In summary, public attitudes about organized science's understanding, governance role, and "interests" in relation to stem cell research appear to be weakly affected by political ideology and party. Yet, public attitudes toward federal funding of stem cell research appear highly politicized.

Table 7 shows the results of four ordinal logistic regression models predicting attitudes toward genetically modified foods. This set of attitudes provides a unique test case, because genetically modified foods are a less salient controversy in the U.S. than global warming and stem cell research. In addition, public opinions about genetically modified foods are not ostensibly associated with any particular ideology or party, and may even be politically charged in the opposite way (i.e., a concern among liberals). Yet, if attitudes towards genetically modified foods exhibit patterns similar to those observed for attitudes toward global warming and stem cells, then it is possible that the politicization of science may have "spillover" effects into other areas of public policy. To put it another way, ideology and party may be viewed as shaping views about science across a range of issues; even those issues that mainstream political organizations and social movements have not embraced. Notably, the public is far less receptive to genetically modified foods in comparison to the other two policies. Only 15% don't care if their food is genetically modified, 53% are willing to eat these foods but would prefer not to, and 32% refuse to eat genetically modified food.

-- Table 7 about here --

With respect to genetically modified foods, the effects of the socio-demographic variables are generally weak. The effect for women is negative in all four models, but is only statistically significant in the model predicting one's willingness to consume genetically modified foods. Likewise, non-whites are not necessarily distrustful of the science behind genetically modified foods, but, by a statistically significant margin, they are less likely to prefer eating genetically modified foods than whites. Once more, none of the education variables, whether measured in years or by degree, has a statistically significant effect on these policy outcomes. Moreover, these education effects are highly inconsistent from one outcome variable to the next. On the other hand, family income has consistently positive effects on the four outcomes but it is statistically significant only for the "science vs. self-interest" outcome. The results show that younger respondents (those born in the 1980s and 1990s) are statistically more positive about scientists' understanding of this outcome and about their role in influencing policy regarding this outcome. Those living in the south, those born in the 1940s, and those who attend church frequently have common dispositions toward genetically modified foods. Whereas neither of these groups shows statistically significant attitudes towards the science of genetically modified foods, all three of them exhibit statistically significant preferences to not eat these foods themselves. Overall, these results point to the possibility of a high degree of public ignorance toward genetically modified foods compared to the other two science policies. Generally, there are few sociodemographic determinants of attitudes for or against the science of genetically modified foods, but several strong sociodemographic predictors of whether respondents would eat these foods themselves. This suggests that differential media publicity about certain science-related topics may be a factor in whether people form coherent attitudes about the science of these outcomes, and that in the absence of such publicity, those who have relatively vulnerable positions in society (e.g., women, non-whites, southerners) may express greater aversion to specific policies.

The results for the political ideology and party variables show a somewhat different pattrern. The effects for conservatives are consistently negative; however, these negative attitudes only achieve statistical significance for the "national vs. self-interest" outcome. Nevertheless, conservatives do not have significantly different attitudes about eating genetically modified foods compared to liberals. Moderates also appear generally less trusting than liberals about the science behind genetically modified foods, and they show statistically different attitudes on two outcomes – influence policy and national vs. self-interest. Even so, moderates, like conservatives, are not any less likely to eat these types of foods. Neither Republicans nor independents show statistically significant differences from Democrats in attitudes toward either the science of genetically modified foods or their preference to eating these foods themselves.

To summarize, attitudes toward science related to specific policies appear to be politicized, but the patterns are not consistent across policies. Climate science is unambiguously politicized: conservatives are less favorable toward climate science than liberals (although there are no significant differences among moderates). Yet, these concerns do not translate into stronger opposition to fuel standards policy among conservatives. For stem cells, the opposite is true; conservatives appear somewhat less receptive to the science in this area than liberals, but the effects are weak and never achieve statistical significance. On the other hand, both conservatives and moderates are significantly more likely to oppose government funding of stem cell research than liberals. At the same time, conservatives and moderates also have significantly less favorable attitudes than liberals toward the science of genetically modified foods, but show no statistically significant differences in their unwillingness to eat these kinds of foods. Altogether, political ideology, particularly identifying as conservative, does seem to have broad effects on attitudes toward science, which provides some support for the strong politicization thesis, but these broad effects vary across issues and are weak.[6]

DISCUSSION

This chapter has accomplished two main purposes. First, using extensive items related science offered in the "science module" of the 2006-2008 GSS, this analysis largely confirms the general findings of the previous chapter. The previous chapter showed that

[6] A supplementary analysis combined the first three outcomes related to science for each policy into a single scale (i.e., the "understand," "influence," and "interest" outcomes). This analysis examined whether ideology and party affected the overall credibility of science related to global warming, stem cells, and genetically modified foods. This analysis showed that conservative had a negative and statistically significant effect on the credibility of science for all three issues. The strongest effect observed was in the model predicting the credibility of science in relation to global warming.

attitudes toward science were associated with political ideology and that this association was growing over time. Specifically, conservatives were less trusting of organized science and their levels of trust were declining over the period. This chapter confirms that conservatives display less favorable attitudes toward science next to liberals. The 1974-2008 analysis also revealed that moderates showed unfavorable attitudes toward science but; unlike the effect for conservative, the effect for moderate was constant over the period. The results in this chapter also show that moderates, like conservatives, have less favorable attitudes toward science on a range of topics. This chapter also confirms that political party does not have a consistent effect on public attitudes toward science. The second goal of this analysis was to clarify the relationship between attitudes toward ideology and science. That is, given the battery of outcomes examined here, are there identifiable patterns that indicate what aspects of organized science concern conservatives, moderates, and independents, respectively. Towards this end, conservatives' concerns with science are broad; however, they seem most acute in relation to the nexus between science, government, and political authority. Conservatives appear to have more reservations about the role of organized science in public policy and are less supportive of federal funding of scientific research, compared to liberals. Moderates are also skeptical about the relationship between science and the state, but are also less likely to view science as beneficial to society as a whole (i.e., they view organized science as harmful and threatening). Independents, on the other hand, appear generally alienated from central social institutions and not exclusively disenchanted with organized science.

The results also suggest that conservatives' concerns with science may stem from their unique view of "what science is" and "what it should be." Conservatives are more likely than other political groups to view science as a form of cultural knowledge among other essential forms such as traditional religious teachings and common sense. These findings are in line with Hofstadter's (1970) observations about conservatives in the U.S. He claimed that large segments of the public view organized science as an esoteric professional class that threatened populist American values of egalitarianism, individualism, and pragmatism by claiming to possess superior modes of specialized knowledge.

These findings also cry out for a more detailed conceptual discussion of ideology than has been offered thus far. In the everyday sense, ideology refers to a political divide between the amorphous left and right. However, a sociological analysis requires a deeper and more intricate definition of the concept of ideology. The classic conceptualization of ideology, rooted in Marxist and neo-Marxists theory, describes a set of connected ideas and beliefs that act to legitimate an existing or desired arrangement of power, authority, wealth and status in a society. From this perspective, left and right ideologies correspond with the interests of labor and capital, respectively, although, neo-Marxists have amended this simplistic assumption. Mannheim (1936), on the other hand, argues that ideologies are essentially worldviews or thought systems associated with specific socio-historical groups (e.g., economic class, cohorts, and status groups). Although the concept has lost traction to ideas such as "identity" and "framing" since the cultural turn in sociology (Jasper 2005; Weakliem 2005), contemporary sociologists use ideology more generally to refer to "a rationalized set of images, claims, and values that are a useful tool in political mobilization and argumentation" (Jasper 2005: 124). Of course, adjudicating between these definitions is well beyond the scope here. Instead, I will present two general views that are prominent in contemporary political sociology (van den Berg and Janoski 2005), and consistent with those ideas presented in Chapter 2.

Habermas's and Bourdieu's conceptions of ideology provide distinct theoretical perspectives for interpreting the results of this chapter. In essence, Habermas (1989) maintains a Marxist conceptualization of ideology – a cognitive scheme that masks the power relations of society – but fuses it with the Weberian notion of "instrumental rationality." Habermas thus rejects the vulgar Marxist position that the political right and left correspond to the interests of labor and capital, while maintaining the view that ideology operates to disguise domination by elite groups. Alternatively, Habermas argues that ideologies are fomented by the dominant classes to legitimate power in the "system" – the domain of large bureaucracies and global markets in which institutional elites compete for power. As mentioned in Chapter 2, Habermas emphasizes a second layer of analysis apart from the system, the lifeworld, or public sphere, in which actors coordinate their activities and interact in everyday life. "Lifeworld" therefore refers to "the background resources, contexts, and dimensions of social action that enable actors to cooperate on the basis of mutual understanding: shared cultural systems of meaning, institutional orders that stabilize patterns of action, and personality structures acquired in family, church, neighborhood, and school" (Stanford 2010). Habermas sees the idea of instrumental rationality, the legitimating force of the "modern" system, as inherently contradictory, leading to a bifurcation, between markets, which are rational systems for allocating resources based on libertarian values; and scientific rationality and expertise, which allocates political power and prestige according to meritocratic values and "superior knowledge" (i.e., a Weberian ideal-type bureaucracy). According to this account, the ideological divisions in the lifeworld and public sphere reflect these divergent visions of "rationality," with the political right supporting libertarian values of "free markets" and "natural" property rights, and the left supporting administrative power, technocratic authority, and expertise. Overall, this perspective is somewhat useful for understanding these data and the evident tension between conservative ideology and organized science as well as the surplus trust among liberals. Yet, this approach does not as easily explain the worldviews of moderates unless this cleavage was assumed a "residual" category that adheres to neither ideology strongly (or has rejected the contradictory views of rationality). However, the data suggest that moderates are far closer to conservatives than liberals in relation to their attitudes toward science (a situation reinforced by the analysis in Chapter 2). Another, more general problem with this approach is the idea that the worldviews of conservatives and liberals boil down to a conflict over the meaning of instrumental rationality and legitimate authority, a claim for which there is little direct empirical evidence.

The difficultly of explaining moderates' views toward science is less prominent in Bourdieu's field theory. Recalling Chapter 2, Bourdieu's concept of habitus overlaps with the various definitions of ideology provided above, particularly his idea of *doxa* – representing the taken-for-granted assumptions in society or in a field (e.g., science and technology will create opportunities for the future). In short, Bourdieu's view emphasizes the conflicts between status groups. Bourdieu's field theory, somewhat problematically, assumes that the allocations of social resources, material and symbolic, produce embodied orientations toward the world (i.e., status groups). That is, structural position and ideology are mutually reinforcing: socialization provides a worldview based on one's structural position, and this worldview then shapes one's structural position (i.e., what one defines as achievement, valuable, attainable/unattainable, etc.). From this perspective, there should be a direct correlation between one's stock of social resources and one's evaluations of the social world including organized science. The complexity of field theory lies in the variety of social resources that Bourdieu identifies – symbolic capital, cultural capital, scientific capital, financial capital, political capital. Thus, as Chapter 2 showed, political ideology does vary according to compositions of scientific cultural capital relative to financial capital. According to Bourdieu, the conflicting views on science observed above are simply a reflection of habitus: a status group culturally valuing those resources available to it and devaluing those resources unavailable to it. Yet, there remains a residual uneasiness about how little this perspective offers theoretically: we are forced to suppose that the unmeasured concept of habitus, which overlaps considerably with conventional concepts like worldview and ideology, produces beliefs and attitudes about science. In other words, field theory provides an interesting exploratory toolkit for examining cultural phenomena such as attitudes toward science, but does little to provide concrete explanations about how a habitus develops or how status groups emerge in the first place. The critical theory and status group approaches will be revisited in the final chapter.

The next chapter examines the relationship between ideology and attitudes toward science cross-culturally. The purpose of this analysis is to examine whether or not the U.S. is uniquely politicized, or if these patterns are present in other advanced democratic societies. That is, do conservatives and moderates display concerns about science in other comparable societies, or, are other cultures politically charged in an opposite way (eg., liberals and left groups are more disenchanted)? These questions are examined using data from the most recent 2005 wave of the World Values Survey.

Table 1. Logistic Regression Estimates of Confidence in Institutions, 2006-2008 GSS

	Science (Model 1)		Major Companies (Model 2)		Medicine (Model 3)		Education (Model 4)	
Female	-0.349***	(0.077)	-0.098	(0.100)	-0.118	(0.076)	0.046	(0.083)
Non-White	-0.526***	(0.099)	0.015	(0.130)	-0.004	(0.095)	0.262**	(0.100)
Education (years)	0.038	(0.025)	0.017	(0.034)	0.003	(0.024)	-0.019	(0.025)
High School	0.024	(0.156)	0.114	(0.210)	-0.333*	(0.147)	-0.661***	(0.151)
Bachelor	0.331	(0.233)	0.314	(0.306)	0.003	(0.221)	-0.772***	(0.235)
Graduate	0.516	(0.290)	0.204	(0.382)	-0.054	(0.276)	-0.690*	(0.297)
Family Income	0.052	(0.045)	0.128*	(0.053)	0.026	(0.045)	-0.073	(0.053)
South	-0.048	(0.088)	-0.153	(0.116)	-0.148	(0.087)	-0.215*	(0.095)
Born 1940-1949	0.090	(0.149)	-0.319	(0.186)	-0.378**	(0.142)	-0.449**	(0.154)
Born 1950-1959	-0.181	(0.138)	-0.540**	(0.177)	-0.456***	(0.131)	-0.619***	(0.143)
Born 1960-1969	0.209	(0.137)	-0.266	(0.169)	-0.408**	(0.131)	-0.430**	(0.141)
Born 1970-1979	0.248	(0.139)	-0.172	(0.171)	-0.249	(0.132)	-0.283*	(0.141)
Born 1980-1990	0.400**	(0.149)	0.103	(0.179)	0.354*	(0.141)	0.074	(0.148)
Church Attendance	-0.070***	(0.015)	-0.013	(0.019)	0.009	(0.014)	0.029	(0.015)
Conservative	-0.363**	(0.113)	0.344*	(0.149)	-0.039	(0.109)	-0.046	(0.119)
Moderate	-0.163	(0.099)	0.183	(0.137)	-0.079	(0.097)	0.096	(0.106)
Republican	-0.004	(0.101)	0.421***	(0.127)	0.198*	(0.098)	0.139	(0.107)
Independent	-0.149	(0.109)	-0.186	(0.156)	-0.074	(0.107)	-0.030	(0.115)
Log likelihood	-1975.101		-1362.044		-2071.646		-1815.193	
Cox-Snell R^2	.062		.027		.028		.045	
N	3053		3128		3174		3173	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$

Table 2. Effects of Political Variables on Scientific Cultural Capital in 2006-2008 GSS
Panel A. Scientific Cultural Capital, General Attitudes, and Textbook Knowledge

	Scientific Cultural Capital (Model 1)		General Attitudes (Model 2)		Textbook Knowledge (Model 3)	
Female	-0.152***	(0.020)	-0.044	(0.023)	-0.127***	(0.013)
Non-White	-0.290***	(0.025)	-0.242***	(0.029)	-0.283***	(0.017)
Education (years)	0.088***	(0.007)	0.033***	(0.008)	0.039***	(0.005)
High School	0.030	(0.041)	0.046	(0.046)	0.106***	(0.027)
Bachelor	0.344***	(0.062)	0.162*	(0.070)	0.201***	(0.041)
Graduate	0.395***	(0.077)	0.249**	(0.087)	0.252***	(0.051)
Family Income	0.051***	(0.012)	0.042**	(0.014)	0.030***	(0.008)
South	0.014	(0.022)	-0.009	(0.025)	-0.020	(0.015)
Born 1940-1949	0.196***	(0.038)	0.085	(0.043)	0.179***	(0.025)
Born 1950-1959	0.259***	(0.035)	0.081*	(0.040)	0.244***	(0.023)
Born 1960-1969	0.251***	(0.035)	0.091*	(0.040)	0.226***	(0.024)
Born 1970-1979	0.254***	(0.036)	0.007	(0.041)	0.246***	(0.024)
Born 1980-1990	0.403***	(0.038)	0.120**	(0.044)	0.331***	(0.026)
Church Attendance	-0.019***	(0.004)	-0.022***	(0.004)	-0.016***	(0.002)
Conservative	-0.147***	(0.029)	-0.130***	(0.033)	-0.048*	(0.019)
Moderate	-0.192***	(0.026)	-0.138***	(0.029)	-0.085***	(0.017)
Republican	0.049	(0.026)	0.016	(0.029)	0.007	(0.017)
Independent	-0.052	(0.028)	-0.063	(0.032)	-0.045*	(0.019)
Adjusted R^2	.443		.138		.366	
N	3145		3165		3225	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. Ordinary Least Squares (OLS) regression used to predict the effects for each model.
* $p < .10$; ** $p < .05$; *** $p < .001$.

Table 2. Effects of Political Variables on Scientific Cultural Capital, 2006-2008 GSS
Panel B. College Science Courses and Perceived Knowledge

	College Science Courses (Model 1)		Perceived Knowledge (Model 2)	
Female	-0.261***	(0.067)	-0.385***	(0.093)
Non-White	-0.092	(0.087)	-0.034	(0.119)
Education (years)			0.080*	(0.033)
High School	1.357***	(0.147)	0.302	(0.190)
Bachelor	3.126***	(0.158)	0.599*	(0.287)
Graduate	3.483***	(0.174)	0.665	(0.364)
Family Income	0.126***	(0.035)	0.085*	(0.043)
South	-0.093	(0.076)	0.259*	(0.104)
Born 1940-1949	0.276*	(0.134)	0.515**	(0.172)
Born 1950-1959	0.665***	(0.123)	0.485**	(0.157)
Born 1960-1969	0.434***	(0.125)	0.701***	(0.159)
Born 1970-1979	0.603***	(0.125)	0.659***	(0.163)
Born 1980-1990	1.026***	(0.133)	1.257***	(0.182)
Church Attendance	-0.012	(0.013)	-0.002	(0.017)
Conservative	-0.396***	(0.099)	-0.717***	(0.134)
Moderate	-0.493***	(0.086)	-0.710***	(0.121)
Republican	0.320***	(0.088)	0.264*	(0.120)
Independent	0.037	(0.099)	-0.019	(0.127)
Log likelihood	-4947.963		-2263.953	
Cox-Snell R^2	.290		.126	
N	3131		1768	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. Model 1 is predicted using negative binomial regression. Model 2 is predicted using ordinal logistic regression.

* $p < .10$; ** $p < .05$; *** $p < .001$.

Table 3. Ordinal Logistic Estimates of Attitudes toward Science, 2006-2008 GSS

	Benefits vs. Harms (Model 1)		Changes Life Too Fast (Model 2)		Supported by Federal Gov. (Model 3)		Too Speculative & Theoretical (Model 4)	
Female	-0.141	(0.073)	-0.056	(0.069)	-0.205**	(0.074)	-0.041	(0.096)
Non-White	-0.644***	(0.091)	-0.593***	(0.089)	-0.200*	(0.094)	-0.741***	(0.124)
Education (years)	0.080**	(0.026)	0.075**	(0.024)	0.028	(0.026)	0.057	(0.034)
High School	0.194	(0.145)	0.014	(0.141)	0.044	(0.152)	0.143	(0.196)
Bachelor	0.504*	(0.223)	0.089	(0.212)	0.280	(0.227)	0.588*	(0.294)
Graduate	0.659*	(0.283)	0.168	(0.266)	0.654*	(0.283)	0.950*	(0.370)
Family Income	0.138**	(0.048)	0.157***	(0.042)	0.037	(0.044)	0.054	(0.044)
South	-0.053	(0.082)	0.044	(0.077)	-0.050	(0.082)	-0.021	(0.106)
Born 1940-1949	0.080	(0.141)	0.275*	(0.130)	0.245	(0.141)	0.175	(0.181)
Born 1950-1959	0.146	(0.128)	0.174	(0.119)	0.228	(0.130)	0.313	(0.168)
Born 1960-1969	0.060	(0.130)	0.202	(0.121)	0.221	(0.131)	0.341*	(0.166)
Born 1970-1979	-0.135	(0.132)	0.241*	(0.122)	0.032	(0.133)	0.142	(0.171)
Born 1980-1990	-0.231	(0.139)	0.577***	(0.133)	0.256	(0.142)	0.534**	(0.185)
Church Attendance	-0.039**	(0.014)	-0.044***	(0.013)	-0.057***	(0.014)	-0.064***	(0.018)
Conservative	-0.169	(0.104)	-0.207*	(0.101)	-0.264*	(0.106)	-0.572***	(0.139)
Moderate	-0.277**	(0.093)	-0.244**	(0.090)	-0.206*	(0.094)	-0.550***	(0.126)
Republican	0.152	(0.092)	0.072	(0.088)	-0.159	(0.094)	-0.147	(0.124)
Independent	-0.261*	(0.102)	-0.141	(0.098)	-0.132	(0.105)	-0.144	(0.133)
Log likelihood	-2959.133		-3504.022		-2760.832		-1796.443	
Cox-Snell R^2	.112		.073		.042		.120	
N	2993		3151		3125		1685	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$

Table 4. Effects of Political Variables on Other Attitudes toward Science, 2006-2008 GSS

	Interest in Science		Science & Next Generation		Meaning of Science Method		Meaning of Science Location	
Female	-0.154***	(0.046)	0.135	(0.070)	-0.009	(0.129)	-0.126	(0.129)
Non-White	0.002	(0.056)	-0.098	(0.089)	-1.168***	(0.173)	-0.400*	(0.158)
Education (years)	0.036*	(0.017)	0.008	(0.024)	0.033	(0.027)	0.075**	(0.025)
High School	-0.012	(0.080)	0.236	(0.140)	-0.043	(0.272)	-0.388	(0.243)
Bachelor	-0.074	(0.123)	0.381	(0.215)	0.784*	(0.371)	-0.291	(0.349)
Graduate	-0.247	(0.153)	0.562*	(0.265)	1.288**	(0.465)	0.264	(0.443)
Family Income	0.208*	(0.091)	-0.003	(0.043)	0.283***	(0.063)	0.161*	(0.067)
South	0.007	(0.045)	0.140	(0.078)	-0.406**	(0.145)	-0.106	(0.140)
Born 1940-1949	-0.029	(0.077)	0.198	(0.133)	0.078	(0.252)	-0.240	(0.235)
Born 1950-1959	-0.015	(0.071)	0.090	(0.121)	0.408	(0.226)	-0.096	(0.214)
Born 1960-1969	-0.109	(0.073)	0.038	(0.123)	0.555*	(0.227)	-0.341	(0.223)
Born 1970-1979	-0.173*	(0.073)	0.175	(0.125)	0.730**	(0.234)	-0.033	(0.225)
Born 1980-1990	-0.071	(0.078)	0.306*	(0.134)	0.697**	(0.254)	-0.002	(0.242)
Church Attendance	-0.014	(0.008)	-0.021	(0.013)	-0.120***	(0.024)	-0.123***	(0.024)
Conservative	-0.029	(0.058)	-0.073	(0.107)	-0.543**	(0.183)	-0.477**	(0.183)
Moderate	-0.104*	(0.052)	-0.278**	(0.096)	-0.291	(0.164)	-0.009	(0.163)
Republican	-0.066	(0.051)	0.174	(0.095)	-0.066	(0.169)	0.152	(0.167)
Independent	-0.163**	(0.060)	-0.129	(0.107)	-0.417*	(0.177)	-0.231	(0.173)
Log likelihood	-1585.309		-2985.785		-1662.317			
Cox-Snell R^2	.066				.178			
N	1429		3221		1661			
Estimation	OLS		Generalized Ordinal		Multinomial Logistic			

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$.

Table 5. Ordinal Logistic Estimates of Attitudes toward Global Warming, 2006 GSS

	Understand Global Warming (Model 1)		Influence Policy (Model 2)		National vs. Self Interest (Model 3)		Fuel Standards (Model 4)	
Female	0.510***	(0.134)	0.473***	(0.139)	0.449***	(0.132)	0.200	(0.154)
Non-White	-0.476**	(0.176)	-0.145	(0.183)	-0.156	(0.171)	-0.326	(0.198)
Education (years)	0.026	(0.046)	0.053	(0.047)	-0.015	(0.045)	-0.158	(0.321)
High School	0.131	(0.283)	0.045	(0.284)	0.045	(0.269)	-0.504	(0.483)
Bachelor	0.214	(0.416)	-0.433	(0.424)	0.252	(0.406)	-0.122	(0.621)
Graduate	0.642	(0.519)	0.404	(0.539)	0.507	(0.509)	-0.111	(0.171)
Family Income	0.118	(0.063)	0.017	(0.064)	0.073	(0.062)	-0.061	(0.070)
South	-0.093	(0.148)	-0.114	(0.154)	-0.233	(0.148)	-0.111	(0.171)
Born 1940-1949	0.199	(0.246)	0.061	(0.257)	0.086	(0.246)	-0.053	(0.283)
Born 1950-1959	0.489*	(0.224)	0.165	(0.240)	0.096	(0.227)	0.115	(0.265)
Born 1960-1969	0.391	(0.228)	0.318	(0.244)	0.310	(0.235)	0.140	(0.272)
Born 1970-1979	0.784**	(0.239)	0.270	(0.251)	0.326	(0.235)	-0.078	(0.268)
Born 1980-1990	0.656**	(0.251)	0.176	(0.267)	0.385	(0.253)	0.079	(0.295)
Church Attendance	-0.029	(0.025)	-0.035	(0.026)	-0.042	(0.025)	-0.006	(0.029)
Conservative	-0.538**	(0.191)	-0.611**	(0.201)	-0.605**	(0.187)	-0.193	(0.227)
Moderate	0.232	(0.176)	-0.208	(0.182)	0.055	(0.170)	-0.214	(0.210)
Republican	-0.358*	(0.173)	-0.346	(0.179)	-0.301	(0.169)	-0.584**	(0.198)
Independent	-0.456*	(0.183)	-0.336	(0.191)	-0.212	(0.183)	-0.117	(0.219)
Log likelihood	-1037.059		-1061.026		-2760.832		-662.787	
Cox-Snell R^2	.106		.039		.042		.034	
N	857		854		852		877	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$

Table 6. Effects of Demographic and Political Variables on Attitudes toward Stem Cells Research, 2006 GSS

	Understand Stem Cells (Model 1)		Influence Policy (Model 2)		National vs. Self Interest (Model 3)		Government Funded Research (Model 4)	
Female	0.171	(0.137)	0.350**	(0.136)	0.144	(0.129)	0.044	(0.137)
Non-White	-0.359*	(0.179)	-0.028	(0.178)	0.400*	(0.171)	-0.189	(0.180)
Education (years)	0.061	(0.048)	0.013	(0.047)	-0.015	(0.045)	0.030	(0.048)
High School	-0.277	(0.296)	-0.185	(0.286)	-0.054	(0.274)	-0.145	(0.285)
Bachelor	-0.375	(0.437)	-0.338	(0.425)	-0.024	(0.407)	-0.014	(0.426)
Graduate	-0.104	(0.549)	-0.046	(0.527)	0.044	(0.507)	0.642	(0.541)
Family Income	0.054	(0.065)	-0.001	(0.063)	-0.057	(0.059)	0.037	(0.065)
South	-0.187	(0.152)	0.129	(0.153)	-0.043	(0.147)	-0.021	(0.156)
Born 1940-1949	-0.349	(0.253)	0.011	(0.252)	-0.342	(0.246)	0.202	(0.263)
Born 1950-1959	-0.080	(0.241)	-0.362	(0.233)	-0.164	(0.225)	-0.141	(0.240)
Born 1960-1969	-0.200	(0.245)	-0.298	(0.238)	-0.123	(0.230)	-0.501*	(0.242)
Born 1970-1979	-0.289	(0.247)	-0.249	(0.245)	-0.319	(0.235)	-0.407	(0.246)
Born 1980-1990	-0.100	(0.269)	-0.364	(0.261)	-0.421	(0.246)	-0.560*	(0.261)
Church Attendance	-0.095***	(0.026)	-0.070**	(0.026)	-0.078**	(0.024)	-0.222***	(0.027)
Conservative	-0.316	(0.195)	-0.295	(0.193)	-0.267	(0.184)	-1.035***	(0.200)
Moderate	-0.053	(0.180)	0.169	(0.174)	0.042	(0.168)	-0.405*	(0.179)
Republican	0.075	(0.176)	-0.404*	(0.176)	-0.180	(0.169)	-0.334	(0.175)
Independent	-0.100	(0.189)	-0.308	(0.186)	-0.199	(0.181)	-0.439*	(0.189)
Log likelihood	-940.691		-835.8426		-1129.837		-934.577	
Cox-Snell R^2	.051		.056		.044		.201	
N	839		849		850		829	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$

Table 7. Ordinal Logistic Estimates of Attitudes toward Genetically Modified Foods, 2006 GSS

	Understand Risks (Model 1)		Influence Policy (Model 2)		National vs. Self-interest (Model 3)		Eat Genetically Modified Foods (Model 4)	
Female	-0.050	(0.127)	-0.046	(0.133)	-0.152	(0.127)	-0.578***	(0.136)
Non-White	0.030	(0.163)	-0.208	(0.166)	-0.160	(0.160)	-0.647***	(0.167)
Education (years)	0.078	(0.046)	-0.011	(0.047)	0.072	(0.044)	0.037	(0.048)
High School	-0.020	(0.269)	0.138	(0.278)	-0.153	(0.265)	0.361	(0.281)
Bachelor	0.025	(0.400)	0.443	(0.414)	-0.144	(0.390)	0.533	(0.421)
Graduate	-0.173	(0.498)	0.402	(0.519)	-0.679	(0.484)	0.329	(0.521)
Family Income	0.057	(0.059)	0.055	(0.061)	0.125*	(0.059)	0.032	(0.064)
South	0.004	(0.142)	-0.203	(0.147)	-0.070	(0.143)	-0.477**	(0.152)
Born 1940-1949	-0.282	(0.245)	0.045	(0.255)	-0.362	(0.244)	-0.527*	(0.262)
Born 1950-1959	0.358	(0.225)	0.238	(0.231)	0.038	(0.224)	-0.341	(0.243)
Born 1960-1969	0.054	(0.219)	-0.217	(0.227)	-0.083	(0.223)	-0.226	(0.237)
Born 1970-1979	0.235	(0.226)	0.060	(0.233)	-0.142	(0.228)	-0.201	(0.243)
Born 1980-1990	0.573*	(0.248)	0.659*	(0.266)	0.357	(0.253)	0.188	(0.266)
Church Attendance	-0.009	(0.023)	-0.047	(0.024)	-0.017	(0.023)	-0.052*	(0.025)
Conservative	-0.241	(0.183)	-0.128	(0.190)	-0.518**	(0.185)	-0.074	(0.195)
Moderate	-0.167	(0.164)	-0.332*	(0.168)	-0.482**	(0.163)	0.033	(0.172)
Republican	0.219	(0.167)	0.040	(0.172)	0.257	(0.167)	0.055	(0.176)
Independent	-0.118	(0.180)	-0.097	(0.184)	-0.101	(0.175)	-0.199	(0.188)
Log likelihood	-1125.407		-857.183		-1132.548		-829.446	
Cox-Snell R^2	.041		.043		.049		.092	
N	862		870		869		880	

Note: Standard Errors in parentheses. Birth year 1939 and earlier is the reference category for born. Liberal is the reference category for political ideology. Democrat is the reference category for political party. * $p < .10$; ** $p < .05$; *** $p < .001$

CHAPTER 5: BEYOND LEFT AND RIGHT: ATTITUDES TOWARD SCIENCE AND POLITICS IN DEVELOPED COUNTRIES

INTRODUCTION

The last chapter ended with a discussion of the thorny concept of ideology. This complexity is amplified in any analysis of cross-national patterns. For example, ideas like left/right and liberal/conservative are not consistent when comparing the U.S. to other "developed" nations. In fact, since political sociologists have abandoned the idea that ideology reflects social class positions, there is little theoretical justification for conceiving of ideology as anything more than a set of values and beliefs, or even an identity (Laclau and Mouffe 1985; Jasper 2005; Torfing 2005). Yet, the left/right and liberal/conservative distinction remains a consequential political cleavage in the U.S., as evidenced in previous chapters that show statistical differences between liberals, moderates, and conservatives' attitudes toward science Thus, the current chapter extends the analysis of public attitudes toward science to other economically developed countries in order to examine whether or not the ideological differences in U.S. are unique, or conversely, whether economically developed countries exhibit parallel patterns. In the current chapter, political party is excluded from the analysis for a number of reasons. First, even in economically developed countries, the various political systems are so different that comparisons by political party become unwieldy, particularly in terms of measurement. Second, the ideological stance of many European parties is open to debate. In fact, some argue that the U.S. party system is unique compared to others in the world in not having a "liberal" party. Overall, this chapter examines the effects of multiple dimensions of political values on public attitudes toward science using the 2005-2008 wave of the World Values Survey.

There have been very few studies of public dispositions toward science using international data. In the U.S., the National Science Foundation (NSF) has dominated research on public opinion toward science, promoting a particular perspective that links favorable attitudes toward science with public knowledge of science (i.e., the "deficit" model). This knowledge-attitudes perspective has fostered mistrust among social scientists, because it appears self-serving – increased funding to the NSF can simultaneously achieve greater public understanding and acceptance of organized science, both assumed essential to modern democratic institutions. For instance, the NSF sponsored *Science Indicators Survey*, also referred to as the Public Attitudes toward Science and Technology Survey (PATSAT) 1979-2001, provided copious measures of public knowledge and attitudes, the two key factors in the knowledge-attitudes perspective, but did not include adequate demographic controls or socio-cultural variables. For example, income was not included in the survey until 2000. Accordingly, few quantitative studies have examined the political or socio-cultural factors related to science and technology in the public sphere. Furthermore, given that political and cultural factors are theoretically tangential to the knowledge-attitudes perspective (i.e., the relationship between knowledge and attitudes transcends and "explains away" culture and politics variation), research in this area did not demand collection or analysis of cross-national data. In the UK, research on science and technology in the public sphere was more independent from national funding agencies, prompting its own specialty journal: *Public Understanding of Science.* Although, this scholarship in the UK produced considerable skepticism towards survey research on public attitudes toward science (Wynne 1995), it also created a dialogue that encouraged improved survey designs, methodologies, and theoretical perspectives (see Bauer, Allum, and Miller 2007; Gauchat 2010). The consistent use of European data sets (e.g., Eurobarometer) has also facilitated discussion of political and cultural factors related to the cultural authority of science. However, relatively few studies have explicitly examined how well theoretical models explain cross-cultural variation in public attitudes toward science.

Allum et al.. (2008) provide the most sophisticated and comprehensive study of cross-cultural variation in attitudes toward science, focusing on whether or not the knowledge-attitudes perspective explains public attitudes outside the U.S. and UK. In a meta-analysis of over 200 nationally representative surveys conducted in 40 countries from 1989 to 2003, Allum et al. (2008) found a weak positive correlation between public knowledge of science and favorable attitudes. Nonetheless, Allum et al. acknowledge the theoretical limitations of the knowledge-attitudes perspective and recommend: "Understanding the social and psychological mechanisms that generate the associations we observe in this analysis must surely be an important future avenue of research in public understanding of science" (2008:52). Hayes and Tariq (2000) used cross-national data to test the hypothesis that unfavorable attitudes toward science among women result from their greater disinterest and ignorance of scientific developments. Using data from the 1993 International Social Survey Programme (ISSP), they found that outside of the U.S., disparities in male-female educational backgrounds and religious beliefs explained differences in attitudes toward science but not variations in scientific knowledge. Pardo and Calvo (2002) used the 1992 Eurobarometer to examine the soundness of longstanding instruments used to access the knowledge-attitudes perspective. They found that many of the instruments used to survey research were fuzzy and, therefore, the empirical support for the knowledge-attitudes model based on published results was extremely limited. They recommended the development of new theoretical perspectives to inform the design of questionnaires and "the combined use of statistical exploratory techniques and qualitative analysis in the interpretation of the data" (Pardo and Calvo 2002:155). This advice was heeded in 2006 when the NSF revamped the *Science Indicators Survey* in the U.S. and integrated into the GSS (see previous chapters). However, these developments have yet to develop: a) a comprehensive shift toward social, political and cultural explanations of public attitudes toward science, or b) a renewed focus on international datasets.

The current study addresses these major shortcomings of previous research on the cultural authority of science by (1) exploring the political and socio-cultural factors that relate to public attitudes toward science, and (2) by examining these factors cross-nationally. In addition, this chapter builds on the previous three chapters by focusing on the relationship between political ideology and public attitudes toward science. Using data from the 2005-2008 wave of the WVS, this chapter explores numerous political and cultural explanations of public attitudes toward science. These explanations are discussed in detail in the section below.

THEORETICAL BACKGROUND

Building on previous chapters, this study explores and theoretically expands the *politicization thesis*. Broadly, the *politicization thesis* refers to the idea that public attitudes toward science will correspond with political cleavages and, particularly, political ideology. Mooney's (2009) account of the politicization thesis is specific to the post-World War II U.S. In essence, Mooney proposes that an "extreme right-wing" (e.g., movement conservatism, the religious right, tea party) has emerged in U.S. politics that is a reaction to the sweeping social and cultural upheavals of the 1950s and 1960s. Although Mooney acknowledges that extreme elements have always existed "on the fringe" of conservative politics (see also Hofstadter 1965, 1970), he argues that the current strand enjoys unparalleled power in the political right and often directs and defines the "conservative identity" in political discourse (see also Krugman 2009; McCarty, Poole, and Rosenthal 2006).

Although Mooney does not claim to offer a coherent sociological theory, there are interesting theoretical implications worth exploring, most notably, the idea that ideological extremism has forced conservatives in the U.S. to confront the cultural authority of science, principally, in relation to the policy apparatus of the state. STS research has shown that since World War II, organized science has grown increasingly independent from the military-industrial sector and, due to its ability to legitimate policy, moved into more controversial spheres such as economic security, social policy, environmental policy, stem cell research, and psycho-pharmaceuticals (Jassanoff 2004; Moore K. 2008). Consequently, in the public sphere organized science belongs to a symbolic "chain of equivalences" that connects it with the state's policy apparatus, political institutions, technocracy, and social engineering, which all represent adversaries of the contemporary conservative movement in the U.S. (Krugman 2009; Laclau 2005; Mouffe 2005; McCarty, Poole, and Rosenthal 2006).

Yet, given the historical idiosyncrasies of Mooney's claims, it is unclear whether the ideological patterns observed in the U.S. will persist in other highly developed countries. Beyond the idiosyncratic meanings of liberal/conservative and left/right in different national contexts, scholars have also pointed to the size and strength of the religious right in U.S. politics (Hofstadter 1970), and the absence of a similar political cleavage in other highly developed countries. Moreover, mainstream voters in the so-called "Red states" increasingly identify with conservative positions on social, cultural, and religious issues (Frank 2004). Krugman (2009) and McCarty, Poole, and Rosenthal (2006) have also pointed to a marked political polarization among political elites in the U.S. (e.g., elected officials and major donors) and, especially, among ideological conservatives. Thus, it is unlikely that the patterns observed in the U.S. and presented in the previous chapters can be generalized to other highly developed countries.

In an international context, the theoretical and methodological difficulties that surround the concept of ideology encourage us to look beyond left and right. Social scientists have consistently argued for a more "cultural" approach to public opinion and political cleavages. This approach moves public opinion research away from conventional ideological distinctions, which quite possibly represent "empty referents," to more complex instruments that represent sets of definite and coherent cultural values (Bourdieu 1984, 1990; Giddens 1991; Inglehart 1997; Putnam 2000; Jasper 2005; Weakliem 2005). Accordingly, this chapter explores a number of alternatives to the simple the left/right distinction. First, Inglehart (1997) has shown that the core values of publics are changing across national boundaries. Socialized under conditions of economic and existential security, Inglehart claims that post-war generations in highly developed countries have shifted their values away from basic material concerns towards "post-materialist" values. Post-materialist values correspond to a variety of "higher order" concerns including increased democratization of social institutions, suspicion of traditional, bureaucratic, and technocratic modes of authority, and an emphasis on autonomy and self-expression. It is likely that post-materialist values correspond with less favorable attitudes toward science, because this institution is assumed part of the discredited modern bureaucratic state apparatus.

In political sociology, research no longer predominately centers on electoral processes and organizations associated with the state; instead, it has shifted focus to social movements and protest – in particular, those directed at the state and non-state actors (Melucci 1996; Hicks, Janoski, and Schwartz 2005; Jasper 2005). Studies of social movements that target scientific experts and organized science have also contributed to the literature on science and technology in the public sphere (Epstein 2008; Hess, Breyman, Campbell, and Martin 2008; Moore K. 2008). Additionally, the co-production of rational-legal authority and scientific authority endemic of modern societies suggests that trust in and acceptance of organized science is concomitant with confidence in political institutions such as legislative bodies, civil service, and political parties (Irwin 2008; see Jasanoff 2004 for concept of co-production; see also Frickel and Moore 2005). Thus, confidence in the center-establishment of contemporary democratic governments is likely associated with favorable attitudes toward science and technology.

Beck (1992) and Giddens (1991) have proposed that socio-cultural factors, particularly risk and trust, shape late-modern political cleavages as well as public attitudes toward science and technology. In Beck's "risk societies," science and technical expertise becomes deeply intertwined with the often invisible consequences of industrialization, both as harbinger and hero (e.g., oil spills, pollution, nuclear accidents, energy shortages, and food contamination). Catastrophic risk becomes particularly salient to publics, because these (potential or actual) crises are largely outside of the control of individual persons or local actors (e.g., the British Petroleum Gulf oil spill), implying an important relationship between self-perceptions about the capacity to manage risk and attitudes toward science and technology. For Giddens, trust becomes necessary to alleviate the anxieties associated with the risk society: trust in both an actor's local network but also in the abstract political system (i.e., the state). Thus, Beck and Giddens point to concepts such as "locus of control" (i.e., perceived capability to manage risk) and "trust" to explain the formation of public attitudes toward science and technology in highly developed societies.

To summarize, it is theoretically important to examine the relationship between ideology and attitudes toward science outside of the idiosyncrasies of U.S. politics. However, it is also theoretically important to move beyond the simple left/right dimension and examine the effects of other political and cultural values on attitudes toward science. To put it another way, the cross-national analysis in this chapter provides valuable perspective for understanding the politicization of science in the U.S., but also one of the few studies to systematically examine various political and cultural explanations of scientific attitudes toward science in different national contexts. In addition, the 2005-2008 wave of the WVS is conducted at approximately the same time that the politicization of science was observed in the GSS data (2006-2008).

DATA AND MEASUREMENT

The World Values Survey (WVS) is a useful data source for examining hypotheses about socio-cultural and political factors across highly developed countries. Building on the European Values Surveys, the 2005-2008 wave of the WVS includes representative national surveys of basic values and beliefs in 54 countries all over the world. This study selects the 11 richest countries in the WVS based on rankings from the UN's 2007 *Human Development Report*. The nations included are Australia, Canada, Finland, Germany, Italy, Norway, Spain, Sweden, Switzerland, and the U.S. each of which are labeled "very highly developed" by the *Human Development Report*. The WVS contains well-tested instruments for each of the major concepts central to this analysis. Furthermore, the WVS uses standard methods for sampling and data collection, and the timing of the data collection is coordinated to maximize comparability across countries. Consequently, the WVS provides comparable cross-national data on scientific attitudes as well as the necessary demographic, cultural, and political indicators to accomplish the goals of this analysis.

Measurement of Attitudes toward Science

The 2005-2008 wave of WVS includes five items related to attitudes toward science and technology. The first question asks respondents: "All things considered, would you say that the world is better off, or worse off, because of science and technology?" This outcome measures the public's basic evaluation of science and technology (i.e., harmful/good). The second item ask respondents to assess the following statement: "Science and technology are making our lives healthier, easier, and more comfortable." This also provides a general evaluation of science and technology, but more clearly defines what "benefits" mean. Next respondents were asked if they thought: "Science and technology make our way of life change too fast." This item captures how much the public thinks science and technology has negatively transformed their everyday lives. The fourth question asks respondents to evaluate the statement: "Because of science and technology, there will be more opportunities for the next generation." This item is an indicator of the public's belief that science and technology engenders progress and growth. The fifth question asks respondents if they think as a society: "We depend too much on science and not enough on faith." This outcome represents how much the public sees a tension between organized science and traditional religious faith. Variations of each of these questions have been asked in previous surveys measuring public attitudes toward science dating back to the 1970s (see Pardo and Calvo 2002; Miller 2004; Gauchat 2008; Gauchat 2010).

For each item, respondents were asked to identify their views on a scale from 1 to 10, where 1 and 10 represent opposing views (e.g., 1 = "very harmful" and 10 = "very good"). In some cases the final outcome was recoded so that for all five variables higher values represent more favorable attitudes toward science and technology. All five outcomes were then z-score standardized to compare the effect sizes in standard deviation units. Because of the large number of response categories and the use of a gradated numerical scale to measure each attitude, ordinary least squares (OLS) regression is appropriate for examining these outcomes.

Measurement of Independent Variables

To measure the effects of political ideology on attitudes towards science cross-nationally, the WVS includes a single left/right item. Respondents were given the following: "In political matters, people talk of 'the left' and 'the right.' How would you place your views on this scale, generally speaking?" Similar to the outcome variables, respondents were asked to use a 10-point scale in which 1 = "left" and 10 = "right." Note that this measure of ideology is different from the instruments used in previous chapters in two key respects. First, the WVS survey uses the left/right terminology rather than liberal/conservative.[1] Second, the 1 to 10 scale makes the WVS instrument more gradated than the traditional 7-point item included in the GSS. Consistent with the discussion above, it is difficult to predict the direction of ideology's effect in an international context.

To measure post-materialist values, Inglehart's (1997) original 12-item *post-materialist index* was used. As mentioned above, post-materialist values are predicted to have a negative effect on attitudes toward science. To measure willingness to participate in protest movements an index was created from five items that asked respondents if they had recently or would be willing to attend demonstrations, join demonstrations, sign petitions, join boycotts and occupy buildings. The Cronbach's alpha across all 11 countries for the *protest movements* scale is .76. Based on previous literature, the relationship between protest movements and attitudes toward science is unclear, especially in an international context. An index was also used to measure public confidence in political institutions. Respondents were asked to rate their confidence in the parliament/legislature, civil service, and political parties. The Cronbach's alpha for the *confidence in political institutions* scale is .84. Because organized science legitimates and, in turn, is legitimated by the state apparatus, confidence in political institutions

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[1] A search of the *Roper Center's* poll archives indicates that the left/right terminology is rarely used in U.S. surveys of public opinion. International surveys that include the U.S. sometimes include both left/right and liberal/conservative to clarify meaning; yet, the WVS survey used only the left/right wording.

should correspond with positive attitudes toward science. A measure of *locus of control* was constructed from the following item: "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. Please use this scale where 1 means "none at all" and 10 means "a great deal" to indicate how much freedom of choice and control you feel you have over the way your life turns out." Similarly, a measure of *trust* was constructed from the following item: "Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair?" 1 = take advantage and 10 = try to be fair. These two measures are used to approximate risk exposure. Given the theoretical discussion of Beck and Giddens above, greater locus of control and greater trust are predicted to have a positive effect on attitudes toward science. All of the main explanatory variables discussed above were z-score standardized.

Demographic factors were also included in the models. Gender is represented by a dummy variable, coded 1 for female and 0 for male. Ethnicity is represented by a dummy variable coded 1 for whites and 0 for non-whites. Education is represented by a count variable for years of schooling. Income is measured using a standard scale that represents the income category a respondent belonged to in their respective country (in deciles) and thus measures relative income. Additionally, a subjective social class ranking is included in the models (i.e., upper class, upper middle, lower middle, working class, lower class). Religion may also factor into the relationship between politics and confidence in science (Gauchat 2008; Gauchat 2010). The strength of religious faith is measured by a numerical variable representing how often respondents attend religious services. As in the previous chapters, age is measured using six dummy variables for those born before 1940, those born in 1940-1949, those born in 1950-1959, those born in 1960-1969, those born in 1970-1979, and those born in 1980-1990.

RESULTS

Figure 1 shows the mean values for each of the five outcome variables by country. Recall that each outcome is z-score standardized. So, each point on the graph represents *country-specific means* relative to the *grand mean* for the 11 highly develop countries in the analysis which is equal to 0. First, notice that there is variation in public attitudes toward science by country but that the degree of variation and the nature of that variation differs substantially from item to item.

For the harm/good measure in the upper left corner of Figure 1, the unstandardized mean for harm/good outcome is 6.88, suggesting that, on average, publics in highly developed countries believe that the benefits of science outweigh the harms. For this outcome, most countries are to the right of zero, with the exception of Japan. Japan's lower mean likely reflects the cultural trauma of the nuclear attacks at the end of World War II. The unstandardized mean for the improved life measure is 6.84, which again shows that on average publics are favorable toward science. Yet, the improves life measure shows more variation across countries, suggesting that when asked to consider the personal benefits of science and technology, between country variation increases. The unstandardized mean for the too fast outcome is much lower compared to the two previous outcomes ($\bar{x}$ = 4.28). Thus, when people focus on the changes that science and technology have wrought for their everyday lives, they are more unfavorable towards it. With the exception of the Australia and the U.S., the graph shows that on average most countries' agree that science and technology changes life too fast. It is also interesting that Australia and the U.S., the two countries with homelands least devastated by World War II, are also the least disenchanted with the changes associated with science and technology. The country means for the next generation outcome are more consistently clustered around zero, showing little variation by country. Additionally, on average publics in highly developed countries accept the idea that science and technology will create opportunities for future generations ($\bar{x}$ = 7.10). Conversely, the unstandardardized mean for the science/faith outcome is comparatively low ($\bar{x}$ = 5.56). Yet, there is not much between country variance for this outcome. Norway and Sweden are the exception; publics in these countries are far less likely think that there is too much trust in science and not enough in faith.

Overall, Figure 1 shows some between country variance in attitudes toward science, however, there is no consistent pattern of variation across countries nor are there enough highly developed countries in the sample to estimate the effects of group-level characteristics (i.e., hierarchical linear models). Consequently, the analysis that follows uses fixed effects estimators to represent country specific variation in the sample, which is conceptually (but not computationally) similar to including a dummy variable for each country. The purpose of this chapter is to examine whether trends in the U.S. are consistent with those in economically developed countries, and to explore the effects of socio-cultural factors in a cross-national context, making fixed effects models appropriate for these questions.

Table 1 shows the results for five OLS regression models predicting attitudes toward science and technology. In the first model predicting the harm/good outcome, respondents who are male, highly educated, and more affluent are more favorable towards science when compared to underprivileged groups. These results also show that there is a positive relationship between social class and favorable attitudes toward science which is consistent with previous research (Gauchat 2010; Chapters 2, 3, and 4). Younger generations are more likely to see the harms of science and technology compared to those born before 1940. Additionally, the effect becomes stronger for younger generations, with those born after 1980 showing the least favorable attitudes. This finding is consistent with the "risk society" thesis, which suggests that trust in science will decline with exposure to catastrophic risks such as climate change and nuclear war. Moreover, it is consistent with the post-materialist hypothesis that younger generations in highly developed countries are more skeptical of science and, particularly, technocratic authority (Inglehart 1997). Also consistent with previous findings, the effect of church attendance is negative and significant, suggesting that the tension between science and religion in the public sphere is not unique to the U.S.

Notably, all of the main explanatory variables are statistically significant in the model predicting the harm/good outcome. The effect of ideology is positive, indicating that those who identify with the "right" are more likely to think the benefits of science outweigh the harms. Notably, this finding contradicts those found in previous chapters that focused exclusively on the U.S. There are two possible explanations for this finding. First, the measurement of attitudes toward science and ideology are somewhat different from the instruments used in previous chapters. Second, numerous scholars have commented on the uniqueness of the U.S. among economically developed countries (Hofstadter 1970; Inglehart 1997; Weakliem 2005). Thus, it is also possible that the political right in the U.S. is exceptional when compared to other highly developed countries, not only in how they identify (i.e., conservative rather than right) but also in the cultural values that underlie these ideologies. We will examine the uniqueness of the ideology effect in the U.S. in further detail below.

As predicted, the effect of the post-materialist index is negative and statistically significant even after controlling for ideology. This suggests that post-materialist values are associated with greater disenchantment from science and technology, but also that post-materialist values have separate effects from the simple left/right identification. The effect of protest movements is positive. This finding is also somewhat surprising. However, it is possible that willingness to protest indicates a high level of engagement with the political process, the latter of which has been associated with positive attitudes toward science (Sturgis and Allum 2004). Similarly, the effect of confidence in political institutions is positive and statistically significant. Comparing the coefficients of the main independent variables, confidence in political institutions has the strongest effect on the harm/good outcome. Thus, publics' confidence in science and technology are connected with their trust and acceptance of the state apparatus. The effects of the two measures associated with the risk society, locus of control and trust, are also positive. As predicted, both locus of control and trust are associated with the belief that science is on balance good.

The second model, predicting the science improves life outcome, largely confirm the results of the previous model. The effects of the demographic variables are all in the same direction. Again, the effect of ideology is positive and statistically significant, but the effect is weaker than in the harm/good model. The effect of the post-materialist index, protest movements and confidence in political institutions are also consistent with the previous model. The positive effect of confidence in political institutions is slightly sharper here, as is the negative effect for post-materialist index. The effects of locus of control and trust are also positive and statistically significant. Overall, defining the benefits of science in terms of making life "healthier, easier, and more comfortable" does not noticeably influence the direction or effect size of the predictors.

The results for the changes life too fast outcome are somewhat different from the two previous models. Recall that this outcome is recoded so that higher values represent more favorable attitudes (i.e., disagreement with idea that science changes life too fast). First, the effect of gender, social class, and church attendance is largely consistent with the previous models; yet, the effects for the age categories and ethnicity are distinct. Those who identify as "white" are more favorable towards the changes that science and technology have brought. Again, this result matches with previous research that has shown that privileged groups, including ethnic groups, are more likely to exhibit favorable attitudes toward science and technology (Gauchat 2008; Gauchat 2010; see also Chapter 2, 3, 4). Underprivileged groups are also more likely to experience the negative consequences of social change. The pattern for the age categories indicates that those born in the 1940s and 50s were more skeptical of scientific and technological changes than the oldest generation (those born prior to 1940). This anxiety likely stems from the devastation of World War II and fears associated with the nuclear age and Cold War that this generation acutely experienced. However, those born in the 1970s and 80s have more favorable attitudes concerning scientific and technological changes. These generations were the direct benefactors of advances in science and technology such as the personal computer, internet, medical advances, and high tech entertainment. Along with the two previous models, these results suggest that the attitudes of younger generations are somewhat mixed: they are not averse to the changes that science and technology produces, but are more generally skeptical of science.

The effects of the main predictors on the too fast outcome are also distinct. First, the effect of ideology is now negative but is not statistically different from zero. The effect of post-materialist values is still negative, but it is no longer statistically significant. This indicates that those on the political right are somewhat averse to scientific and technological changes but, given the previous models, still view science as overall positive. Conversely, those possessing post-materialist values are not adverse to scientific and technological changes even though they, on the whole, are skeptical of science and technology. The effect of protest movements and confidence in political institutions are both positive and statistically significant, which is consistent with the previous models. However, the effects for locus of control and trust are not statistically significant in this model. One interpretation of these results is that they reflect different groups' aversions to change. Conventionally, right-wing ideology has favored a return to tradition and has been indisposed to broad social change. Similarly, those possessing post-materialist value are more inclined to accept broad cultural and societal change. These groups attitudes toward change are then countered by their overall attitudes toward science and technology, producing the net zero effect observed. Moreover, public confidence in what Giddens' calls the "abstract system"—the state apparatus and its chain of equivalences (i.e., organized science)—mute public anxiety about scientific and technological change. On the contrary, factors measuring "local" security, self-efficacy and trust in others, are not associated with attitudes toward change.

The model predicting the next generation outcome is similar to the models predicting the harm/good and improves life outcomes; yet, some differences are worth noting. First, white respondents are less likely to believe that science and technology will provide opportunities for future generations. This is a peculiar finding, but it may reflect positive attitudes about the future among non-whites as much as it represents disenchantment among white respondents. The non-significant effects for education and income are also distinct, although these effects remain in the same direction. The effect of ideology is positive and statistically significant. Again, the political right shows more positive attitudes toward science, which contradicts findings the findings of previous chapters. As mentioned, the stability of this finding within each country will be explored later. The effect of the post-materialist index is negative and statistically significant, which is consistent with the harm/good and improves life outcomes. However, the effect of protest movement is not statistically significant in this model. The effect of confidence in political institutions, on the other hand, is positive and statistically significant. Comparing the effects of other explanatory factors, the confidence in political institutions is the strongest predictor in this model. These results once more suggest a close relationship between confidence in the state and positive attitudes toward science. The effects of locus of control and trust are also in the expected direction and are both statistically significant. As the risk society thesis would predict, respondents' sense of personal control and trust in others is associated with more positive attitudes toward science.

As mentioned above, the science/faith outcome is recoded so that higher values represent more favorable attitudes toward science and, thus, disagreement with the idea that "we believe too much in science and not enough in faith." On average, women are less favorable toward science in relation to religion, while those identifying as "white" are more favorable toward science. Additionally, more educated and wealthy respondents show more positive attitudes toward science. Those born in the 1970s and 80s are also more accepting of science in relation to religious faith than older generations. As expected, the effect of church attendance is negative and is the strongest predictor in the model. In fact, looking across Table 1, church attendance is one of the most consistent predictors of attitudes toward science. Notably, the direction of the ideology variable has reversed for this outcome and is now negative and statistically significant. This finding does correspond to the idea that the political right favors traditional authority and religious morality (Hofstadter 1970; Mouffe 2005; Weakliem 2005). Given the results for the other outcomes, it appears that the political right views science on the whole positively but are concerned about how science has affected the authority of religious faith. The effect of the post-materialist index is not significant. However, the effect of protest movements is positive and, compared to the other models, has the strongest effect for the science/faith outcome. One interpretation of this finding is that those willing to participate in protests are especially critical of religious authority; this is especially true of "new" social movements that attempt to redefine traditional values and define new cultural norms (e.g., censorship, sexuality, reproductive rights, and gender norms) (Melluci 1996). The effect of confidence in political institutions is also positive and statistically significant, but the effect is also notably weaker than in previous models. The effects of locus of control and trust are not statistically significant predictors of the science/faith outcome.

Overall, the results in Table 1 offers support to multiple explanatory factors. First, political ideology is a key predictor of attitudes toward science in four of the five models. For the harm/good, improves life, and next generation outcomes, the effect of identifying with the political right is associated with more positive attitudes toward science. However, those on the right are also concerned about the changes that science and technology have engendered, particularly, the weakening of religious faith. On the contrary, those with post-materialist values are more skeptical of science and technology compared to those with more purely economic concerns. These results largely confirm Inglehart's basic contention that post-materialist values are associated with disenchantment with technocratic and hierarchical authority. At the same time, confidence in political institutions is the most consistent explanatory factor in all five models. This finding confirms the idea that scientific credibility is socially constructed in other central institutions and particularly in the legal and state apparatus (Gieryn 1999; Jasanoff 2004). However, this study is the first to show the close relationship between attitudes toward organized science and attitudes toward the state in the public sphere. The effects of locus of control and trust were also key predictors of the harm/good, improves life, and next generation outcomes. Beck (1992) and Giddens (1991) have argued that locus of control and trust represent social defense mechanisms that allows the public to cope with human-made catastrophes endemic of risk societies. If exposure to risk is a key determinant of public attitudes toward science, as Beck contends, then it follows that locus of control and trust, each social psychological approximations of risk exposure, have the observed effects.

the results in this analysis show that the *politicization thesis* does not apply to other economically developed countries. Specifically, it shows that those identifying with the political right show more positive attitudes toward science compared to those identifying with the left; although, the size of the effect is weak.

There are numerous explanations for the differences between the U.S. and other highly developed countries. The conventional explanation, proffered by Hofstadter (1970), is that the religious right in the U.S. is exceptionally powerful in mainstream political culture. Hofstadter (1970) claims that evangelicalism in the U.S. also permeates non-religious sectors and creates a unique form of cultural conservatism, lining up with Frank's (2004) more contemporary thesis in *What's the Matter with Kansas?* (2004). Alternatively, Mooney (2009), Krugman (2009), and McCarty, Poole, and Rosenthal (2006) acknowledge the importance of the religious right but point to a confluence of other factors. Krugman and others have argued that the dominance of the Democratic party, particularly, the pro-labor and southern Democrat coalition of the 1940s-1960s, allowed conservatives to establish themselves as populist "outsiders." With the social upheavals of the 1960s, including the women's movement, the civil rights movement, and the anti-war activism, the Democratic party weakened (along with moderate Republicans) and its hold on congress was finally lost in the 1980s (McCarty, Poole, and Rosenthal 2006). According to this perspective, a libertarian business elite and evangelical Protestants formed a successful coalition that became the foundation of the contemporary conservative movement (i.e., the Reagan Revolution). For this new regime, organized science was seen as part of the center-establishment and state apparatus and, in fact; intellectuals and scientists had played a key role in the post-War political economy of the U.S. (see Hofstadter 1970; Krugman 2009; Moore K. 2008). Meanwhile, other economically developed countries experienced greater stability in their political systems during this period: to put it figuratively, the “center” held. For the parliamentary governments in many economically developed countries, a dominant coalition formed between center-left and center-right parties (Mouffe 2005). Compared to these countries, populist conservatism in the U.S. became a more influential force in mainstream politics due to the weakness of the political center after the late 1960s.

Moving beyond left and right, this analysis also shows that other political and socio-cultural factors predict attitudes toward science and technology and, in some cases, these factors have stronger effects than the ideology dimension. Specifically, confidence in political institutions, locus of control, and trust were more robust predictors of attitudes toward science, with the exception of the science/faith outcome. One interpretation of these strong effects relates to Beck’s and Giddens’ accounts of risk societies. Particularly for Giddens, individuals cope with risk in a variety of ways, including social defense mechanisms like individualism, trust in the “local” community, and trust in abstract systems: what he calls the dialectic of the local and global. Giddens (1991:244) defines trust as “the vesting of confidence in persons or in abstract systems, made on the basis of a ‘leap into faith’ which brackets ignorance or lack of information.” That is, rather than become alienated from organized science and expert knowledge, “laypersons” trust that the local community and large political institutions can cope with catastrophic risk. In this analysis, confidence in political institutions represents trust in the abstract system (the global), and “trust” represents confidence in persons (the local). Trust can also be turned inwards, what Giddens refers to the “dialectic of control,” which is the “reappropriation of knowledge and control” by the individual, and a faith that one can personally cope with the threats of the risk society. Overall, Giddens’ provides a coherent social psychological interpretation of some of the key findings in this analysis. Future research should examine these ideas further as well as expand scholarship on the relationship between political and socio-cultural factors and public attitudes toward science to explore other perspectives.

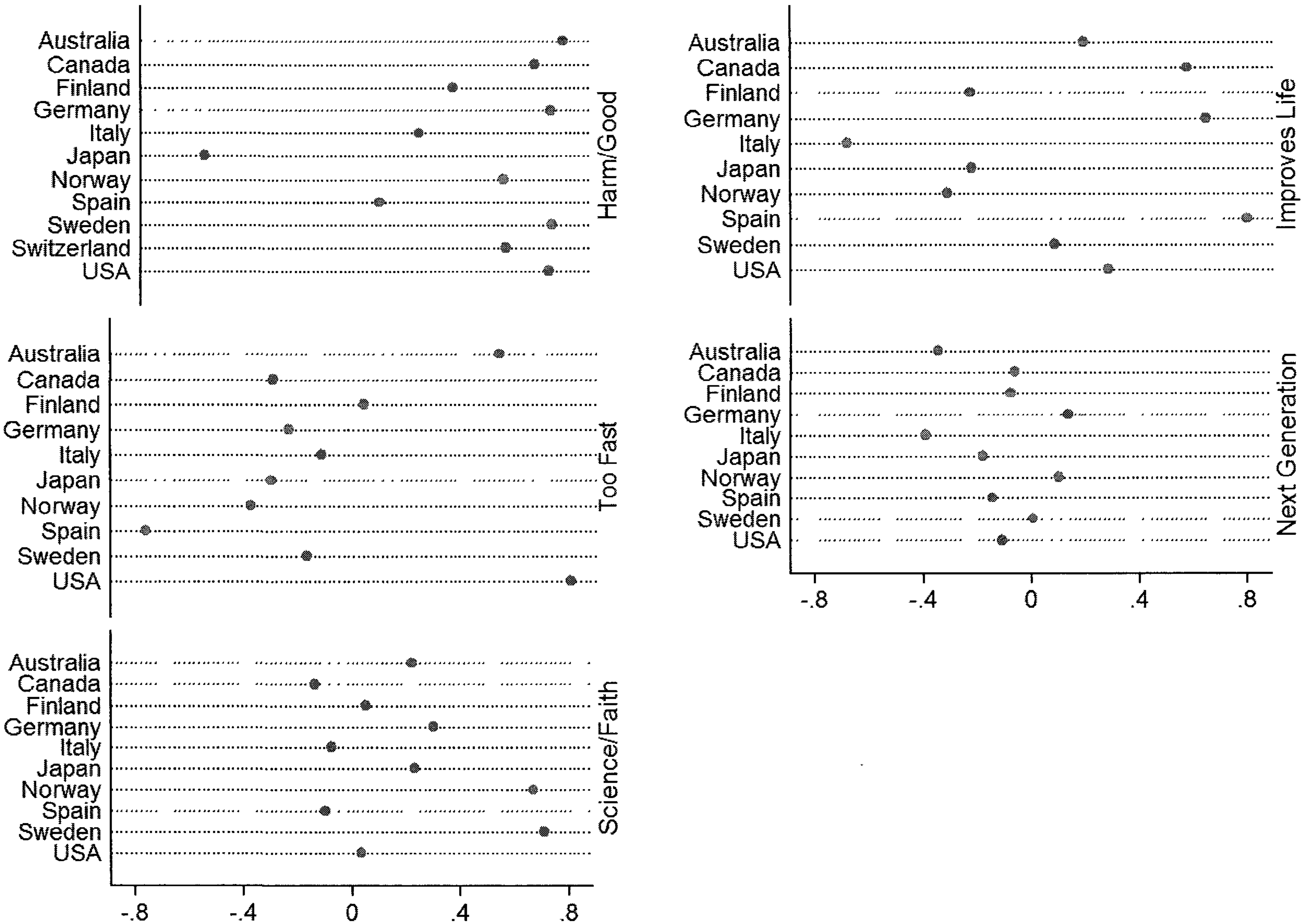

Figure 1. Mean Attitudes toward Science by Country

Table 1. Fixed Effects of Demographic, Political, and Socio-cultural Variables on Attitudes toward Science

	Harm/Good		Science Improves Life		Changes Life Too Fast		Next Generation		Science/Faith	
Female	-0.119***	(0.015)	-0.151***	(0.017)	-0.087***	(0.020)	-0.070***	(0.017)	-0.100***	(0.019)
White	0.050	(0.043)	0.005	(0.046)	0.108*	(0.054)	-0.113*	(0.047)	0.154**	(0.049)
Education (yrs)	0.003**	(0.001)	0.003**	(0.001)	0.003*	(0.001)	0.000	(0.001)	0.004**	(0.001)
Income (logged)	0.062**	(0.020)	0.047*	(0.022)	0.057*	(0.025)	0.032	(0.022)	0.125***	(0.023)
Subjective Class	0.063***	(0.010)	0.027*	(0.011)	0.071***	(0.014)	0.031**	(0.012)	0.055***	(0.012)
Born 1940-1949	-0.050	(0.027)	-0.076*	(0.031)	-0.073*	(0.035)	-0.083**	(0.031)	-0.061	(0.032)
Born 1950-1959	-0.031	(0.026)	-0.079*	(0.031)	-0.072*	(0.036)	-0.073*	(0.031)	-0.025	(0.033)
Born 1960-1969	-0.066**	(0.025)	-0.094**	(0.030)	0.007	(0.035)	-0.094**	(0.030)	0.002	(0.032)
Born 1970-1979	-0.071**	(0.026)	-0.046	(0.030)	0.078*	(0.036)	-0.050	(0.030)	0.069*	(0.033)
Born 1980-1990	-0.100***	(0.030)	-0.084*	(0.034)	0.189***	(0.041)	-0.077*	(0.035)	0.117**	(0.037)
Church Attendance	-0.028***	(0.004)	-0.030***	(0.005)	-0.020***	(0.006)	-0.024***	(0.005)	-0.122***	(0.005)
Political Ideology										
Ideology (left-right)	0.080***	(0.011)	0.058***	(0.012)	-0.013	(0.015)	0.058***	(0.012)	-0.048***	(0.013)
Political Values										
Post-Materialist Index	-0.030***	(0.008)	-0.033***	(0.009)	-0.005	(0.011)	-0.037***	(0.009)	0.014	(0.010)
Protest Movements	0.027*	(0.011)	0.028*	(0.012)	0.033*	(0.015)	-0.004	(0.013)	0.077***	(0.013)
Conf in Political Institutions	0.149***	(0.013)	0.157***	(0.015)	0.087***	(0.017)	0.162***	(0.015)	0.039*	(0.016)
Socio-cultural Variables										
Locus of Control	0.082***	(0.011)	0.092***	(0.012)	0.001	(0.014)	0.075***	(0.013)	0.002	(0.013)
Trust	0.084***	(0.011)	0.081***	(0.013)	0.010	(0.015)	0.062***	(0.013)	0.015	(0.014)
Constant	-0.111	(0.046)	-0.144	(0.051)	-0.016	(0.058)	-0.001	(0.052)	0.024	(0.055)
Adjusted R^2	.072		.062		.024		.044		.102	
N	10638		8950		8931		8903		8808	

Note: Standard Errors in parentheses. Birth year 1939 and under is the reference category for born. * $p < .10$; ** $p < .05$; *** $p < .001$

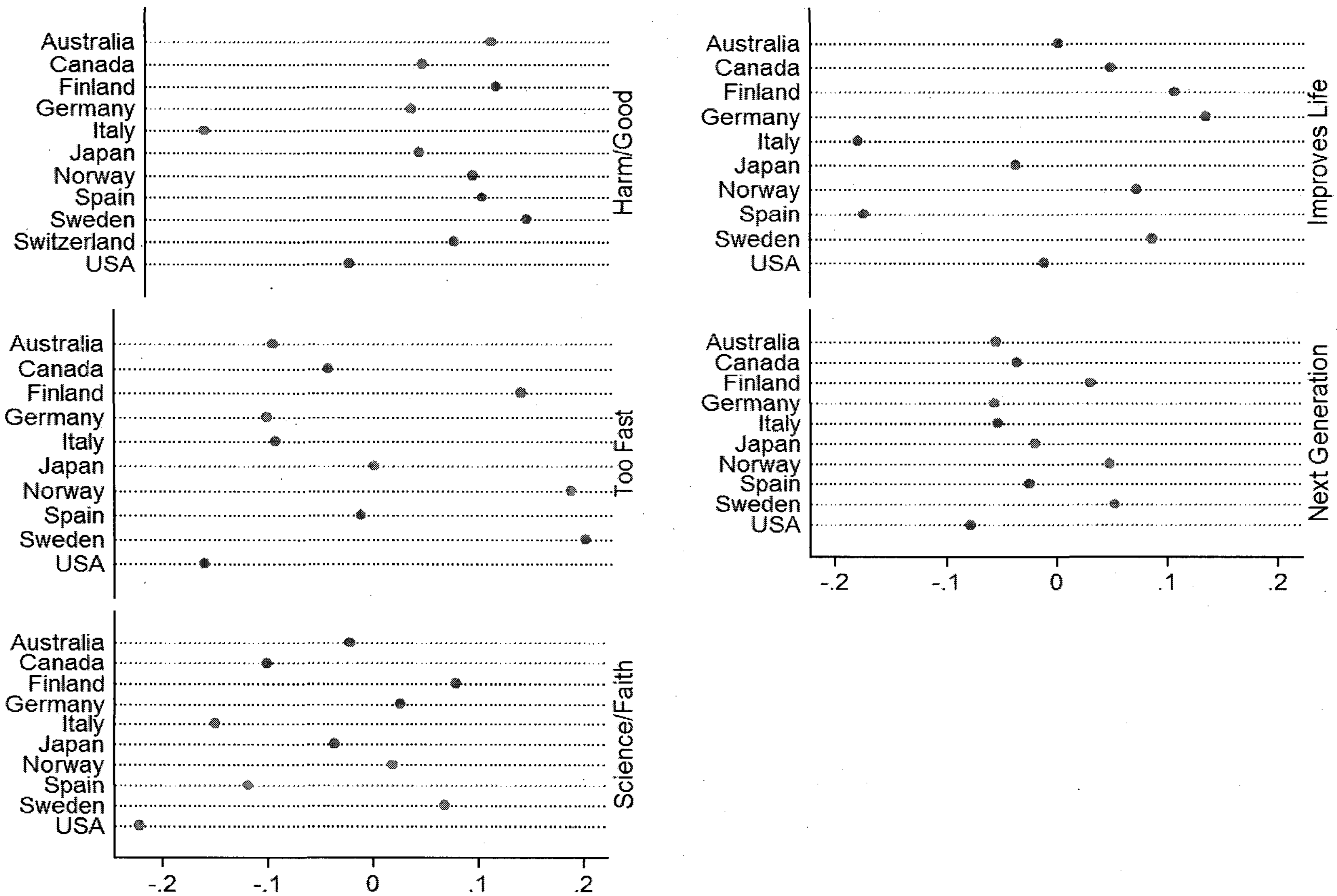

Figure 2. Effect of Ideology by Country (Standardardized Coefficients)

CONCLUSION

> Science, then, can provide us with a set of values — not findings — for how to run our lives, and that include our social and political lives. But it can do this only if we accept that assessing scientific findings is a far more difficult task than was once believed, and that those findings do not lead straight to political conclusions. Scientists can guide us only by admitting their weaknesses, and, concomitantly, when we outsiders judge scientists, we must do it not to the standard of truth, but to the much softer standard of expertise.
>
> - Harry Collins, *We Cannot Live by Skepticism Alone*

Harry Collins, in this short essay in the journal *Nature,* repeats a familiar theme in the contemporary STS and PUS literature, namely, the decline of scientific authority in advanced economic societies. In this study, this was described as the *legitimacy problem* (see also Collins and Evans 2007; Gauchat 2010). Science's legitimacy problem currently represents an unchallenged certainty for many natural scientists, scientific organizations, and social analysts, and each group has offered numerous explanations for this phenomenon. Collins (2009), for example, argues that social scientists are partly to blame for replacing "the myth of the individual scientists using evidence to stand against the power of the church and state" with an equally mistaken model in which "Machiavellian scientists engage in artful collaboration with the powerful." Moore (2008) has also weighed in, arguing that scientists' activism has blurred the line between scientific authority and politics; so that scientific claims are often made by groups outside the scientific establishment (i.e., science has become "unbound"). She argues, therefore, that it is not the cultural authority of science that has declined but "the authority of *scientists* to serve as unchallenged mediators between nature and the public [emphasis in original]" (Moore 2008:191). The NSF and the National Science Board, on the other hand, appear committed to the position that the public is to blame for being uninterested in and ignorant of science (COPUS 2010). Likewise, some isolated but powerful voices in STS make the claim that "we have never been modern," which is to say that the cultural authority of science in the public sphere has never been ubiquitous, and that scientists and experts have never enjoyed the unrestrained power that many scholars now presume (Latour 1993; Shapin 2008). Beck (1992), on the other hand, argues that the scientific establishment must take responsibility, along with industry, for unleashing catastrophic uncertainty on the public (e.g., oil spills, nuclear waste, climate change). Overall, many voices have reflected on the legitimacy problem, although few scholars have offered definitive evidence for it.

The results of this study cast some doubt on the severity of science's legitimacy crisis, particularly in the U.S. Instead, these findings suggest considerable revision of the fundamental assumptions of the legitimacy problem. First, chapter 3 and subsequent chapters find little evidence for a uniform decline in public trust in and acceptance of science in the U.S. Instead, public alienation from science appears to correspond with certain social locations and identities and not others. Yet, *the cultural authority of science in the public sphere does appear increasingly politicized*: there is a growing association between political orientation, especially, conservative ideology, and public trust in and acceptance of science in the U.S. Second, chapter 5 shows that explanations of public trust and acceptance of science are not consistent across advanced capitalist democracies. That is, in the U.S., ideology is a key source of cultural conflict over the scientific authority, with conservatives and moderates both showing less confidence in science than liberals. However, in other rich democracies, ideology has the opposite effect; those identifying with the political left are more alienated from science compared to those on the right. Additionally, other factors such as trust in political institutions and locus of control have stronger associations with favorable attitudes toward science. Altogether, the legitimacy problem contains numerous mistaken assumptions about society and the public that lessen its ability to guide the PUS research program.

In this chapter, I return to the main problems introduced in the introduction, particularly, in relation to the politicization of science in the public sphere. First, I outline the general assumptions of the politicization problem given the findings in this dissertation. This theoretical problem is offered as an alternative to the legitimacy problem. The question of politicization should now be considered one of the three major questions sociology of science must address – equal to or surpassing legitimacy and democracy problem. I then offer some theoretical interpretations of the findings in this study. Finally, I discuss the implications of these findings for the contemporary U.S. and for the future of PUS research.

Politicization Problem vs. Legitimacy Problem

Taken as a whole, this study represents the most systematic analysis of group differences in public trust in and acceptance of science. This is not to suggest that many of the findings in these chapters have not been reported in other academic studies, but group differences and, particularly, political cleavages, have never been the focus of published research. In many ways, the assumptions of the legitimacy problem and the PUS program have precluded such a focus. That is, inadequate public understanding was assumed to have culturally universal effects on public trust. In contrast to the legitimacy problem, the politicization problem emphasizes group differences in the public and society, some of them more enduring than others. In short, the politicization problem refers the "politics" in a general sense of conflicts among groups and cultural values, and builds on the basic assumption that cultural authority of science has grown to the point that it becomes entangled in polarized social conflicts (e.g., economic growth vs. environmental sustainability). As a result, science is "increasingly seen as being politicized and not disinterested" (Yearley 2005:121). This basic idea excludes grand explanations of group differences, because the various social identities, categories of difference, and cultural values that divide the public sphere are overdetermined and uniquely situated in a system of relations. To put it another way, reservations about science among women are unlikely to resemble patterns for other groups, like conservatives, African Americans, or older Americans, because different socio-historic factors produce these patterns.

Some general hypotheses are possible, however. For example, one could examine the idea that disadvantaged groups in a society will show greater apprehension toward science (i.e., alienation thesis, chapter 3). But, contextualizing these effects must surely be the paramount concern of future research on the politicization problem. For example, group differences by ethnicity are likely to vary *with* factors such as education, church attendance, family income and political identity. Therefore, research identifying differences *within* social and political cleavages is as imperative as identifying *between* group differences. The politicization thesis (chapters 1, 3, 4, and 5) is also a contextualized hypothesis relating to distinctive historical and social conditions of the post-World War II U.S. Without cultural and historical knowledge related to the evolution of the conservative identity in this period, the differences between conservatives and liberals would be difficult to interpret.

The theoretical problem of politicization, in contrast to the legitimacy problem, also offers some hope for serious rapprochement between STS and PUS, and theoretically between Publics-in-Particular and Publics-in-General. That is, quantitative research of in Publics-in-General can provide detailed accounts of group differences in public trust in and acceptance of science. But, only detailed qualitative descriptions of these identities and groups can discover how these groups culturally "understand" science. Qualitative studies could examine public discourse about policies related to science (e.g., climate change), or discourse related to the production of scientific knowledge (e.g., patient groups). An analysis of the cultural authority of science in the public sphere akin to Gamson's (1992) *Talking Politics,* in which groups small groups of working-class people discussed a variety political issues, would be particularly illuminating. For example, a book titled *Talking Science* might examine focus groups of conservatives from different regions and ask them to discuss science and science related policy.

To conclude, I have proposed an alternative to the legitimacy problem that is primarily concerned with the unevenness of the cultural authority of science in the public sphere, and how science has become entwined in social conflict and polarized cultural disputes. But, one should not ignore that science is an instrument of power, even if it is contested, and it can affect political outcomes (Moore 2008). From the perspective of politicization problem, it is not the decline, but, the ascent of the cultural authority of science that has produced pockets of resistance to scientific authority and, equally important, the emergence of groups that value scientific authority and use it to guide their political decisions. In this politicized atmosphere, the cultural boundary of science may become difficult for the public to identify, which concurs with Moore's (2008) basic point that scientific authority has become culturally decoupled from scientists and experts. The media has undoubtedly contributed to a blurring of the cultural boundary of science and expertise, which was never rigid in the first place, but now, appears to be in a process of unraveling around the edges (H.M. Collins 1987; Zehr 2000). Yet, this may be less a crisis of pubic ignorance or ambivalence, and rather a crisis for the scientific establishment itself: its ability to communicate within and outside its borders.

Although scholars have criticized Merton's norms of science for being idealized; there is something to the idea that science must be free and open, not only to a small esoteric community, but to the broader culture and society. This is, in fact, the impetus behind thinking about "science in society" in STS rather than a philosophical quandary about producing "truth." As Collins (2009) argues, the scientific establishment has not adjusted to the idea that scientific authority in the public sphere is no longer merely a matter of evidence. Simply, scientists cannot take credibility for granted, nor was there ever a time where it was simply a matter of "presenting the findings" to the public. Instead, the scientific establishment must learn to adjust to politicization and to speak to the public honestly and openly about the uncertainty and fallibility of scientific knowledge.

The climate change debate may be an excellent test case for this new approach. In many ways, losing control over the climate change narrative may indicate that science must reacclimate itself to the modern media environment and no longer trust that political activists and cable news can effectively "speak for the facts" and, possibly, give up on the idea that "facts can speak" at all. (I may have better luck waiting for my cat to speak). It may take time for natural scientists to grapple with, but sociologists have largely accepted that cultural and political conflicts are permanent features of democratic society: a continual process of challenging authority, clashes between authorities, and re-evaluations of the consensus. Sociologists can illuminate these conflicts, identify the dynamics of power in them, but should not be chiefly concerned with the maintenance of public reverence for and compliance with science.

Scientific Cultural Capital vs. Scientific Literacy

The second contribution of this dissertation is the introduction of *public dispositions toward science,* which represents an alternative to Miller's longstanding but ridiculed concept of scientific literacy. The idea, presented in chapter 2, is that particular dispositions toward science are socially valued, similar to the idea that competency and taste in literary and artistic fields bestow social dividends for individuals and groups. Drawing on Bourdieu, I argue that cultural experiences related to science, attitudes, and textbook knowledge represented a kind of cultural capital. Moreover, this *scientific cultural capital* represents an increasingly essential means of differentiating the public sphere, both horizontally, the types of power different groups possess (i.e., symbolic or material); and vertically, the groups that are alienated from power. Scientific cultural capital has numerous theoretical advantages over scientific literacy.

To summarize, PUS survey research rarely clarifies exactly what kind of knowledge their instruments measure: (1) privileged knowledge of the truth; (2) practical knowledge that allows non-experts to understand science debates; or (3) culturally privileged knowledge that is valuable because scientific rationality is valued in central institutions. The science literacy concept presumes either the first or second interpretation of knowledge. Scientific cultural capital, in contrast, assumes the third type of knowledge: privileged cultural knowledge that is significant because it reflects the norms and values of powerful actors and institutions in society. This basic assumption about what survey instruments represent seems more in line with sociologists' view of science. Second, the idea that attitudes toward science and scientific knowledge are components of the same concept frees PUS research from continuing debates about the relationship between knowledge and attitudes. That is, general knowledge of textbook facts and general attitudes represent broader dispositions and social resources. This shifts the research focus to the compositions of these resources various groups possess. For example, future research might identify groups with very positive attitudes but low textbook knowledge, or a high number of college courses but less positive attitudes. One could examine compositions of scientific cultural capital by occupation, education, college-major, and political party (see Table 3, Chapter 2 for example).

Although I have argued that scientific cultural capital is a subtype of cultural capital, it is also likely of growing consequence relative to artistic and literary fields. Based on this idea, research on PUS might be able to identify major subtypes of cultural capital and compare their influence on political cleavages and other types of cultural values to examine which subtype has the greatest consequence. In sum, the concept of scientific cultural capital will provide a useful tool for future analysis of scientific authority in the public sphere.

Scientific Authority vs. Conservative Populism

Another theme of this study is the relationship between political ideology, especially, the conservative identity, and trust in and acceptance of science. Throughout this dissertation, I have discussed a transformation of the conservative identity in the U.S. that occurred over the last 30 to 40 years that numerous scholars have observed (Frank 2004; Krugman 2009). I have also argued that this transformation has been fueled by a reframing of the conservative identity to signify "populist discontent" and an "outsider" status. At the same time, the cultural authority of science has made the scientific community a visible branch of the center-establishment. That is, science is viewed as part of the Foucauldian power-center of "modern" society that also includes judicial, governmental, and media institutions (i.e., the center of power/knowledge). Consequently, I have offered the interpretation that the conflict between conservatives and the scientific establishment is an inevitable result of these two socio-historical conditions. There are a number of empirical patterns that support this interpretation, but these results are by no means a final confirmation this argument.

First, the convergence between moderates and conservatives over time may indicate that the current conservative identity has a more populist flavor. This, of course, assumes that the moderate identity is a good approximation political populism. Looking back at Figure 2 in Chapter 2, moderates and conservatives in the U.S. share a similar social location in relation to overall power (the vertical axis), and composition of power (the horizontal axis). Conservatives and moderates generally showed average to below average power, while their social resources were concentrated in economic capital rather than scientific cultural capital. According to Bourdieu, conservatives and moderates discontent with science stem from the fact that it is increasingly not the basis of their power in society, rather these groups rely on economic capital and not scientific cultural capital for their power. Bourdieu would also claim that these social locations would generate a host of cultural values that might relate to trust in science and experts. In addition, conservatives have particularly strong reservations about the connection between science and the state (see chapter 4). One interpretation of this finding is that conservatives view themselves as "outside" the center-establishment and see scientists as advocates for liberalism. This is consistent with Hofstadter's (1970) observations about conservatives in the U.S. He claimed that large segments of the public view scientists and intellectuals as an esoteric professional class that threatens populist American values of egalitarianism, individualism, and pragmatism by claiming to possess superior modes of knowledge. An alternative interpretation relates to the divergent cultural values of conservatives, moderates, and liberals. For example, conservatives and moderates may have greater confidence in individual rationality and the rationality of markets, and view scientific rationality and its relationship to the state with less confidence than liberals. However, those identifying with the "right" in other rich countries do not view science with the same apprehension as American conservatives, suggesting that populism against science is not necessarily drawn to the political right.

Given the above discussion, it is important to reflect on the policy implications of this study, and conceptually, to reflect on the idea that public understanding of science is an increasingly salient dimension of social inequality and difference in modern society. First, if we acknowledge that distinct and enduring cultural dispositions toward science are present in modern society, it is essential to explore whether these dispositions reflect other dimensions of social difference like social class, acculturation, race, ethnicity, religion, and gender. Enduring groups and dispositions would indicate that expanding formal education alone would unlikely fundamentally transform the boundary between organized science and the public and, equally importantly, the boundaries between segments of the public. Alternatively, cultural authority of science may have more to do with addressing social inequalities and transforming the way the scientific establishment communicate with the public and manage expectations about its capacities and limitations. Nonetheless, it appears that "natural" scientists, sociologists of science, and scientific organizations must reorient their theories and research problems to a politicized environment in which the scientific establishment is a key voice in democratic discourse, but not the ultimate arbiter of truth.

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