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States of Science: A Comparative Analysis of Germany and Turkey

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STATES OF SCIENCE:
A COMPARATIVE ANALYSIS OF GERMANY AND TURKEY

by

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Dedication

For my dad, who continues to walk kilometers barefoot, uphill, and in the cold so that I may build castles in the snow.

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Abstract

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This study explores the nature of science in Germany and Turkey. Specifically, I want to know what science looks like in different settings, and how it interacts with other institutions of the state. Science is assessed within the two contexts at both an individual-societal and institutional level. Indicators of knowledge and attitudes are analyzed to identify individual orientations towards science. Discourse analysis is used to evaluate the nature of science within legislatures and national academies, as well as the overall state scientific bureaucracy. I expect observed patterns to translate into policy and, as such, apply my findings to an explanation of German and Turkish reactions to the Fukushima-Daiichi nuclear catastrophe in March 2011. I conclude with a discussion of science's implications for the German and Turkish state, as well as the prospects of Turkish membership into the EU.

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Chapter 1

Problem/Purpose

The role of scientists is as problematic as it is indispensable.
(in *Counter-Democracy: Politics in an Age of Distrust,* Pierre Rosanvallon 2008)

Introduction

The above quote highlights the dialectic of science's role for the modern state: although science has been recognized in most societies as a solution to diverse challenges, the proper role for science within existing political systems continues to be disputed. Science's objective quality, as the adage goes, has made it an optimal avenue for "speaking truth to power": that is, if science reveals truth as it claims, its presence minimizes the amount of value-laden discourse necessary to arrive at solutions, a measure which serves to streamline policy-making under conditions where multiple interests compete (Grundmann, 2006, p. 74). Indeed, billions of dollars of investment into research facilities and scientific equipment worldwide substantiates the diffusion of this perspective. Adoption of some type of federal Science, Technology, and Innovation Policy (STI) or Research and Development Policy (R&D) exists almost universally. The Organization for Economic Cooperation and Development (OECD) now publishes comprehensive R&D indicators to aid in the development and analysis of national science policies.

The widely accepted perception of scientists as the harbingers of truth, however, frequently transports these actors, their methods and philosophies, as well as their innovations, from the periphery and into the core of heated political debate. Recent scholarship notes that scientists are increasingly viewed as embedded social actors and, therefore cannot always be viewed as independent from the societies within which they interact (Haas, 2004; Weingart, 1999). Just as controversial scientific discoveries find themselves in deep ideological debate (think evolution, birth control, the atomic bomb), politicians increasingly outsource their responsibility of forming legitimate policy to scientists (Demeritt, 2006; Lahsen, 2005; Milkoreit, 2011).

This holds true especially in the case of climate change and energy paradigms. Climate change is widely considered a question of science since its existence is tracked by scientists and its most commonly-accepted solutions developed in their laboratories. Climatology and atmospheric science rely on complicated graphing and historical tracing methods, most of which are unfamiliar to non-scientists (Demeritt, 2006, p. 461). Scholars considered experts in one area of physical science such as biology or chemistry may be completely unprepared to interpret climate change information since the atmospheric sciences is such a specialized field of study (*ibid*, p. 466) and depends largely on time-scale projections (Hempel, 1993, p. 232). Atmospheric scientists themselves are confronted with the complexities of climate change since extrapolation modeling has not yet been perfected (Chasek, 2010, p. 179). The details of climate change are often so complex that new institutions are being created to help scientists communicate their findings with the public (Miller, 2001, pp. 480-481).

The pressure to form a sustainable international climate change regime coupled with the desire for energy security and growing energy demand worldwide have caused shifts in energy discourses. Since increases in fossil-fuel usage for energy production, transport, and industry account for a majority of the increase of greenhouse gas emissions, the key culprit in anthropocentric climate change from 1970-2004 (IPCC, 2007, p. 36), more attention is now being given to the development of a wide range of alternative energy sources. The DESERTEC Foundation, for example, concentrates on forming collaborative networks around the world in order to harness solar energy from all available desert landscapes which, according to the foundation, receive more energy in six hours than the average human consumes in a year (DESERTEC, Concept, para. 3). Nuclear energy, perceived as a viable replacement for coal and fossil fuels, now accounts for 14 percent of the world's electricity (World Nuclear Association, Overview, para. 5). Scientists even claim they can harness additional energy resources from beyond the Earth's stratosphere, as in the case of solar panel satellites in space and Helium 3 extraction from the moon (Underhill, 2006, pp. 82-83).

What is unclear is the extent that science and politics collaborate in these policy processes, and what specific transformative effects overlap has on the nature of each entity. Due to these complexities, science necessitates deeper consideration as a factor within political systems. In this study, I explore the relationship between science, politics, and policy across two countries: Germany and Turkey. Specifically, I want to know what science looks like in different settings, and how it interacts with other institutions of the state. In the remainder of this chapter, I provide a historical outline of science's evolution and summarize major challenges confronting its position in social and political debates today. In the second chapter, I assess science at the societal level using public opinion data of individual knowledge and orientations. The third chapter focuses on science in national academies and legislatures to pinpoint its role in the state. In the fourth chapter, I apply observations of science to an analysis of the Fukushima-Daiichi nuclear disaster in Japan. I conclude with policy implications and directions for further research.

Origins of Scientific Authority

The origins of science as a normatively dominant epistemology in most parts of the world can be traced to Copernicus' assertion of heliocentrism, followed by the contributions of Newton, Galileo, and Darwin to the earth and life sciences in the 16th and 17th centuries. These discoveries paved the way for what was later termed a "Scientific Revolution" marked by the "displacement" and "liberation" of mankind from hegemonic interpretations of the universe (Tarnas, 1991, p. 326). The Enlightenment Movement of the 18th century borrowed from emancipatory discourse of science to form a connection between intellectual autonomy and good governance. Political despotism and authoritarianism, particularly in Europe, limited the extent to which individual citizens were allowed to interpret information at all. Religion, in most cases, provided a framework through which to live and progress as well as a system of unquestioned authority (Gaukroger, 2006, p. 22). Concepts of enlightenment paved the way for citizens to voice their desire for a new social order to liberate them from the despotism of religious and political elites. Science presented itself as an alternative knowledge system based on the emancipation of rational individual thought quelled by repressive regimes of the era. Indeed, emancipation from belief systems grounded upon chance, such as mythology, superstition, and religion, characterized the Enlightenment era and allowed empiricism and science to gain force as 'enlightenment's canon' (Horkheimer & Adorno, 2002, p. 4).

Scientific principles appear in the writings of a number of philosophers and political scientists of the Enlightenment period. David Hume (1742), for example, outlined a core element of the scientific ethic by which most scientists operate today-namely, the discerning between matters of chance and causation through careful observation. He posited that 'what arises from a few persons… is to be ascribed to chance' and 'what arises from a great number may be accounted for by determinate and known causes' (Essay XIV; para. 2). Writing in a similar fashion in 1784, Immanuel Kant's *What Is Enlightenment?* alludes to connections between rationalization of modern science and rationalization of modern politics. He called for a revolution to enlighten what he referred to as 'the great unthinking mass', characterizing the goals of the process as "[spreading] the spirit of *rational* appreciation [...] for each person's calling to think for himself".

Marquis de Condorcet (1795), a French philosopher and mathematician, advocated for social progress parallel to that of scientific progress. From his perspective, the two could follow the same rational methodology to reach truthful conclusions and improve the conditions of mankind. He outlines progress below:

> The sole foundation for belief in the natural sciences is this idea, that the general laws directing the phenomena of the universe, known or unknown, are necessary and constant. Why should this principle be any less true for the development of the intellectual and moral faculties of man than for the other operations of nature? Since beliefs founded on past experience of like conditions provide the only rule of conduct for the wisest of men, why should the philosopher be forbidden to base his conjectures on these same foundations, so long as he does not attribute to them a certainty superior to that warranted by the number, the constancy, and the accuracy of his observations?

In this text, Condorcet makes specific reference to systematic collection of past observations, or empiricism. Observations exhibiting certain tendencies under similar conditions point to rules and laws explaining the operations of nature. Using these laws as a key, man should be able to predict certain occurrences. The last line emphasizes the element of uncertainty which accompanies most scientific research. Here, Condorcet is calling for reaction proportional to the scientist's confidence in his discovery. He also encourages openness in the interpretation of results, and recognition of their inherent strengths and weaknesses.

The scientific spirit diffused by the Scientific Revolution and Enlightenment contributed to the rapid growth of the physical and natural sciences, as well as the transformation of the state from tyranny to democracy. The Industrial Revolution of the 18th and 19th centuries followed out of technological innovations, themselves a manifestation of scientific knowledge (Horkheimer & Adorno, 2002, p. 2), such as the steam engine and later the internal combustion engine. The introduction of these technologies into markets helped increase productivity, thus boosting economic activity and raising the quality of life for the average person. Eventually, societies began uncritically equating the scientific enterprise and its consequent new technologies with "triumphant symbols of human progress" (Smith & Marx, 1994, p. 8).

Environmental Critiques

This transition to modernity marked by innovation in science and politics, however, ran parallel to degradation of the environment. Those dissatisfied with the demystification of nature through the Industrial and Scientific Revolutions formed a counter-culture of Romantics. It is from this response that the modern environmental movement took root. Romanticism rejects the utilitarian view of nature as a tool for mankind's progress and questions the conventional hierarchy that positions man as superior to his/her surroundings. This point is similar to ecocentric environmental perspectives where, "items like water, fertile soils and fossil fuels are seen as parts of the total environment rather than as 'resources' available for human consumption," (Detraz, 2010, p. 108). From Romanticism evolved a more extreme stance on environment and the consequences of modernity called transcendentalism. Transcendentalist thinkers, led by Henry David Thoreau and Ralph Waldo Emerson in the United States, revived an appreciation of nature for its spiritual value and Eden-like quality (Hall, 2002, p.286) to counteract the alienating forces of modern science and technology. In Thoreau's *Walking* (1861), for instance, he describes the wilderness as an inspiration for adventure as well as personal growth:

> Some do not walk at all, others walk in the highways, a few walk across lots. Roads are made for horses and men of business. I do not travel in them much comparatively, because I am no in a hurry to get to any tavern, or grocery, or livery stable, or depot to which they lead. […] I walk out into a nature such as the old prophets and poets Menu, Moses, Homer, and Chaucer walked in. You may name it America, but it is not America. Neither Americus Vespucius, nor Columbus, nor the rest were the discoverers of it. There is a truer account of it in *mythology* than in any history of America so called that I have seen. (p. 9; *author's emphasis*)

Such accounts present a more conservative perspective and privilege traditional understandings of the relationship between humans and the environment. Moreover, they represent a number of numinous-aesthetic epistemologies, such as "religious knowledge traditions, folk and indigenous wisdom, local and tacit knowledge, and knowledge movements in art, music, literature, and philosophy" (Cohen, 2000, p. 84), which position themselves in opposition to the rationalist guiding principles of science.

Limits of Technology

More recently, scholars from diverse academic backgrounds have also noted the need to reflect upon the use of scientific advancement in the form of technology as a cure-all. The role of technology in mitigating environmental degradation, for example, is the core of the contested ecological modernization paradigm (EM) that took shape in the 1980's and has since evolved by criticism throughout both sociology and environmental literature. A response to the strengthening environmental movement, the discourse attempts to reconcile the assumed zero-sum quality of economic growth and environmental degradation via technological innovation in environmental reform (Huber, 1985). Further modernization through scientific innovation rather than de-modernization, as EM claims, is conducive to effective environmental management (Eckersley, 2004, p. 72-73). As such, earlier EM arguments can be viewed as satisfying both the concerns of the environmental community while keeping state and individual economic practices largely unchanged (Buttel, 2000, p. 59). Science-driven technological innovation is the key to earlier versions of the EM paradigm.

Critics within the research program point out, however, that remedial technologies and a narrow focus on changes in manufacturing processes supported by EM rhetoric only displace waste while leaving aggregate levels unchanged (York & Rosa, 2003, p. 278). These critiques call for a closer look at political economies and systemic trends of production and consumption to mitigate harmful environmental outcomes, rather than just controlling post-consumer waste and pollution (Dauvergne, 2008; Pellow, Schnaiberg, & Weinberg, 2000, p. 132-133). *Limits to Growth* advocates support the notion that supply of resources dictates the extent to which societies and civilizations can develop and draw attention to the possibility of limits to consumptive patterns (Meadows, Randers, & Behrens, 1972). What Cohen (2000) calls the *sine qua non* of ecological modernization- that is, “a willingness to respond to environmental problems in technical terms,” (p. 79) - may obscure more appropriate alternatives by limiting the discourse in favor of one development path.

Writing within the context of post-Chernobyl Germany, Ulrich Beck was one of the first to challenge science as the embodiment of unquestioned authority and point out the incalculable risks associated with certain technologies. In his concept of the *Risk Society* (1987), Beck rejects the possibility for control over nature through technology and Enlightenment rationality. In the highly-scientized and rationalized world that he describes, human progress transforms the nature of risks and renders society incapable of anticipating the consequences of its current activities and technologies. Whereas industrializing societies compete over acquisition of material goods, highly industrialized societies struggle with the side-effects of that acquisition. Following from this logic, Beck avers that highly industrialized societies become aware of risks and exhibit an abating faith in science, technological advancement, as well as the institutions and agents responsible for controlling them. On nuclear technology, for example, he asserts:

> There is a world of difference between security and probable security. The sciences have only the authority of probable security…. Until now, we have lived in the false security that probable security meant actual security. Along with this soap bubble, illusions have been punctured about the technical controllability of technical development. In the nuclear age, probabilities of error, even when they attain dimensions that no mathematician would dare to assume, behave in inverse proportion to the survival chances of all. This raises the question how long the development of whole societies will be left to the probability calculations of the engineers. (p. 157)

As such, he proposes new channels for democratic participation in order to ensure accountability of decisions over science and technology. Beck's discussion draws attention to whether or not science and technology are compatible with democratic governance.

Democracy and Governance of Science

A wealth of scientific literacy scholarship mirrors the emancipatory discourse of the Scientific Revolution and Enlightenment by asserting a connection between higher levels of scientific knowledge and well-functioning democratic societies. According to this research, wider distribution of scientific knowledge serves to reduce barriers to democracy in two ways: first, science introduces citizens to broader perspectives on modern processes that enable them to participate in social debates (Godin & Gingras, 2000, p. 44). Secondly, knowledge of science and scientific issues prepares information to receive scientific information and evaluate it in a less emotional or reactive manner by reducing the shock-value associated with policy justified in scientific terms (Laugksch, 1999, p. 84). Science is also perceived as a part of the wider education necessary to achieve the republican ideal of civil society (see Hirsch, 1987).

In contrast to these accounts of the positive effects of science on democratic societies, there is concern that control of science is becoming less democratic. The democratic deficit in science and technology appears in critiques of scientific elite and their tendency to undervalue other sources of knowledge. Formation of an international climate regime, a highly scientized issue area, is marked by regional bias of climate change research and lack of representation of the geographic Global South in political deliberations (Lohmann, 2004, p. 246-251). Since scientific research and equipment relies heavily on funding, science-based environmental policy can exhibit a similar bias (Jasanoff, 2004, p. 182). The scientific enterprise also reflects gender and racial biases that limit political influence by those in closest physical proximity to environmental problems (Third World Network, 1993). As a solution, scholars encourage an increase in exchange of information between scientists and lay persons to improve the legitimacy of actions made by those with power over decisions, as well as provide a more comprehensive representation of problems and solutions (Eden, 1996; Scott, 1997; Wynne, 1992).

Control of science by the state is also a subject of concern for democracies. In earlier accounts, Robert Merton (1938) and Walter Hirsch (1961) commented on the link between the autonomy of scientific institutions and regime type. Paradoxically, they recognized the high output of scientific research under conditions of totalitarian governance, but cautioned against the centralization of control over science due to the state's potential to abuse science for political ends. More recently, James Scott (1997) addressed the complex relationship between the state and science in his book *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. The text offers a critique of the state's imperative to make society more 'legible' by enforcing the order of scientific rationality onto the chaotic natural order of human development. Particularly in rapidly developing countries science becomes an instrument for social engineering and state planning. Essentially, it becomes the central component of a wider ideology imposed on civil society by technocratic elites, what Scott coined as "authoritarian high modernism". The transformation of science from a means to an ends in itself has serious implications for the prospects of democracy within these contexts.

Deconstructing Science

More recently, scholars within poststructuralist and constructivist paradigms have begun problematizing the universal quality of science. Max Weber in 1922 was one of the first to comment on the social construction of science. He wrote that, "the belief in the value of scientific truth is not derived from nature but is a product of definite cultures," (as cited in Merton, 1938, p. 321). A plurality of scholarship now explores science as a product of cultural dispositions (Cohen, 1998; Franklin, 1995; Harding, 1993). These studies point to a rejection of C.P. Snow's (1959) classic characterization of the irreconcilable tensions between scientific and cultural circles of knowledge and, rather, place scientific values within larger cultural belief systems (Godin & Gingras, 2000). Much literature points out that as a result of cultural interpretations, it is difficult to regulate science internationally or pinpoint scientific norms shared by all those who employ it as a tool (Drenth, 2005; Henk ten Have, 2007).

The experiences of the Scientific Revolution, Enlightenment, and Industrial Revolutions mentioned in the previous section highlight divergent cultural relationships towards science. These events are cited as unique experiences which have contributed to the formation of a cultural narrative particular to Western Europeans (Tarnas, 1991; Witzens, 2007). In other areas of the world, these three epochs were experienced at different times within different social and political contexts. The writing of Ibn Khaldoun in the late 1300's, for example, represents some of the most substantial records of the development of science and philosophy in the Arab world, but plays a minimal role in Western accounts of the development of modern science. As a function of location and timeframe, there is significant variation in the residual influence of science on modern political and social institutions.

A Multi-level Comparative Analysis of Science

The previous historical timeline provides a foundation for understanding the momentum science has gained over the past three centuries and introduces some of the challenges of reconciling science, politics, and policy. The malleability of the concept of science points to a plurality of interpretations and uses of science across cultural and geographic contexts. In this study, I explore these complex issues in two countries: Germany and Turkey. There are two reasons to focus on these particular countries.

First, this is a useful grouping since it allows us to view these dynamics within the context of a relevant political entity: the European Union (EU). Germany, a member since the European Coal and Steel Community in 1952, represents the founding group of the Union. Turkey, whose relationship with the community extends as far back as the Ankara Agreement in 1963, has officially been a candidate country since 2005 and can be therefore viewed within the sphere of influence of the European Union. Since the EU is making a concerted effort to become an "innovation union", science becomes a significant part of its policies. The EU might welcome a candidate country that can offer a boost to its scientific capacity. Common attitudes towards shifts in energy infrastructure of Europe as well as agreement on the viability of sustainable energy technologies would help Europe realize its ambitious carbon reduction goals, as well as long-term energy direction. Since the EU has significant international influence in these policy areas (Chasek, Downie, & Welsh Brown, 2010, p.182), it has an interest in considering the scientific orientations of candidate states and their respective publics during the enlargement process. As such, a comparison of Germany and Turkey as a candidate state provides the EU with valuable information. Second, a comparison of Germany and Turkey is also essentially a comparison of two countries positioned differently in stages of the modernization process; in world-systems terminology, a country in the core and a country in the periphery/semi-periphery (see Wallerstein, 1974). If links are found between science and specific political circumstances or outcomes, a comparative analysis could provide a model for improving the domestic politics of Turkey as well as other developing countries struggling with the challenge of managing science as a component within their current political systems.

The topic of science and politics is broad and deep and therefore must be narrowed. The literature on the overlapping concepts of *scientific literacy*, *public understanding of science,* and *scientific culture* offers a good starting point for framing my measurement of science. *Scientific literacy* studies, in particular, tend to be the domain of educators and focus on tracking scientific indicators as a part of overall educational achievement by students across diverse educational settings. The OECD Program for International Student Assessment (PISA) is an example of this type of study at an international level. Among this scholarship, achievement is measured by knowledge of scientific facts and methods as well as application of those principles in problem-solving situations (Laugksch, 1999, p. 76). *Public understanding of science* and *scientific culture* adopt different measures of scientific knowledge, instead focusing on knowledge of scientific issues in the news or recognition of institutions, policies, or people (Bauer, Petkova, Boyadjieva, 2000; Miller, 1998, 2001). In addition, the two converge in their attention to individual attitudes towards science's influence on society and politics (Cohen, 1999, 2000).

These types of studies imply that certain levels of science yield certain political outcomes without shedding light on the location of that science within existing political structures or the nature of that scientific knowledge. The agency of the individual is traded for a clear picture of the status of science at an aggregate societal level. My research should emphasize that science appears in various forms with specific values, norms, and rules crucial to a comparison of different states. Therefore, individual indicators offer an incomplete picture of the dynamics of science and politics. As Godin and Gingras (2000) ask: "Can the simple reference of the sum of the attributes and practices of individuals adequately describe a society's effort to appropriate science and technology?" (p.46). Restated for this study: can the reference of the sum of individual orientations towards science be used to adequately characterize how science operates as an institution in Germany and Turkey? Scientific literacy and public understanding of science cannot capture science as represented in the state or as represented by dynamics between the state and the civil sphere. A more complete depiction of science is available if we include institutions of science at a state level of analysis. Following from this focus, I propose expanding the typical measurement of science beyond the individual societal-level to include observation of science within the bureaucratic and legislative contexts of the state. In doing so, I hope to pinpoint representation of science as well as the function of science within the broader structure of the political system.

Chapter 2

Science and Society

Introduction

In the previous chapter, I explored the range of connections between science and politics. I have highlighted the need to show differences in science at both an individual-societal level and a state level. I begin my analysis by looking at science at an individual level in Germany and Turkey. Measurement of science will be done with a focus on knowledge of science, attitudes towards science, and strength of research and development (R&D) indicators. As such, this chapter should very closely resemble the scientific literacy scholarship. Information on knowledge and attitudes is taken from online data tools of the Eurobarometer Data Wave 63.1 2004/5. R&D indicators are found within national reports for 2008 on the OECD's statistics website.

OECD data were also available for performance in science among 15-year-olds through the Program for International Student Assessment (PISA). These data, however, do not allow for in-depth analysis of possible cultural underpinnings relating the content of questions to the answers given. Although the latest Eurobarometer survey questions regarding science and technology do not include more recent data, they are the best representation of both knowledge of science and orientations towards science in Germany and Turkey that allows for thick description. The Eurobarometer survey data evaluated the entire EU after the 2004 enlargement as well as the remaining candidate countries. I have included all 13 knowledge questions, but I narrowed the wealth of attitude questions down to a set of 12 for a more focused analysis. The number of participants was roughly 1,000 for each country.

Knowledge of Scientific Facts

The knowledge portion of the data is an assessment of strictly factual information where participants were asked to answer either true or false to a set of statements about science. This type of knowledge question omits dimensions of scientific knowledge such as application of its methodology or knowledge of scientific developments. In this case, data are not yet available to remedy the problem, so I must proceed with less than perfect information. Questions, as well as the percentage of respondents who answered correctly to each question, are displayed in Table 1. A higher percentage indicates a more knowledgeable public.

Based in these data, the surveyed German population scores much higher than the Turkish participants, indicating a higher level of scientific knowledge among its public. Germany also ranks higher than the average EU level of scientific knowledge, though it is lower than Sweden, Switzerland, and the Czech Republic in this respect. If scientific literacy research holds any water, this should put Germany in a good position to meet social needs and remain competitive economically. Taking into consideration the high scores in questions 1, 3, 7, 11, and 12 (those with obvious connections to earth and atmospheric sciences), Germany's participants appear especially prepared to contribute to discussions on climate change, a policy area where the EU is already particularly active. Turkey fares much lower than average EU levels in terms of scientific knowledge. This could be a result of the low aggregate level of literacy in science, math, and reading of the Turkish population in general, although Turkey has made serious forward strides in the past 4 years in these areas (PISA: Turkey highlight).

Table 1

Knowledge of Science in Germany, Turkey, and Wider EU

		Value	**GER**	**TUR**	**EU**
Q1	The center of the earth is very hot.	TRUE	97.2	83.6	92.5
Q2	The oxygen we breathe comes from plants.	TRUE	87.7	78.1	87.1
Q3	Radioactive milk can be made safe by boiling it.	FALSE	90.8	46.5	85.6
Q4	Electrons are smaller than atoms.	TRUE	54.9	55.3	60.1
Q5	The continents have been moving their location.	TRUE	96.55	83.5	93
Q6	It is the mother's gene which decides a baby's sex.	FALSE	78.15	69.8	76.5
Q7	The earliest humans lived at the same time as the dinosaurs.	FALSE	88.4	41.8	74.4
Q8	Antibiotics kill both viruses and bacteria.	FALSE	47.7	31.7	49.7
Q9	Lasers works by focusing sound waves.	FALSE	58.5	51.5	62.6
Q10	All radioactivity is man-made.	FALSE	76.75	52.1	66.8
Q11	Human beings developed from earlier species of animals.	TRUE	79.75	34.6	72.9
Q12	The sun goes around the earth.	FALSE	75	40.4	68
Q13	It takes one month for the earth to go around the sun.	FALSE	79.45	74.5	80.2
	TOTAL percentage answering correctly		**77.75**	**57.18**	**74.56**

Source: Eurobarometer 63.1 (2004/5)

When compared to Germany, in particular, Turkish scores do not reflect the same level of knowledge and are, in all but three questions, considerably lower. In the five questions regarding earth sciences, Turkey scored consistently below average compared to the EU and much lower than Germany. This remains the case today according to the PISA scientific literacy performance scores which place Turkey lower Germany. In the 2009 PISA, for example, Germany's average 15-year-old scored 520 out of 600 points, whereas Turkish pupils on average scored only 454. Germany ranks above the OECD average and 7^{th} in the world for scientific performance among the age group selected, whereas Turkey ranks below average.

It is worth bringing attention to two specific questions to draw out possible cultural factors that might have an impact on participant answers. Question 11 might strike the reader as interesting, since the question's focus is to assess recognition of evolution as a scientific fact or fiction. This is in itself an example of the complex debates of science and politics. Here, only 34% of Turkish participants answered in the affirmative to the statement "Human beings developed from earlier species of animals." In the German sample, 70% answered true to the statement. This indicates a huge disparity in understanding of an issue often at the crux of debate between scientific and religious epistemologies.

Intuitively, one might link false answers in this question to participation in religion in each country since religion represents a knowledge tradition which positions itself very often in opposition to the rationalist guiding principles of science (Cohen, 2000, p. 84). This is to some extent true; in Germany, only about 12% of participants within the same survey said they attend church once or more than once a week compared to almost 36% in Turkey. An exploration of how religious values fit into the wider educational program in each country would be necessary to pinpoint the exact effects of the correlations indicated here.

Regarding radiation, an issue which received much publicity in Europe after the Chernobyl nuclear disaster in 1986 and again after the tsunami and subsequent meltdown at Fukushima-Daichi in Japan in 2011, results also signal culturally imbedded understandings of facts. In Question 3, only 46% of participants in Turkey answered false to the statement "Radioactive milk can be made safe by boiling it", whereas the EU average stood at 85%. This could be a lasting effect of the Chernobyl incident in the collective memory of Europeans and Turks. In Germany, we see a very high percentage of respondents answering correctly to this question about radioactivity- 90%.

Germany's case could be much less a reflection of pure knowledge than an indication of the sample's fear of it; Germany was, after all, the setting which compelled Ulrich Beck's concept of *Risk Society* in 1987. If risk of radioactivity prevails within a society's discourse, as it did in Germany following Chernobyl, individuals would have a tendency to be overcautious about it. Therefore, no amount of precautionary measure, such as boiling radioactive liquid before consuming it, would reduce risk. To emphasize this point, Question 10 also regards the nature of radioactivity, but does not make reference to its safety and is thus devoid of the risk component delineated above. In this case, percentage of Germans answering correctly is much more modest at 76%.

In Turkey, low percentage of those who answer correctly to questions regarding radioactivity may be the result of misinformation during this same time frame. It is reported that in order to reduce fear of radiation and possible economic damage to the agricultural industry on the Black Sea coast, then Prime Minister Turgut Ozal appeared on television promoting consumption of teas and other key produce grown in the region, commenting that "Radioactive tea is more delicious, more tasty," ("Authorities Lied on Impact of Chernobyl", 1996; Gusten, March 23, 2011). In addition, scientific evidence reporting high levels of radiation was concealed and scientists researching the incident branded "atheists and traitors".

The questions of evolution and radioactivity highlight science's political component; knowledge of science becomes, to an extent, perception of science formed through shared experiences with scientific issues. In this case, misinformation emerges as an additional obstacle to scientific knowledge and communication between government elites, the scientific community, and the public. As such, it could also have important implications for the formation of certain policies as well as the democratic process. In addition, the disparities in understandings of these issues in Turkey and Germany mark further incongruities between them.

Attitudes towards Science

Scientific attitudes are also surveyed in the Eurobarometer dataset. Scientific attitude assesses how individuals feel about the role of science, scientific elites, and the intersection between science and politics. I split the included questions into two separate groups due to content and format of the questions.

Among questions regarding the beneficence of science (Figure 1), Germany and Turkey share the basic belief that science is useful and has advantages. In the first and second questions, the percentage of surveyed German and Turkish individuals either agreeing or strongly agreeing is very high, with minimal difference between the two countries. The agreement among the three entities shifts slightly, however, when participants are asked to consider risks involved in science. Only 43% of Germans respond that the benefits of science outweigh the risks involved. This reinforces the characterization of Germany as a risk society. In contrast, 68% of Turkish participants agree or strongly agree that science is mostly beneficial to societies.

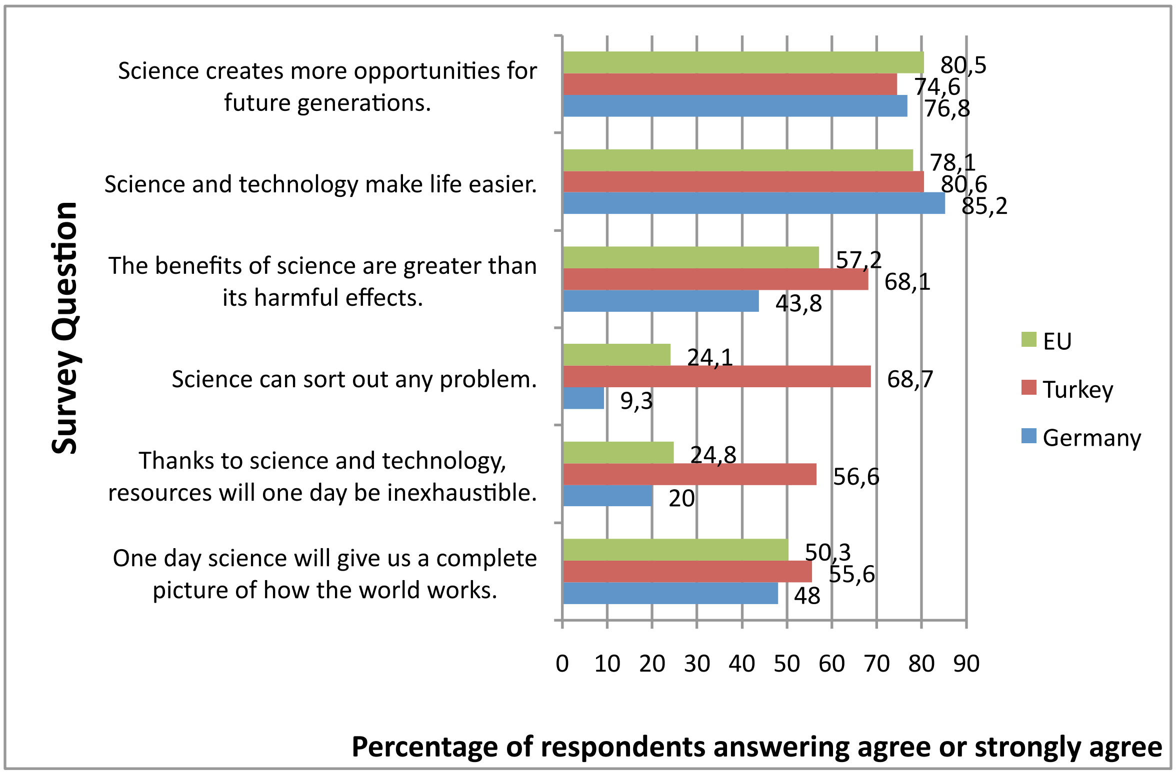

Figure 1. Beneficence of Science in Germany, Turkey, and Wider EU
Source: Eurobarometer 63.1 (2004/5)

Germans/Europeans and Turks alike are split almost down the middle within themselves as to the nature of the scientific endeavor and its ability to reach an end goal of pure truth as asserted by positivist accounts of science. However, Germans are very reluctant to link science's ability to evolve as a discipline to science's ability to offer viable solutions to social problems. Only 9% of Germans agree that science can sort out any problem. 68.7% of Turks agree with the statement. This points to a German (and, modestly, European) population that differentiates among alternative solutions to social problems as compared to a Turkish population that prefers, according to these results, to yield to science in most cases.

This works in tandem with results for question 5. When asked specifically about environmental challenges, such as resource depletion, 56% of Turkish individuals agree that scientific solutions can eliminate the problem. Only 20% in the German population agrees to the statement. This particular question underscores a contested issue within global environmental politics, namely the debate over structural solutions to distribution concerns that address consumption patterns versus techno-corporatist solutions emphasizing how scientific discoveries can aid in helping societies maintain current patterns of consumption. Viewed in this light, the Turkish public might be less willing to adapt personal consumption habits, whereas Germans might expect to make individual adjustments.

Attitudes towards science itself are distinguished here from attitudes towards science as a political agent (Figure 2). Both Germany and Turkey call for more interaction between politicians and scientists. Ironically, Germany also worries significantly more about the way scientists might abuse their power than Turkey or the rest of the EU. This might be the legacy of science during the National Socialist regime of the 1930s and 40s where science was misused to achieve perverse political ends (see Koonz, 2003). In any case, the German responses to these two questions indicate a desire for both scientific oversight of politics and political oversight of science.

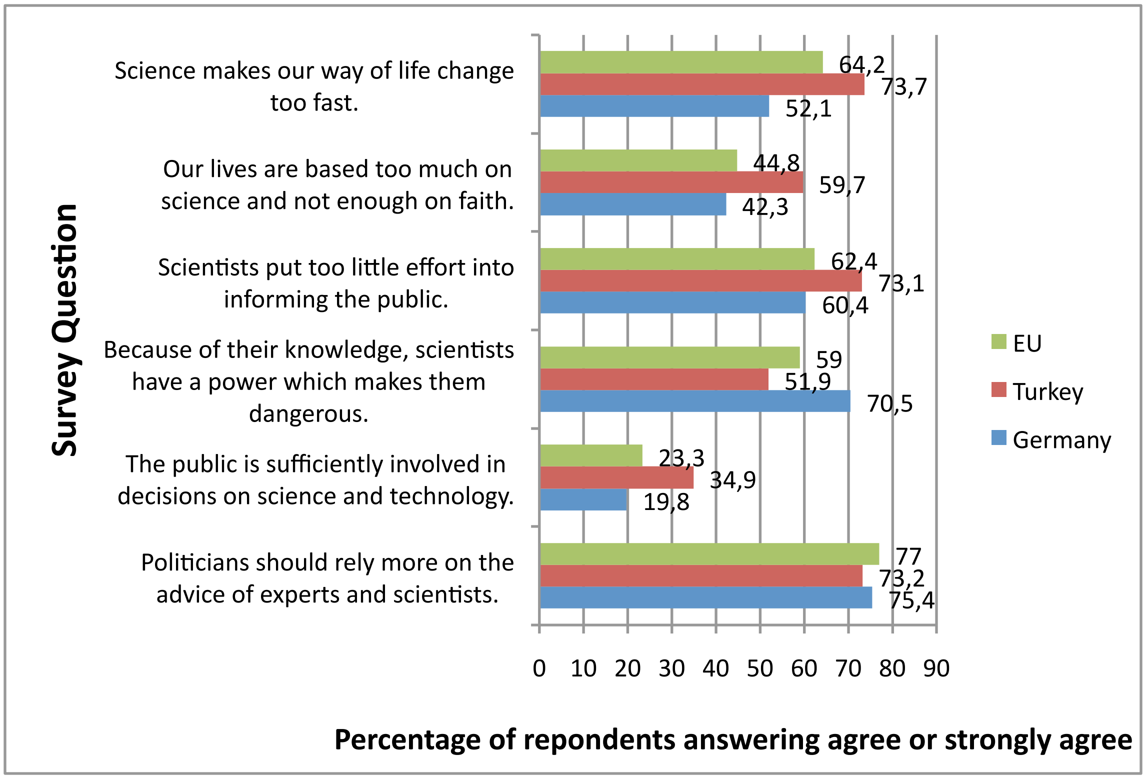

Figure 2. Attitudes Towards Science in Germany, Turkey, and Wider EU
Source: Eurobarometer 63.1 (2004/5)

Although not portrayed in Figure 2, Turkish participants represent the highest proportion of individuals who disagree with the statement that scientists have a dangerous power. Although Turks seem to trust their scientists more, they recognize a deficit in communication between the public and scientific elites. They are curiously the most satisfied with their role in scientific decision-making, although this percentage remains too low in absolute terms to conclude that Turks see the systems as being perfect. This indicates, perhaps, that Turks understand the limitations of their personal knowledge for policy, but wish to be more informed about policy as it changes.

Overall, Germany's attitudes towards science are rather pessimistic and cautious. In contrast, results in the Turkish sample indicate a strong support for science, but point to a possible disconnect between science's usage and legitimate political power. Very low beliefs in science's reputation as a cure-all among the German sample reflect a rejection of uncritical utilization of science. In Turkey, however, the case may be that as economic growth makes employment of new technologies an option, it might not see the same danger in 'risk' technologies that Germans do.

Summary

Germany and Turkey differ greatly in terms of knowledge, attitudes, and overall scientific indicators. Most individuals in Germany possess high knowledge of scientific facts, and almost a third are employed in a field that depends on this knowledge. Most Germans are hesitant to cede political power to the scientific community due to a high distrust in scientists and skepticism over the usage of science as a panacea. In Turkey, there is a deficit of scientific knowledge due to more general low educational achievement as well as government manipulation of facts. High percentages of Turkish people believe in the power of science to offer solutions to problems like energy resource scarcity and are relatively satisfied with their personal involvement in decisions over science. There is evidence, however, that most Turkish people desire more information from scientists regarding scientific developments that might affect their lives. As such, Germans can be described as very knowledgeable but pessimistic or cautious. Turks in general have low levels of knowledge, but are highly optimistic towards scientific endeavors.

This characterization of the cultures of science in German and Turkish society has two important implications. The first deals with the institution of science itself. Levels of scientific knowledge in each country determined in the knowledge section in 2004/2005 appear to correspond to Research and Development (R&D) trends on both countries four years later, although an argument of causality is not being made here. Table 2 summarizes societal R&D indicators for Germany and Turkey based on 2008 OECD statistics. The indicators include scientific articles produced per million population (ART), number of researchers per thousand people employed (RES), percentage of science and engineering degrees in all new degrees granted (DEG), percentage of human resources in science and technology occupations as a part of total employment (OCC), and the level of gross expenditures on Research and Development (GERD).

Table 2

Research and Development Indicators

	GERD	**ART**	**RES**	**DEG**	**OCC**
Germany	**2.68**	820	7.5	28	36
Turkey	**0.73**	272	2.4	18	12.7
EU	1.84				
OECD	2.34				

Source: OECD Science, Technology, and Industry Outlook Country Profiles 2008 (published 2010)

In terms of spending, Germany has positioned itself to support the research activities of science better than Turkey and much of Europe and the OECD. A point of prestige, scientific articles produced in Germany make up 4% of world scientific publications (OECD Outlook Country Report, Germany, p. 178). More than a third of Germans are employed in some form of R&D positions, and almost a third of all new degrees awarded during the year were characterized as science or engineering. Thus, Germany appears to be putting the knowledge of its public to good use in order to implement science-based projects in health, energy, transportation, security, and communications as outlined in its Federal Ministry of Education and Research "High-Tech Strategy 2020" (pp. 12-19). Turkey, on the other hand, appears ill equipped to match its ambitious innovation and technology goals as set out in its Vision 2023 plans since it lacks the skilled workforce required to produce such activities. Vision 2023 is part of the Turkish government's national strategy to achieve modernization by the 100th Anniversary of the founding of the Turkish Republic by Mustafa Kemal Ataturk. The Vision calls for huge improvements in technology and development to address development problems and bring Turkey into ranks with the developed world, especially the European Union (TUBITAK website, Vision 2023). If this knowledge deficit it not tackled, Turkey may not be able to meet these ambitious economic and social goals. Moreover, the lack of knowledge resources could limit Turkey's role in bilateral or EU-level cooperation on research and development.

The second implication of this characterization of Germany and Turkey is its influence on the nature of civil society. The indicators above identify the potential for scientific knowledge and attitudes to become 'appropriated' into social settings. Science can be interpreted as knowledge capital for the state, but also as social capital for collective activities regarding science. More important than the way this collective action is facilitated to serve state goals is its potential to mobilize itself as a counterweight to the state. It is evident that smaller proportion of the surveyed Turkish population possesses an understanding of science, whereas knowledge in Germany is more diffuse. This situation becomes precarious in contexts such as Turkey where science is widely perceived as a cure-all to the problems of development, making technocratic governance a pragmatic option. Technocratic governance often relies upon an ill-informed public preoccupied with events and issues that fall outside of the political sphere, thus rendering it incapable of making the best decisions through inclusion and participation in the democratic process. Moreover, the perspective recognizes an evolution in the nature of the problems facing modern societies that complicates the average citizen's ability to make decisions (Bobbio, 1984, p. 196). Rather than attempting to change this status-quo, technocracy denotes a shift in power over complex decision-making into the hands of a specialized group of technicians well-versed in the appropriate disciplines, granting them significant leverage over political decisions.

These findings indicate that Turkey's society is, in fact, ill informed. Therefore, ceding power over decisions to designated knowledgeable elite would maximize the efficiency of outcomes over politically contested issues, since experts are perceived as having specialized knowledge and access to truth. Essentially, the argument asserts that those who know the answers should answer the questions:

> The hypothesis which underlies democracy is that all are in a position to make decisions about everything. The technocracy claims, on the contrary, that the only ones called on to make decisions are the few who have the relevant expertise. In the time of absolute states,…, the common people had to be kept at bay from the *arcana imperii* because they were considered too ignorant. Now the common people are certainly less ignorant. But are not the problems to be resolved […] becoming increasingly complicated? Do not these problems, by their very nature, require scientific and technical knowledge which are no less arcane for the man or woman in the street (no matter how well educated)? (Bobbio, 1984, pp. 196-197)

According to this understanding of technocracy, governance is limited to experts and civil society becomes peripheral to the decision-making process. The problem of rule by technocrats is "… that they increasingly define the agendas and alternatives needed to govern, thereby reducing bargaining and compromise as major components of the democratic process," (Hempel, 1993, p. 231). Literature on political recruitment explores another danger associated with the role of the elite in political systems, recognizing the overlap between political elite and scientific elite that appears in many technocracies which only further consolidates power over decisions into the hands of a small circle of individuals (Mahler, 2003, p. 174). Where does this leave prospects for democratic decision-making?

Comparativists cite the role of elite-mass linkages or "the patterns of relationships between the elite and the masses which *allow the elite to govern on behalf of the masses*," (Mahler 2003, p. 174; *author's emphasis*) as contributing to a more democratic form of technocracy. Here, the Weberian distinction between power as domination and power as legitimacy becomes a crucial factor in the democratizing of science. Technocratic elitism may be considered to hold power as legitimacy insofar as it makes itself open to feedback by the masses and aligns itself with their values (*ibid*). The greater the distance between the elites and the masses, or the fewer opportunities for feedback and responsiveness present themselves, the more decision-making begins to resemble power as domination. In the case of Turkey, a huge gap necessarily exists between the individuals with knowledge of or employment in science, making technocratic decision-making a possibility. Moreover, wide belief among the Turkish public in the potential of science to improve the human condition provides the indirect affirmation technocrats need to implement their policy choices with minimal resistance. In Germany, on the other hand, wider distribution of knowledge and participation points to the possibility of more democratic level of control over science.

Chapter 3

Science and the State

Introduction

In the previous chapter, I revealed two very different societies in Germany and Turkey according to individual knowledge and attitudes towards science. Germany has a knowledgeable but skeptical public, while Turkey's public is less knowledgeable and highly optimistic towards science and technology. In this chapter, I supplement these individual-societal level findings with institutional and state-level indicators. First, I look at the institutionalization of science within national academies of science to establish both how science looks internally as well as in relationship to the external bureaucracy of science. Then, I observe to what extent science is represented within national legislatures and how the inclusion of science within this context might influence policy-making.

National Academies of Science

National academies of science are crucial in any understanding of the institutionalization of science in a country in two ways. First, the projects undertaken by these bodies and the amount of research they produce serves as a gauge of the strength of the scientific community as a whole. The size of the Academy and the rigor of its programs reflect the aptitude for scientific discovery and the overall status of science within a society (Ben-David & Sullivan, 1975, pp. 209-210). From a methodological standpoint, national academies of science are also the most visible and unified concentration of scientific norms on a national level, allowing us to explore with greater ease how science operates across specific contexts.

Secondly, Academies have experienced a complicated history in their relationship to state power; in many ways, the Academy developed alongside the European state in the 17th century with a clear connection to political interests and institutions both financially and structurally (McLellan, 2003, p. 2-3). In fact, longevity was experienced more often among Academies supported by powerful political interests such as monarchy or the aristocracy than within those originated within a university setting (Fay, 1932, p. 259). While the scientific academy served to solidify the position of the nation-state and its prestige, it was also instrumental in the diffusion of science internationally. Efforts to transform France into a "Republic of Science", for example, turned Paris into an epicenter of international science by the mid- 18th century (Hahn, 1971, p. 35). At the turn of the century, political instability initiated a trend where scientific institutions became critical of autocratic governance and its conflicting norms, although science was still held in high esteem by government due to its ability to produce valuable information (Ben-David & Sullivan, 1975, p. 206). Today, Academies struggle with reconciling their desire to offer solutions to social issues with their desire to remain unaffiliated with politics; this is only complicated by their unavoidable dependence on public funding for research activities and inclusion within the bureaucratic structure of the state (Ben-David & Sullivan, 1975, p. 207).

I conduct a discourse analysis in order to explore how science is represented within national academies of sciences, especially within the context of political and social goals. Discourse, according to Maartin Hajer (2005), refers to the "ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomenon" (p.300). Discourse analysis focuses on deconstructing arguments and discursive mechanisms found in documents or spoken statements to reveal their influence on politics. In order to explore how meaning is given to the concept of science in Germany and Turkey, I examine academy profiles submitted to the All European Academies (ALLEA) which describe the histories, goals, and projects of the two cases. Since these reports are submitted by the individual academies themselves, I take them to be representative of their institutional self-image. Therefore, I concentrate on the framing of scientific matters and repetition of themes and language.

Important for this section is not only a characterization of the national academy in its own right, but also of the dynamics between the academy and the bureaucracy/polity. In particular, I seek to understand the power relationships and direction of policy-making between them. As such, I also pay close attention to the relationship between the academies and national governments or bureaucratic structures. Comparatively speaking, most countries possess a set of five ministries or departments within their bureaucratic structure, minimally. These include foreign affairs, justice, finance, defense and war, and internal affairs. Internal affairs ministries typically atomize to adapt to political or social conflict, producing a range of additional ministries of various form (Heady, 1966, p. 23). Ministries of environment and education, for example, might have emerged to adapt to increasing pressures to coordinate those issues. Therefore, the make-up of the ministerial structure, as well as science's role within the structure, is key to our understanding of the dynamics between science and politics in Germany and Turkey. A list of relevant scientific institutions discussed within this chapter is provided in the Table 23 based on my own research.

Table 3

Institutions of Science in Germany and Turkey

Germany	Website
Federal Minister of Economics and Technology	www.bmwi.de
Federal Minister of Education and Research	www.bmbf.de
Federal Minister for the Environment,	
Nature Conservation and Nuclear Safety	www.bmu.de
Federal Minister for Economic Cooperation and Development	www.bmz.de
German Council of Science and Humanities (Wissenschaftsrat)	www.wissenschaftsrat.de
German National Academy of Sciences (Leopoldina)	http://www.leopoldina.org/
Turkey	
Ministry of Education	www.meb.gov.tr
Science and Technology Ministry of Industry	www.sanayi.gov.tr
Ministry of Environment and City	www.ormansu.gov.tr
Ministry of Energy and Natural Resources	www.enerji.gov.tr
Science and Technology Research Council of Turkey (TUBITAK)	www.tubitak.gov.tr
Turkish National Academy of Sciences (TUBA)	http://www.tuba.gov.tr

Germany's Scientific System. Of Germany's 14 federal ministries, two represent science and scientific research specifically. The Federal Ministry of Economics and Technology is responsible for technological development and innovation as sources of economic growth, and thus focuses on employment opportunities and the competitiveness of German markets. The Ministry of Education and Research specifically focuses on the development of knowledge communities within Germany, as well as the strengthening of Germany's role as a leader in the international scientific community. Language and framing of goals on the German Federal Ministry of Education and Research's website highlights how scientific education, in particular, has become a huge part of the concept of German education in general. The headline on the Home Page on September 9, 2011 read "Scientists, Come Home!" and is labeled as a top theme amongst other ministry priorities. This headline followed the introduction of an initiative to bring German scientists back to Germany as well as attract new scientific minds, regardless of country of origin. Here, the website uses the discourse of *future* in order to foster a diverse scientific community which aims to put Germany at the center of international science for the long-term.

The German *Wissenschaftsrat*, or Council of Science and Humanities, is a further institution which appropriates science within the bureaucratic structure of the state. While the Council is not a separate government-run ministry, it is institutionally connected to scientific policy in its role as an advising body to both federal and state governments. The substance of its output, mostly recommendations on the strategy, funding, and efficiency of institutions, signifies policy-oriented involvement. The Council describes itself as "an important instrument of cooperative federalism for the advancement of science in Germany," speaking to its role as a mediator between policy-making bodies of government. Moreover, the Council gives great political power to its members: "The scientists and figures of public life in its ranks work at equal level with representatives of the federal governments and the state governments," (see About, Function). The Council's function can be described as the improvement of science policy via a close partnership with federal and state governments.

The Leopoldina, Germany's national academy of sciences, officially became the national academy of Germany in 2008, combining 8 individual academies into one overarching institution. The Leopoldina is not new, however. It originated in 1652 by a German physician and was recognized by Emperor Leopold I in 1677 as an imperial institution operating both independently and "without censorship" (para. 5). These basic principles have been transmitted into the culture of the current Academy where the Leopoldina maintains a large degree of agency within German politics. Elections of members to the Academy are and have always been free from (direct) government control and influence; members are elected from within the General Assembly. Distinguished members, including administrative representatives of non-scientific capacity are appointed internally rather than by government officials. The Academy's autonomy must be bolstered by its size- it consists of approximately 1300 elected members, twice as many members as there are representatives to the German Bundestag and almost 4 times the size of the Turkish national academy of sciences. A statute sets the limit of members under the age of 75 to 1000, indicating a modest level of institutionalized gerontocracy in the Weberian sense which appears to contradict a merit-based pattern of recruitment while serving to facilitate the transmission of science from academic generation to generation.

The text from ALLEA's report is relatively short, but it emphasizes a defining principle of the scientific culture within the Leopoldina- namely, the process of *independent review.* This shapes the relationship between the Academy and the German federal government. According to its description, the activities organized through Leopoldina serve as "a basis for science-based recommendations and statements which are addressed to political institutions and the interested general public" (p. 3). Following annual meetings or other planned events, the Leopoldina might further investigate topics it feels warrant deeper attention and produce statements as a resource to both governments and the public, as was the case with the 2003 "Thesis Paper on Energy" which resulted out of a biennial assembly and was prepared in large part by ad-hoc committees.

In some cases, government officials solicit research from the Leopoldina, as was the case following the events in Fukushima and the subsequent decision to enact a 3-month moratorium on nuclear plants in operation before 1980. This topic will be discussed in more detail in the analysis of Fukushima in Chapter 5. In this way, policy-making appears to flow in a reciprocal manner between government and the Academy. While politicians in Germany use scientific expertise widely and scientists deal with content of social and political nature (Weingart, 1999), the output of the scientific elite within the Leopoldina does not appear to be limited or directed by the desires of the political elite. The upfront recognition of boundaries of science and government distinguishes the German scientific system.

Turkey's Scientific System. Of the 21 federal ministries of the Republic of Turkey, no single ministry focuses on the appropriation of science. The Science and Technology Ministry of Industry focuses, as its name implies, on economic growth of the country and makes no specific reference to the development of scientific knowledge. The

Ministry of Environment and the Ministry of Energy and Natural Resources concentrate only minimally on science's role in policy. The Science and Technology Research Council of Turkey (TUBITAK) assumes the role of a ministry of science to the Turkish government. It is responsible for funding of all other scientific programs. TUBITAK advises the Supreme Council for Science and Technology, the mechanism which implements new science policy legislation and is directly linked to the Prime Minister's office. Other federal ministries and government agencies serve on the Board of the Supreme Council.

TUBA, or the Turkish Academy of Sciences, was established in 1993 by government decree. The idea of an academy with a strictly scientific focus did not become visible in Turkey until the 1960's and, according to the ALLEA text, failed initially due to political and legislative obstacles during that time frame. The current TUBA is the product of centuries of the development of an educational system rooted in the Ottoman era. The academy text implies a close association between scientific education and general education which is reflected in the scholarly composition of its General Assembly and choice of projects; of the current 136 members of TUBA's General Assembly, 80 belong to basic and engineering sciences, 32 to medical sciences, and 24 to social sciences. This indicates a broader conception of science than in the Leopoldina, where only 2 out of 28 disciplinary sections stray from the standard of natural and health sciences (Leopoldina Website, Sections).

Moreover, the Academy's projects extend to elements of social and cultural sciences. An example of this is the Academy's Cultural Inventory Project, an initiative which utilizes highly technological Geographic Information System (GIS) equipment to catalogue cultural assets in Turkey and create an end product: the Kultur Kitap (Culture Book). In essence, the project is a conservation effort and falls into the territory of science insofar as it applies an “elaborate methodology” to produce “standardized documentation” of cultural “inventory” (p. 6). TUBA works closely with TUBITAK and the Ministry of Culture on this project and the State Planning Organization supplies much of its funding indicating a close relationship with the Turkish political elite. This relationship, however, looks much different from that of most national academies. The relationship between TUBA and the government is defined by TUBA’s role in producing research conducive to achieving political goals. I separate these goals, based on their appearance in the TUBA text, into two categories: the *creation/maintenance of a Turkish identity* and *acceptance by the international community*.

TUBA is implicated in the maintenance of a Turkish identity through the nationalist quality of the majority of its undertakings. As mentioned, the Cultural Inventory Project is responsible for the collection and documentation of Turkish heritage sites of which Turkey has an abundance. TUBA is also involved in the restoration of many Ottoman/Byzantine buildings and universities. Most notably, TUBA committees are currently focusing energy into the compilation of a Dictionary of Scientific Terminology in the Turkish language. The placement of this responsibility in part within a scientific organization simultaneously claiming a capacity as a “consulting institution” (p. 2) and the focus within a majority of the Academy’s submitted text on this element of its activities underscores the reality of the Academy’s role in the achievement of specifically Turkish national priorities. Membership in the Academy is also reflective of this theme: whereas the German National Academy includes honorary members of other nationalities (Swiss, Austrian, and American) and mentions this explicitly in its text, membership in TUBA appears limited to Turkish nationals and explicitly focused on drawing in young scientists of Turkish origin (p. 2: para. 3).

The initial information given in the TUBA text is a quote from Mustafa Kemal Ataturk, the founder of the Republic of Turkey. It is worth reprinting the quote in its entirety here since it underscores key elements of Turkish scientific culture and its connection with a nationalist sentiment:

> For everything in the world; for civilization, for life, and for success, the most reliable guide is science and technology. Seeking other means to guide us is slumber, ignorance, or even treason! However, it is also essential to understand its developments and to follow in every minute of our lives the most recent improvements in science and technology. (22 September 1924; *author's emphasis*)

Here, the word treason appears again, as in the radiation discussion, to emphasize the nationalist function of scientific knowledge. This is important since Ataturk is cited repeatedly by Turkish politicians as the source of modernity and development in Turkey. According to many scholars (see Adaman & Arsel, 2005), this narrative of development defines Turkish political life today. Its inclusion in the TUBA summary highlights the place of this philosophy across different spheres of social life, including science.

Ataturk also spoke of Turkey's ascension into the international community, frequently using France as a model of the modern state. The candidacy of Turkey into the European Union (EU) reflects the perpetuation of this goal. This effort appears again within the language of the Academy's report. The Academy emphasizes the democratic quality of its scientific research, almost in order to present itself outwardly to the EU (and the international community) as legitimate. As such, the text implies a perception in Turkish scientific (and political) culture of an inherent connection between scientific norms and acceptance. The text makes reference to assumed universal scientific values such as “scientific merit” “criteria of scientific excellence”, “scientific principles and ethics”, and “norms of excellence” (p. 2, para. 4&5). The Turkish Academy text repeatedly mentions these principles, whereas they are much less prevalent in the content of the Leopoldina text. In addition, the Turkish Academy does not provide a separate document which outlines explicitly what is meant by these principles, although working papers touch on this topic.

That the words society and culture are also repeated throughout the text underscores an attempt to use science as a tool for the further democratization of Turkish society. TUBA supports the diffusion of science education in Turkey by focusing on the inclusion of science at early education phases as well as the accessibility of science to more people through institutional networking via technological innovation. The Academy specifies promotion of “freedom of expression and a “culture of debate” and sees its function as providing a “scientific platform as a basis for communication and debate on public issues,” (Aims and Mission/Activities, pp. 2-3).

At the time of writing, the (un)democratic character of TUBA has received much attention within the international and national science community following a decision by the Turkish government and Higher Education Board (YOK) to enforce changes in its structure. According to this change, the government and YOK would be responsible for the appointment of 2/3 of TUBA’s total members whereas the current constitution mandates election from within the Academy (TUBA: Public Notice, 2 September 2011). Numerous responses to this decision appeared in early September and are available on the TUBA website (See Science Insider’s article “Turkish Academy Fights Government

Changes", letters of concern from the Global Network of Science Academies (IAP) and the International Human Rights Network of Academies and Scholarly Societies). On September 5, Hurriyet Daily News reported that TUBA members are threatening to resign if the Prime Minister does not reconsider his position. The direction of policy, which begins at the request of the Turkish government, erodes TUBA's claim of autonomy as an advisory body. In this case, the increasingly ambiguous boundary between Turkish scientific and governmental organizations ironically opens the government up to harsh criticism and threatens to undermine the political priority of international acceptance.

Science within Legislative Bodies

I continue exploring the relationship between science and the state by looking at the individuals closest to policy-making, legislators in national parliaments. Based on themes already situated within literature on political elites and recruitment, attention to the role of legislators has two potential links to science. First, there is evidence of variations in the complexion of national parliaments on lines of educational background due to the political recruitment patterns typical to certain cultures or political systems. In the United States, for example, studies have shown an overwhelming percent of legislators have practised law, whereas lawyers are much less prominent within other legislatures around the world (Mahler, 2003, p. 172). This points to differences in standards of political leadership across geographic contexts. Patterns in elite backgrounds might reflect wider cultural tendencies or political circumstances creating an impetus for selection of certain candidates over others. If 80% of legislators in the U.S. have practised law at some point in their professional careers, what does this say about what

Americans want politics to be? This same question could be asked of other professionals in legislative bodies such as those with scientific training; if a wealth of scientists is found within a particular legislature, what might this say about that its citizenry?

Secondly, and following from the first point, studies have also attempted to show links between representatives with certain backgrounds and their policy stances or political activities (Poggione, 2004; Swers, 2002, 2005). Much work in this vein has focused on gender and race with reference to Hannah Pitkin's (1967) distinction between descriptive and substantive representation (in her words, "standing for" and "acting for": see Chapters 5 & 6). In a descriptively representative legislature, qualities of the constituency would be reflected in the legislature- that is, if women account for 47% of the population of the United States, 47% of legislators in the United States Congress should be women. Following from this, it is questioned whether legislators represent the substantive values of their constituents. Do women, for example, defend women's issues in Parliament? Do they have an essential quality about them (nurturing, nonviolent, emotional) that can drive a shift in the general norms and practices of policy-making altogether? These questions could be asked equally of candidates with scientific backgrounds. Does a degree in the physical sciences mean a rationalization of decision-making and better decisions? Do scientists in legislative bodies represent the interests of science or contribute more to debates over scientific issues like climate change or nuclear energy policy?

I borrow from these ideas to formulate an initial picture of how science is represented within the legislative branches of government in Germany and Turkey. For each legislature, I assessed educational backgrounds for each representative based on resumes provided on their respective websites. This proved complicated due to the incongruities across educational systems in Turkey and Germany and the inclusion of occupational as well as educational information within texts. The general rule used to determine the most accurate classification of professional background for each individual, which would be subject to inter-coder reliability testing in the future to improve the coding method, was to pinpoint the concentration and level of education in a certain discipline.

For individuals whose professional histories deviated from one discipline, the discipline of highest degree was taken. For those who had very little or only low level education experience, occupational background was coded in its place. If the resume was unclear or too convoluted to pinpoint a concentration, it was coded as missing. This method yielded 603 out of 630 members of the German Bundestag and 510 out of 550 members of the Turkish Grand National Assembly (TBMM in its Turkish acronym). A master list of disciplines was created initially for each body to ensure fullest collection of information, but was then collapsed into 11 categories for easier analysis. The results are in Figure 3.

Overall, representation of the physical or earth sciences, as well as mathematics across the two cases is low. Although little difference exists in the amount of individuals within this area of science, a huge difference exists in the number with medical or health sciences backgrounds. In Turkey, 12% of legislators fall into this group, while only 2-3 have this sort of background in Germany. This might indicate a phenomenon in the last parliamentary elections in Turkey- namely, that the public holds medical professionals and doctors in high esteem equated with ability to solve political and social problems in office. In Germany, 21% of legislators have social sciences degrees, whereas only 9% do in Turkey. This pattern might also reveal a perception among the German public that social scientists and philosophers make better politicians.

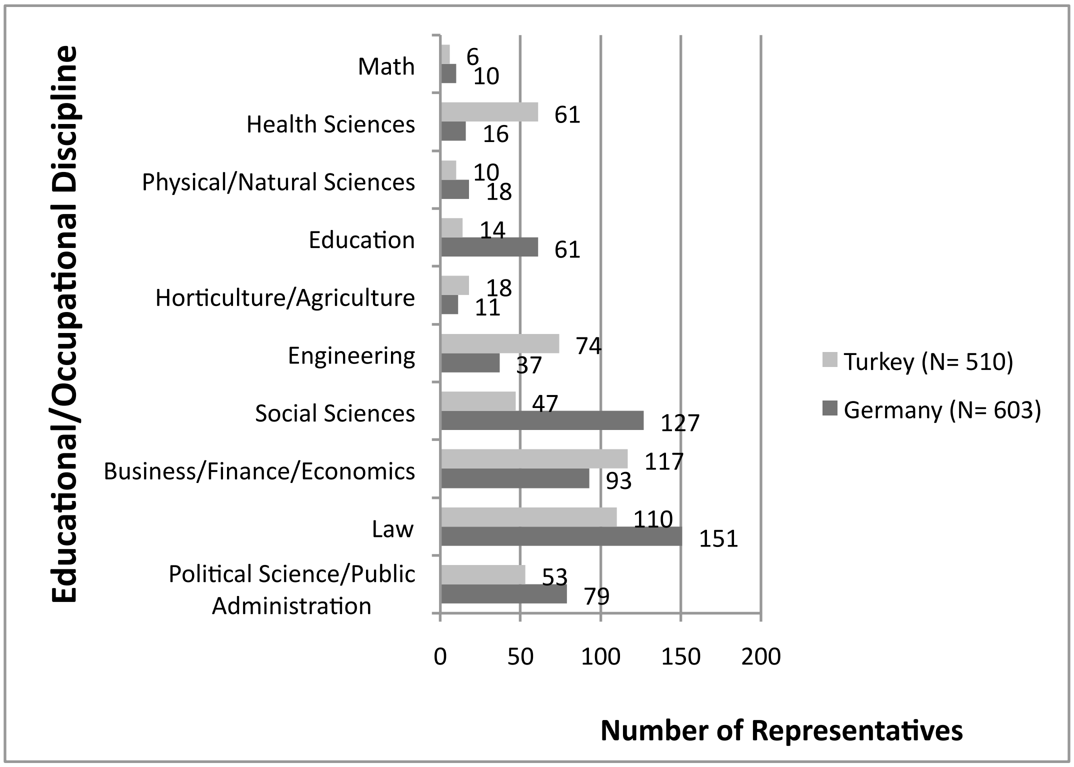

Figure 3. Educational Profiles of Parliaments in Germany and Turkey
Source: Bundestag.de and BMM.tr

The disciplines of Turkish representatives as a whole are reflective of the developmental path and structure of Turkish politics. The titles of post-graduate degrees tended to be specific to a practical application of the knowledge. In the German case, however, discipline names tended to be much broader and encompassing of more than one possible direction. The sociology of the legislative bodies illustrates this point: Turkey has twice as many engineers as Germany's Bundestag, indicating a concentration in the educational base of recruitment in Turkey in areas considered to cater to social needs. If we revisit the descriptive representation discussion, Germany's legislature under represents the population of scientists in the country at large, while the Turkish National Assembly over represents scientists in comparison to national trends. This again indicates a support among the Turkish public, expressed through democratic election, for a science-driven politics. Certainly, the party structure of each Parliament also contributes to the epistemological commitments of legislators. The Greens are a huge force in Germany, whereas the Developmentalists dominate in Turkey. The party principles, as well as the educational backgrounds prevalent in both Parliaments are reflective of the risk society sentiment in Germany and the technological optimism in Turkey.

Summary

A look at the functional aspects of science offers the opportunity to further illuminate the relationship between polity and society in these two very different settings. The Leopoldina, Germany's official national academy of sciences, plays a crucial role in the development of policy as well as the oversight of policy. Despite its involvement with Ministry affairs, the Leopoldina has a level of agency as an organization that Turkey's TUBA is currently battling to retain. While both organizations produce science for social purposes, the Turkish academy has tunnel vision in this respect; TUBA's scientific undertakings do not reflect a strong theoretical scientific tendency (science for the sake of science), but rather cater to a narrative of science for nation-building. In this way, Germany's scientific community appears to be somewhat insulated from politicization, while the Turkish scientific community molds itself (or is molded by elites) specifically to fit political needs.

The differences highlighted here between the understanding of science within the German and Turkish scientific academies are not meant to be interpreted as a normative critique, but rather as descriptive of the current form of the two entities. The nationalist character of the Turkish Academy is not an anomaly in the evolution of national academies, and it is not abnormal for scientific elites to advocate for the conservation of cultural artifacts or diffusion of knowledge through language studies; this was done in the most influential academies of Europe in the 17^{th} and 18^{th} centuries (Ben-David, 1971, p. 78; Fay, 1932, p. 263). The comparison of the German and Turkish cases, however, highlights the separate socio-spatial paths of development in the two countries which contributes to the nature of the academies in their current forms.

The usurpation of TUBITAK over TUBA however, which had at least been a structurally distinct organization despite its nationalist identity, *is* an anomaly to the wider EU. It represents an extension of what Michael Mann (1984) termed the "despotic power" of the Turkish state- that is, its power *over* its own civil society (p. 114). By way of top-down government decree in this case, the Turkish government reduces "the space of uncoerced human association" (Walzer, 1990, p. 1) available to pose as an obstacle to state goals, especially those regarding decisions on science and technology. According to a distinction made by Foley and Edwards (1996), Turkish society might be marked by the trust and thick associational life necessary to civilize the current political sphere (what they call Civil Society I), but it lacks the autonomy necessary to challenge the authoritarian tendencies of the state (Civil Society II). By centralizing its power through control over its largest civil scientific organization, the Turkish government necessarily creates a more simplified scientific system for the acceleration of the gains of scientific research and development. Appointment of members by political elites, moreover, risks turning the scientific academy into the profile of the legislature- that is, well-trained technocrats with ideological commitments rather than a theoretical scientific ethic. By limiting bargaining and consultation processes between polity and society on issues of science, however, the Turkish government is simultaneously quelling one of its most reliable mechanisms for feedback and rigidifying its policy direction. For the EU, which identifies itself as a civilian power, the growing distance between Turkish elites and civil society should be a cause for concern.

The inclusion of the Leopoldina within the policy-making structure of the German state, on the other hand, can be interpreted as an enhancement of its infrastructural power, to continue with Mann's nomenclature. This is the recognition of the state's necessary confrontation, whether negative or positive, with civil society in the pursuit of its goals. Leopoldina's autonomous position within the political system in Germany is illustrative of the potential of German civil society to serve as both a partner to the state, but also as a potential challenger. By making itself permeable to input from civil society, however, the German government also risks developing oversensitivity to a spectrum of social interests whose political divisiveness obstructs decisive policy-making (Foley & Edwards, 1996, pp. 45-46).

The autonomous power of science can also be explored within the legislative contexts of Germany and Turkey where epistemic communities come together, blurring the boundaries of the political and the scientific. The Bundestag is marked by a high number of representatives with social science and education backgrounds, disciplines emphasizing the complexity of social processes. Medical practitioners and engineers, disciplines characterized by positivist epistemological orientations, largely populate the TCMM. Given this information, the legislative climate of Germany might be marked by lively debate and appreciation of discourse, while in Turkey the legislature might be rigid and more likely to promote zero-sum solutions.

This chapter offers only an initial impression of science at the state level and must be supplemented with more nuanced data to derive concrete results. Preliminary differences in Germany and Turkey point to a few avenues for future research: first, a deeper look at individuals with scientific backgrounds on the context of their party affiliation would provide an extra layer to bolster my proposition that certain jobs can be equated with certain ways of thinking. Secondly, the overlap between politicians in legislature and members of national academies would be crucial to our understanding of the mobility of actors between the two institutions and, as such, the interaction between the two spheres of influence. Finally, when is the Academy actually brought in to advise in legislative committees and hearings? Under what circumstances, how often, and what is the protocol?

Chapter 4

Science at Play: The Case of Fukushima-Daichi

Introduction

The trends observed in the previous chapters are important in characterizing science in Germany and Turkey and, consequently, their respective social and political climates. Indeed, the two are distinct on an individual as well as state level. On an individual level, Germany has high levels of knowledge of science which feeds into higher levels of scientific employment and output at a broader societal level. Germany tends to be pessimistic towards science, and has institutionalized mechanisms for controlling its undesired risks. The Leopoldina's relationship with the bureaucratic structure of science in Germany can be characterized as multidirectional in that it holds the power to both initiate new policy and evaluate recommended policy. In Turkey, low knowledge correlates with weakness in the R&D infrastructure. The Turkish public has high confidence in science and technology, a sentiment which might account for the large number of legislator with scientific backgrounds. TUBA, the national academy of sciences in Turkey, is defined by its maintenance of a specifically Turkish science. If the August decree holds up, the relationship between TUBA and the overall bureaucratic structure of the state runs the risk of becoming unidirectional- initiated by the state rather than by the scientific community.

In the final section of this study, I use my findings about science in Germany and Turkey to interpret divergent orientations toward an extremely scientized issue that has received serious attention from the international community recently: nuclear power. In particular, I use the Fukushima nuclear disaster in Japan in March 2011 to illustrate how elements of science and politics discussed in the previous chapters are visible within the context of a real political situation. The event challenged the logic of state-centered nuclear energy policies, heightening the relevance of coordinated energy governance. Moreover, Germany and Turkey's policy responses after the event are striking and can be better understood through a contextualized analysis which includes science as a contributing factor.

First, I give an overview of the core arguments surrounding nuclear energy usage and provide a basic description of the events in Japan. Then, I review the substantive reactions of the German and Turkish governments in the weeks following, paying close attention to the actual language used in those decisions. In doing so, I try to pinpoint how knowledge attitudes and the scientific academies of each country actually played a role in shaping discourse and policy direction after the event. In this way, I further characterize the political climates of Germany and Turkey.

Nuclear Energy and Its Critics

Nuclear energy has been utilized by developed and developing countries alike in order to cover the increase in consumption which results from economic growth. Nuclear power releases less carbon into the atmosphere and is therefore viewed by many supporters as an alternative to thermal energy sources like coal and oil, culprits in the global warming phenomenon (Rhodes & Beller, 2000). Moreover, the nuclear option offers import countries the opportunity to become energy-independent by increasing domestic energy production, essentially acting as part of the state-building enterprise (Stoett, 2003, p. 100). Despite these advantages, a wealth of critiques of nuclear energy exists. It is argued that investment in nuclear energy, often termed by politicians as a “bridge technology”, often precludes the development of alternative, renewable energy resources (Hennike & Muller, 2006, p. 149). Moreover, the unforeseen end products of nuclear energy are the subject of much controversy; risk of natural disasters or terrorism leaves nuclear plants and their toxic contents vulnerable (Stoett, 2003, p. 102-105). Finally, the dilemma of nuclear waste storage remains unsolved.

Fukushima and Political “Fallout” in the European Union. Fears associated with the last two criticisms were confirmed in March of 2011, when an earthquake struck the South-Pacific, sending the waves of a 15-meter tsunami up the shores of the northeastern coast of Japan. The strength of the tsunami, in addition to flooding cities and leaving whole communities without electricity during the height of the Japanese winter, also disrupted the cooling capacity of three nuclear reactors at Fukushima-Daiichi which were dependent on external power to function. Within a few days, all three reactors experienced overheating and their internal units burst, releasing radioactive debris into the water and air. This was the beginning of a mass panic in Japan’s nuclear industry, which had, up until this point, been a model of nuclear technology and safety. All eyes were on Japanese officials and their attempts to bring a nuclear catastrophe, now concluded to have exceeded that of Chernobyl in its damage, under control.

The nuclear fall from grace witnessed in Japan proved to the world that the most technologically-advanced country was still not immune to the risks of nuclear catastrophe, prompting the end of a short-lived nuclear Renaissance as well as a possible ‘authentic’ paradigm shift in global energy usage (Schneider, 2011). Following the events, worldwide solidarity protests and rising citizen concerns over safety prompted countries around the world to begin reconsidering their nuclear programs. The countries of the European Union spearheaded efforts to construct a multilateral response to the unfolding events. Following sessions on May 24 and 25, the European Council formulated a request to the European Nuclear Safety Regulators Group (ENSREG), the collective body for nuclear power in Europe, to evaluate nuclear usage EU-wide. By May 13, the ENSREG and Council had issued a declaration ratified by the member states to investigate the strength of Europe's nuclear facilities when confronted with potential "extraordinary triggering events" such as those experienced in Fukushima (p. 1: para. 3). Recognizing the "potential cross-border nature of nuclear accidents," (*ibid*) Armenia, Belarus, Croatia, Russia, Switzerland, Turkey, and Ukraine further adopted stress-testing as a regulatory framework for their respective nuclear programs in a joint declaration with the EU on June 23.

Generally-speaking, policy change regarding the future course of nuclear energy across individual European countries was minimal. European governments already in possession of nuclear energy programs continued them as planned, but began placing more emphasis on the accelerated implementation of prospective alternative energy resources within their energy mixes. Heads of state began promising increased oversight and accountability via the recommendations of ENSREG and the European Council. This is the reality of much of the EU following Fukushima: reactions were limited to formal statements of sympathy to the Japanese coupled with promises of intensified oversight of current nuclear facilities (World Nuclear Association).

France is a prime example of this characterization of the EU after Fukushima. A wise political move on behalf of a country heavily embedded within the international nuclear industry, French President Nicolas Sarkozy was the first foreign head of state to visit the disaster area in Japan following the events. The nature of Sarkozy's visit was in part of genuine condolence to the suffering incurred by the Japanese, and I certainly do not wish to imply that he or the French were devoid of any sensitivity towards the disaster. France's position in the world nuclear system, however, required a very visible response from French officials to ease the world's escalating fears. Although France was deeply involved in the direction of EU stress-testing in the months to come, the country's policy did not significantly change course. This draws attention to the constraints of nuclear dependency on the flexibility of energy infrastructures as well as the collective action problem caused by the union of countries with divergent political interests.

The immediate reactions of Germany and Turkey following Fukushima mark a divergence from the EU-wide sentiment described above. The two represent extreme reactions to the situation- in fact, they appear extremely counter-intuitive and almost irrational given the stage of their respective nuclear programs. In the next section, I outline the development of the nuclear industry in Germany and Turkey separately. Then I describe the impact of Fukushima on the nuclear discourse and policy in both settings. I conclude the chapter by drawing on previous observations on science to offer an explanation for the course of events.

Germany's U-Turn… Again. In Germany, nuclear energy has a patchy history. The oil shocks of 1974 stimulated widespread support of nuclear energy until the Chernobyl accident put dangers of nuclear waste in geographical proximity. As a result, the Social Democratic Party (SPD) put pressure on the ruling Christian Democratic Party (CDU) to phase nuclear energy out of the overall energy mix. By 1998, the SPD and the Green Party, running on an anti-nuclear platform, had formed a coalition government to defeat the CDU. With such a fragmented party system within the federal government and mounting opposition from leading energy companies, concessions were made which limited the operation of Germany's current nuclear units to a shutdown in 2022. The political climate changed once again in 2009, when a new coalition of the CDU and Liberal Democrat Party (FDP) decided to reverse the policy of former Chancellor Gerhard Schroeder and extend the lifetime of older reactors for another 15 years. Under this change, the last reactor would not shut down until 2036. Chancellor Angela Merkel received serious criticisms following her support of nuclear energy as a "bridge technology", especially from party members to the left who accused her of being a pawn of the nuclear energy industry (Connelly, 2010).

After Fukushima, Germany's nuclear policy made an about-face. Despite the country's dependence on the resource, officials called for a three-month moratorium on nuclear power pending safety inspections of all units. As of March 14, only three days after the initial flooding at Fukushima, the two oldest units were taken offline. At the beginning of this period, Chancellor Angela Merkel and her administration hesitated over the appropriate response to rising concerns over the technology, emphasizing the necessity to reflect on the knowledge acquired through Fukushima and cautioning against "false solutions" like stopping production of nuclear within Germany but importing it from other countries. A trained physicist, Merkel turned to science to aid in her decision saying "Energy must be a matter of reliable scientific assumptions." (Kohlhoff & Strauss, 2011). As the event progressed, Fukushima managed to convince to the German public "…how something is possible, that seems to scientific standards almost impossible," (Hannover Fair, 2011, para. 3). The public and strong Green Party again put pressure on

Chancellor Angela Merkel to reconsider her coalition's 2009 decision to extend the usage of nuclear power. Germany became host to the world's largest anti-nuclear protests following Fukushima and in its history; an estimated 250,000 people total appeared in the German cities of Berlin, Hamburg, Munich, and Cologne to protest the administration's current position.

The timing of the disaster certainly played a role in the volatile political situation in Germany following Fukushima. Mounting support for the Greens in the southern state of Baden-Wurttemberg, often attributed to the development of the contested Stuttgart 21 railway project in the city's public park, posed a threat to the incumbency of the CDU/FDP coalition. In light of upcoming regional elections, the administration's sensitivity to public outcry as well as the speed of its reaction to doubts over nuclear energy was interpreted by many as a 'ploy' to win over voters (Gathmann, Medick, & Wittrock, 2011), which proved unsuccessful on election day when the Greens, for the first time in 6 decades, was able to amount an opposition to the incumbent CDU and form a coalition in the regional Parliament. By the end of May, Germany had completely shut down eight of its 17 nuclear power units, cutting overall production by two-fifths (World Nuclear Association). In line with the ruling of an Ethics Commission established on April 4^{th}, the government announced a nuclear energy phase-out by 2022. This has forced a complete restructuring of the German energy system and increased consideration of the role of renewable and alternative energy resources.

Turkey's Never Again Policy. Turkey is still in the planning stages of what it hopes will be a burgeoning nuclear energy program. Its attempts to incorporate nuclear power into its energy mix reach back to 1956 with the development of its first research reactor and the establishment of the Turkish Atomic Energy Agency (TAEA). By 1962 Turkey had installed its first Nuclear Research and Training Center in Cekmece. In 2007, the Law on Construction and Operation of Nuclear Power Plants and Energy Sale was set into law in preparation for the construction of upcoming power plants (TAEA website, History Section). Within the past 50 years, various Turkish administrations have attempted to initiate nuclear energy, yet deals have continuously been stifled by financial concerns such as sealing contracts for construction bids (World Nuclear Association). In May 2010, Turkey finally signed a contract with Russia's Rosatom energy agency to build a nuclear power plant in the Mediterranean Sea town of Akkuyu. An additional agreement with Japan to build a plant in the Black Sea Village of Sinop was also underway, although the contract was switched into the hands of South Korean contractors following Japanese withdrawal. The Ministry of Energy and Natural Resources claims that by 2020, nuclear energy will account for at least 5 percent of electricity in Turkey. By 2023, it hopes to have an additional power plant in operation.

While the government agreed to incorporate the safety regulations of the ENSREG, it dismissed concerns over the benevolence of nuclear energy as a resource with an almost sardonic tone. Prime Minister Erdogan's preliminary response after Fukushima was a crass comparison of the risks of nuclear fallout to the dangers of an explosion from a household gas-powered oven: "We have to know that aside from its beautiful aspects, the modern world has many troubles," he said. "There are, for example, issues related to cosmetics. Yet nobody gives them up," (Kucukkosum, 2011a). His most insulting remark to calm the concerns of radiation levels near future nuclear sites: "remaining single and celibate is more damaging to a human's health than living near a nuclear power plant," (Staying Single, 2011). Further comments from the Prime Minister extend this comparison, which I quote at length to emphasize his manipulation of the plasticity of risk discourses:

> Is there risk [with nuclear reactors]? Of course there is. They can blow up. Now, I said that before that they could blow up and I got criticized by a certain person or persons. Are we not supposed to use bottled gas because there's a risk, because it can blow up? Are we not supposed to ride in cars because there's a risk? Are we not supposed to cross the Bosphorus Bridge in Istanbul because there's a risk? The steel ropes may break unexpectedly… So, we're not supposed to cross the bridge? *They can snap in an earthquake*, so we're not supposed to cross the bridge? If you ask the people with this particular mindset, we're not supposed to do it. We're building a tunnel crossing under the Bosphorus now. We're building a transport system. Are we not supposed to use it, either? (Kahramanmaraş on 27 March 2011 in Gunel; *author's emphasis*)

I emphasize the allusion to earthquakes within this quote since the potential for earthquakes in Turkey *actually does* form the scientific basis for arguments against nuclear energy usage, most of which Energy Minister Taner Yıldız has dismissed as "information pollution" (From the Bosphorus Straight, 2011). Scientists have warned that Akkuyu lies within 25-kilometers of the active Ecemis fault line (MIT, Harvard Experts Divided, 2011) introducing a seismic risk into the equation. Environmentalists have criticized the location of the nuclear station, arguing that politicians have not reconsidered the safety of the area since initial negotiations:

> Not a single geologist can claim that everything has been done as far as site selection for the Akkuyu Nuclear Power Plant is concerned. On the other hand, proclaiming the area strictly dangerous would be mere speculation in the absence of the aforementioned research. The real danger lies in the self-satisfied disregard for science and the stubborn refusal to give consideration to others' opinions. (Cenk Altirak 2004 in Gunel May 11 2011)

The 1999 earthquake in the city of Izmit in the Marmara region killed over 20,000 people, revealing an administration ill-prepared for natural disasters. The infrastructure of most Turkish buildings makes this type of disaster particularly alarming, since loose construction codes in Turkey make buildings instable and vulnerable to quakes. The government's response has been to assure the public of the technical superior of Turkish nuclear technology. According to Energy Minister Yildiz, the Turkish 'third-generation' reactor will be an improvement on the out-dated models used in Japan and will be able to withstand a 7 magnitude earthquake (Kucukkosum, 2011b). The recent 7.2 magnitude earthquake in the Eastern province of Van on October 23 has once again drawn attention to Turkey's vulnerability to earthquakes. Energy Minister Taner Yildiz reaffirmed Turkey's position on nuclear construction.

Most European governments responded to Fukushima in a way that minimally paid lip-service to the unease of their publics. If unease existed among the Turkish public in Turkey, however, it was much less visible. The Mersin Anti-Nuclear platform formed a human chain down a 20-kilometer length of highway to protest construction on the Akkuyu plant. The organisation estimated participation 'in the thousands' (Human Chain, 2011). While opposition to the government's nuclear strategy near the building site increased following Fukushima, public protest of Turkey's position was minimal outside of this context with the exception of a few smaller protests in Istanbul and Ankara. One news outlet later titled an article covering a 30-person protest in the middle of Istanbul's busy Taksim Square a "delightful protest", almost ridiculing its size and influence on the actual political situation (Taksim Hosts Delightful Protest, 2011). As such, protests near Akkuyu took on a quality of "not in my backyard", a protest of proximity rather than principle. In this case, protestors were not able to amount an effective opposition to the government's position on nuclear energy.

Summary

Turkish response to the events in Fukushima is the polar opposite of that of Germany. Not yet having nuclear energy embedded within its economic structure, Turkey could have more easily adjusted to Fukushima by reversing its plans than Germany. Its reaction was exactly the opposite: not only was Turkey indignant to reconsider the course of its nuclear program, the rhetoric used by its political elites indicates a shockingly low level of caution and sensitivity towards the situation. Germany, on the other hand, responded to public outcry in a way that Czech Chief of Nuclear Safety Dana Drabova called “unnecessary, hasty, and premature” (Mlcochova, 2011). This assessment is one many Eastern European and developing countries around the world might be inclined to agree with. It switched its nuclear energy course once again, this time without possibility of reversal. Today, the German federal government faces over 10 million Euros in court fees elicited from the nuclear industry (World Nuclear Association) as well as the dilemma of securing energy without resorting to an increase in imports of Russian gas or coal.

The indicators of science observed in the earlier chapters help explain the course of events in both countries. Individual levels of knowledge and attitudes account for the level of protest following the events. German people, very educated on scientific facts and highly critical of scientific governance, appeared in masses to protest Germany’s nuclear position. Spiegel online reported that some of the smaller protests may actually have been part of anti-nuclear events planned prior to Fukushima. This is very telling of the thickness of the anti-nuclear movement in Germany and its ability to mobilize human resources. As a result, German administration must always be prepared to respond to the needs of various groups of civil society which mobilize to change policy.

The Turkish public's low level of scientific knowledge coupled with its high support for the scientific enterprise partially explains lower levels of participation in public protest. Although protest was not as visible, the anti-nuclear sentiment does exist in Turkey; 64% of participants in one survey said they would vote down further construction of nuclear facilities if the issue went to referendum (Benmayor, 2011). The article points out that opposition to nuclear was "higher among university graduates and the country's younger population (*ibid*) either indicating a tendency in educated Turkish political culture to protest or a direct link between knowledge of science and protest of risky scientific endeavors. This assertion would have to be qualified with a more nuanced evaluation to pinpoint the exact effects.

The peculiarity in Turkey, however, lies in the extremity of the Prime Minister's remarks. Whereas Merkel's remarks reflected a minimal level of reflection over the concerns of her public as well as the scientific basis for nuclear energy, Erdogan's comments rarely incorporated direct confrontation of opposition from the scientific community or from the public. Public calls to awaken from what Hasan Cemal called Turkey's "oblivious slumber" and prevent "crimes against humanity" were once again largely ignored (as cited in Gunel, 2011). How was Erdogan able to respond to concerns both within his country and without to defend his position using language which would be considered unacceptable to most other Western democracies?

His freedom to manipulate the risk discourse to serve political purposes might be a reflection of his understanding of the public's support for a developmental path which relies on science and technology for improvement as well as a high percentage who view the benefits of science to be greater than its risks. His support for nuclear is coached in nationalist language which perpetuates a Kemalist identity narrative which most Turks find appealing (Keyman, 2005, pp. 41-42). His allusion to the Bosphorus bridges as one example of risky science and technology illustrates this point: the bridge is a necessity to most Turks who commute from the rural areas of Istanbul to the business districts and is, therefore, a situation where benefits outweigh risks. Moreover, the bridge itself connects the smaller European portion of Turkey to its much larger Anatolian regions, a symbolic representation of Turkey's accession into the European Union.

The previous discussion on science within national academies of science and parliaments also plays a role in the discourses following Fukushima. The Leopoldina had previously published energy recommendations to the German public and government following its regular meetings. After Fukushima, as mentioned earlier, it became instrumental in the formation of a post-Fukushima energy policy. At the request of Minister of Education and Research Annette Schavan, the Leopoldina submitted a 32-page ad hoc statement titled "Energy and Research Policy Recommendations Following the Events in Fukushima" in June 2011. The report is very upfront in its methodology and limitations, as well as self-aware of its contribution to the political dialogue following the Super-GAU (Methodology, p. 24). The Leopoldina was thanked specifically within the Ethics Commission proposal for its participation in research for a post-Fukushima energy policy (p. 7).

Honorary TUBA members Dr. Sadik Kakac and Dr. Namik Aras of Turkey's TUBA published two short reports after Fukushima. Kakac on March 16 compared the magnitude of Fukushima to past events at Three Mile Island and Chernobyl, focusing on technical aspects of the disaster such as the location and intensity of the explosions, as well as levels of radiation. Aras on March 29 also reviewed the official state of the situation in Fukushima, but went on to address the nuclear construction site in Akkuyu and the potential risk of earthquakes: "While I do not think it is right/appropriate to say "no" nuclear energy despite these events, I believe the question of "what can be done?" should be studied scientifically and technically in a deep and serious manner," (p.4: *author's translation*). While Aras (2011) suggested that risk of nuclear energy be minimized as much as possible and incorporated within a broader energy diversity program, he also commented that, "a case of zero risk is unthinkable," (p. 5). He also emphasized the extraordinary nature of the Fukushima disaster, characterizing it as a "very low probability chain of events" (Aras, 2011).

To be fair, the Turkish Atomic Energy Agency immediately posted its regulatory documents on its website to emphasize alignment with standards of European nuclear safety during the week of the disaster. This included a Decree on the Licensing of Nuclear Installations issued in March prior to Fukushima that specifically addresses disaster management as well as water resources (taek.gov.tr). The two TUBA scientists echo this attention to safety. TUBA's scientists as a cohesive unit, though it is unclear whether it was by personal choice or government censorship, did not publish a comprehensive report on the state of the Turkish nuclear program following Fukushima; within the two published reports, fallout from the nuclear blasts in Japan is the main content, rather than a critical look at the potential for such an incident at a Turkish nuclear facility. This underscores the prevalence of technological optimism across the Turkish public which also extends to the scientific community.

In Germany, the decision to overturn the 2010 extension was granted to an Ethics Commission of the Bundestag at the request of the Federal Chancellery. The Commission consisted not just of politicians, but also of researchers such as Dr. Ulrich Beck, industrial leaders, and religious figures (Vogel, 2011). It suggested the drafting of an energy acceleration law to work out details of the "energy turn around" as well as a Parliamentary Representative to monitor yearly progress towards this commitment. Moreover, it defined its task as the promotion of a "culture of informed and considered discussion" (p. 8) regarding nuclear energy. Moreover, "any decision about the use of nuclear power, its discontinuation or replacement by alternative means of power production will be based on value-based decisions of society, which precede technical and economic aspects," (p.11).

The topic of nuclear energy was introduced onto the agenda of the Turkish National Assembly on March 22nd in the form of a group proposal by the opposition CHP Party. A motion was made (10/1093) to open up an ad hoc research committee to investigate the construction of the Akkuyu nuclear power plant in light of the unfolding events in Japan. On March 31, the motion was presented and voted down, removing the nuclear issue from the legislative agenda. There is no evidence that the author can locate of an official reassessment of the nuclear program within the Parliament in Turkey after Fukushima. An effort to revisit the issue on a political level was made by opposition member and ministerial candidate Necdet Pamir of the Republican People's Party.

Running on an anti-nuclear platform during the run-up to the June 2011 elections, he proposed to put nuclear to a referendum as well as place more focus on the incorporation of alternative energy supply into the Turkish energy mix (Kucukkosum, 2011b). Erdogan's party won the election in June, officially taking nuclear out of the wider discourse.

These processes reflect the makeup of their respective parliaments. Indeed, the German Bundestag relied on re-politicization of the issue to reassess the nuclear question, whereas the Turkish Assembly avoided revisiting the decision by excluding discussion of the issue from the political discourse. New information offering an uncertain picture of nuclear energy was ignored and misrepresented in the author's opinion. In Germany, even with a technically-trained atomic physicist as Chancellor, the appropriateness of an uncritical scientific stance toward nuclear energy found its limits.

Chapter 5

Conclusion

What emerges from these observations on science, when taken in total, is a snapshot of the political climate of each country. Specifically, science in Germany and Turkey offer an optimal avenue through which to analyze the dynamics between polity and society. Germany remains the embodiment of Ulrich Beck's *Risk Society*; its public is both knowledgeable of scientific facts and skeptical of the use of purely scientific solutions to social problems. The desire among the German public for more inclusion in the decision-making process over science and technology is manifested in widespread protests and resistance from civil society. Skepticism is also visible among the political elite where, despite commitment to the growth of science at the federal bureaucratic level and evidence of science as an aid in decision-making, there is still high perception of limitations of advanced technology and responsiveness to associated risks.

Certainly, in its efforts to incorporate technology into the improvement of its country, the German polity oversteps the boundaries of its legitimate authority on occasion, as it did with the construction of the Stuttgart 21 railway project despite widespread civil protests. Germany is also not 100% void of considering its economic interests before its European obligations, as its partnership with Russia over the North Stream gas pipeline exemplifies. The dynamic between the political elite and civil society in Germany, however, reveals a highly democratic state which has developed feedback mechanisms to balance centralizing and decentralizing tendencies. As illustrated in the analysis of the Leopoldina and the government's reaction to the Japanese nuclear disaster, science in Germany is just one of many tools in the political toolbox; it is one of many ways to understand social phenomena and contextualize solutions. It is a part of the *modus operandi* of politics in Germany and creates a framework through which to evaluate the legitimacy of decision-making. Most importantly, it is neither omniscient nor greater than the sum of the values of German society.

Whereas science is a source of pragmatic politics and social improvement in Germany, science in Turkey takes on a character similar to that of Scott's (1997) authoritarian high-modernist ideology. As he clarifies, however, a high-modernist ideology only borrows the legitimacy of science and is, as such, "uncritical, unskeptical, and thus *unscientifically* optimistic about the possibility for comprehensive planning [of society]…" (p.4; *author's emphasis*). To the extent that a high-modernist ideology exists in combination with a powerless civil society and authoritarian tendencies, a state runs the risk of self-destruction (p. 4).

Both of these elements are present in Turkey: first, the Turkish public, mostly unaware of scientific facts but highly optimistic about science, to a large extent accepts the thick ideological vision diffused by the political elite. This is not, in itself, a cause for concern. Rather, illegitimacy arises as acceptance of this vision among the public begins to change in opposition to the state. As Scott (1997) elaborates:

> Where the utopian vision goes wrong is when it is held by ruling elites with no commitment to democracy or civil rights and who are therefore likely to use unbridled power for its achievement. Where it goes brutally wrong is when the society subjected to such utopian experiments lacks the capacity to mount a determined resistance. (p. 89)

The concentration of scientific knowledge within a smaller proportion of the population indicates a potential overlap in the scientific and political elite. Therefore, the minority of Turkish individuals possessing knowledge of science and thus the capacity to resist the Turkish elite's high-modernist vision is either socialized into the developmentalist rhetoric of the political sphere, or cannot mobilize the human capital and resources to make an impact on the political process. If educational achievement continues to improve in Turkey, the political elite might be faced with a repositioning of civil society in opposition to the state and a backlash to its state-centric politics.

Furthermore, the presence of deputies with scientific backgrounds in the Turkish National Assembly, as well as the recent decision to allow government appointment of TUBA members, indicates a trend bordering on authoritarian governance. Turkey has begun enforcing its statecraft on many levels, especially in its control of the media and the ethic Kurdish population in the East. An increase in the centralization of power, although it bolsters the state's capacity to control scientific output and facilitate a specific political vision, also reduces the amount of exchange between the polity and civil society. As such, the imposition of illegitimate policies and practices is a reality in Turkey to the detriment of its status as a democracy.

These observations have particular significance for the Turkey-EU membership discussion. Democracy, human rights, and good governance play a key role in the EU's self-image (Smith, 2003). A discussion of science in Turkey brings these concerns to the forefront. The autonomy of the scientific community as a component of a vibrant civil society partially reflects a state's level of commitment to these principles. The Turkish case reveals not only a violation of these principles, but a completely different interpretation of them. The Federation for European Academies of Sciences, or ALLEA, functions as an umbrella organization for academies in Europe. On its homepage, it characterizes all of the national academies represented as "self-governing communities of leaders of scientific and scholarly inquiry," (para. 1). As a standard, then, national academies are autonomous institutions. This does not rule out potential cooperative efforts between national academies and governments. Indeed, ALLEA works closely with the European Union to improve conditions for scientific research; it presented a position paper as a response to the EC's "Common Strategic Framework for EU Research and Innovation Funding", outlining its role in the EU's vision of an "innovation union" within the scope of the wider Europe 2020 Strategy on sustainable growth. The paper emphasizes a holistic understanding of science where "innovation is not a goal in itself; rather, it responds to the needs of society," (p. 1, para. 2) and is therefore socially embedded. Member national academies, it follows, should exhibit similar levels of autonomy with their national governments, as well as foster discourse with society.

Following the government's decree limiting autonomous elections in TUBA in August, a severe overstep of Turkish authority into the civil sphere, the international scientific community spoke up. On September 6th, the International Human Rights Network of Academies and Scholarly Societies sent one of the first communications to Prime Minister Erdogan, advising him to reverse the legislation (Paragraph 2). Europe and the All European Academies (ALLEA) was a strong voice in this protest, voicing its concern that "… the recent legislative changes will… tarnish its claim to scientific excellence; the Academy would then lose its credibility in nationwide debates on the future role of science and technology, but also in global scientific exchanges," (para. 3). In addition to The All European Academies, the British, French, Italian, Dutch, and the German Leopoldina sent individuals letters of concern to the Office of the Prime Minister.

On October 14th in the last publication available on TUBA's website, Academia Europaea proposed an ultimatum to the Turkish government which I quote in length below:

> Turkey, like every great nation, needs its national academy. But the academy can only fulfil its role of providing the ultimate scholarly standard both for the scientific community and for the nation itself if it retains its full autonomy and can elect its members on the basis of strict procedures, free from any external political, economic or religious influence (Paragraph 6).[…]Unfortunately, the recent legal changes, especially those allowing the introduction of new members and the appointment of the president of the Academy by the government will affect the reputation of TÜBA after its reorganization and will inevitably mean that it is no longer recognized by the international community as Turkey's national academy of sciences and letters. Neither the Turkish nor the European scholarly community wishes to see this happen (para. 8).

This intense response underscores its inclusion of science within a mutual understanding of democracy, human rights, and good governance across the European Union. The encroachment of the polity onto the freedoms of the society threatens Turkey's democracy. Moreover, although science's universality has been questioned (Drenth, 2005; Henk ten Have, 2007), certainly societies sharing similar perspectives on science have increased potential for cooperative efforts in political endeavours. In creating a sovereign science to serve state interests, however, the Turkish political elite has essentially limited the potential for cooperative efforts with the international scientific community.

The conclusion here does not have to be entirely grim. Michael Polanyi (1947) pointed out the unique capability of science to preserve individual freedoms that align with core values of a democratic society. He wrote: "Scientists may want to help the world on its way back to freedom by making known how freedom operates in science," (p. 124). The amount of opposition to the TUBA decree reflects Turkey's membership in an international civil society for science. If Michael Walzer (1990) is correct that the expansion of civil society internationally creates wider networks of support for sovereign civil society (p. 9), it is possible that pressure from the international scientific community might prompt a reversal of Turkey's policy towards TUBA as well as improvements to its wider domestic political situation. In the long-term, increased contact with scientists from Europe and beyond can only serve to increase the overlap in social capital necessary to form strong bonds, elicit trust, and shape values essential to the reconciliation of asserted cultural differences hindering Turkey's alignment with the West.

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