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Corporate Perceptions of Climate Science: The Role of Corporate Environmental Scientists

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Abstract

Although there has been some growing recognition of the role of private actors in international environmental regimes, little attention has been paid to the role of the private sector at the science–policy interface. Because the automobile industry plays a crucial role in mitigation of greenhouse gases, successful policy requires not just the assent but the active cooperation of this sector. Such cooperation, however, requires some institutional acceptance that climate change is indeed a significant risk. In this article, the authors look at the early stages of the automobile industry's engagement with the discourse on climate change. The authors focus, in particular, on the role of corporate scientists in two U.S. automobile companies in translating this discourse. Acting as boundary spanners and institutional entrepreneurs, these individuals influenced both corporate perceptions of and responses to climate change science.

Keywords

climate change, automobile industry, institutional theory, boundary spanners

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Corporations are critical players in the worldwide effort to address greenhouse gas (GHG) and other emissions. The business sector directly or indirectly accounts for the vast majority of greenhouse gas emissions. At the same time, business controls substantial technological, financial, and organizational resources, which, if applied appropriately, could play a major role in reducing GHG emissions. The automobile sector is responsible for substantial emissions and is among the most prominent nonstate actors in the emerging international regime to address climate change (Winter, 1998). Securing the cooperation of automobile companies is thus a key public policy objective.

Science, technology, and society (STS) literature examines the interface between science and policy and suggests that scientific knowledge and social structures of governance are coproduced and that the boundaries between policy and science are inherently ambiguous and subject to continuous renegotiation (Kerkhoff & Lebel, 2006). The private sector, however, has generally been neglected in this debate. Although there has been some growing recognition of the role of private actors in international environmental regimes (Clapp, 1998; Haufler, 1998), little attention has been paid to the role of the private sector at the science–policy interface. Yet this role can be critical in the policy-making process (Erlich, 2006).

What STS tells us is that climate science does not simply land on the desks of policy makers and drive policy; rather, a complex social and political process mediates science and policy. In a similar way, the private sector is not a simple consumer of scientific findings and assessments. As one example, past research has highlighted the efforts of the fossil fuel industry to cast doubt on claims that greenhouse gases are causing dangerous changes to the climate system (Franz, 1998; Gelbspan, 1997; Levy & Egan, 1998). These efforts are generally interpreted to be strategic manipulation of scientific uncertainties and standards of proof; companies recognize that their economic interests are imperiled by potential measures to address climate change, and challenging the science is a time-honored strategy for delaying or averting regulation (Jasanoff, 1990). In this article, the authors argue that corporate perspectives on climate science are not purely strategic; these perspectives are shaped by particular organizational structures, processes, and institutional pressures and are internalized into the value and meaning structures of an organization. In turn, these perceptions of climate science influence a firm's organizational and strategic stance toward change. Similarly, perceptions of economic interests and climate science are mutually constitutive; the perception of economic peril generates skepticism about the science, which in turn leads companies to defer investments in low-emission technologies.

The authors will focus on the role of corporate scientists as boundary spanners during the early entry of the U.S. automobile industry in the climate change science arena. The article first lays out how existing theory suggests that being on the boundary increases the likelihood that these scientists will introduce competing discourses into the firm and, thus, be sources of institutional change. Drawing from the research on institutional translation, the authors go on to discuss how the lenses that these actors use to translate climate science can differ; these differences are due to both individual and contextual factors. The authors explore these theoretical arguments through the case of the response of two U.S. automobile companies, General Motors (GM) and Ford, to the climate change issue during its early emergence as an institutional field. The experiences of these two companies show that these lenses are influenced by their location on the "boundary" between the corporate and scientific worlds. The article concludes with a discussion of implications for policy and management as well as opportunities for future research.

Institutional Theory and Corporate Responses

The core insight of the institutional perspective is that markets and organizations are embedded within institutional fields with important cultural, symbolic, and regulatory dimensions (DiMaggio & Powell, 1983). From an institutional perspective, then, corporate strategies regarding climate change are not purely objective economic calculations but rather are based on understandings of climate science, expected regulation, and the market potential for mitigation technologies. These perspectives are, in turn, likely to be influenced by institutional actors, such as formal scientific assessments, competitors, industry associations, consumers, NGOs, regulatory agencies, the media, and scholarly journals. These actors constitute, in the language of institutional theory, an organizational field, which, over a period of time, establishes norms, policies, and standards of accepted behavior that shape a particular company's discourse and practices (Powell, 1991; Scott & Meyer, 1994).

Although institutional theory has generally been used to explain isomorphism of management practice among organizations, it can also be used to explain heterogeneity. Three primary theoretical arguments could account for heterogeneous organizational responses and perceptions. First, organizations often operate within multiple institutional fields, such as when they belong to different industry associations or operating in different regulatory contexts, creating divergent pressures (Alexander, 1996; D'Aunno, Sutton, & Price, 1991; Hoffman, 1997; Kempton & Craig, 1993). The boundaries of such

organizational fields are inherently unclear, and organizational fields may overlap or be nested in broader structures (Holm, 1995).

A second explanation for differences among companies is that an organizational field can sustain multiple competing discourses. Concerning the environment, many companies still adhere to the notion that environmental regulations are inherently costly and antithetical to their economic interests. A growing group of companies, however, are embracing the discourse and practices of environmental management (Levy, 1997), termed "eco-modernism" by Hajer (1995), who posits that incorporating environmental concerns into business strategy can reduce costs and build new markets. Within the automobile industry, the traditional discourse held sway until the mid-1990s, but the eco-modernist discourse is contesting these conceptions and provides an alternative vocabulary with which firms can engage. Similarly, skeptical approaches to climate science provided discursive competition for those trying to use science to justify aggressive policy measures. These differing institutional logics are contested by different groups with different interests and perspectives.

Often, these alternate discourses are introduced by institutional entrepreneurs. Institutional entrepreneurs are "actors who create technical and cognitive norms, models, scripts and patterns of behavior consistent with their identity and interests, and establish them as standard and legitimate to others" (Dejean, Gond, & Leca, 2004, p. 743). These entrepreneurs have been identified as one source of emerging, competing discourse in institutional fields. In a review of institutional entrepreneurship, Leca, Battilana, and Boxenbaum (2008) found that research pointed to three main conditions under which institutional entrepreneurs are likely to emerge: precipitating jolts or crises, the presence of acute field-level problems that might precipitate such a crisis, and the degree of heterogeneity in the field.

These institutional entrepreneurs can also be institutional *interpreters*, actors that translate and communicate institutional pressures for the organization. Thus, they play a critical role in the third source of heterogeneity—the lenses, or frames, used in the process of institutional translation. Institutional discourses and practices do not pass undisturbed across organizational boundaries; they are translated as they move across these boundaries (Boxenbaum, 2006; Boxenbaum & Battilana, 2005). Each company interprets institutional discourses through its own unique lens, or frame, which is a product of its own institutional history and organizational culture (Boxenbaum, 2006; Lounsbury, Ventresca, & Hirsch, 2003). The same holds for the individual institutional translators. As found by Boxenbaum in the study of the translation of American diversity practices by Danish business actors, different individuals will translate institutional pressures in different ways. In the case of the Danish actors,

translations varied according to individual personal and professional beliefs and interests. Delbridge and Edwards point to the fact that in the early stages of institutionalization, most work focuses on those who attempt to create change, that is, the institutional entrepreneur, and those who oppose it. However, as illustrated in the case of the Danish business actors, it is just as important to understand the field, organization, and individual factors that create the possibility for change to occur and form the context in which individuals interpret and initiate change (Boxenbaum & Battilana, 2005; Delbridge & Edwards, 2008; Tushman & Scanlan, 1981).

It is not that theories of institutional entrepreneurship ignore these aspects of context; institutional entrepreneurs are, by definition, *strategic* actors. As seen in the work of Boxenbaum (2006), institutional "translators" act strategically, altering their translations in a manner that would lead to greater resources, support, and other factors essential for their own success. Similarly, Rothenberg (2007) found that environmental managers altered the translation, or framing, of institutional pressures for improved environmental performance in order to increase the likelihood of response to these pressures. The institutional entrepreneur works within a context that may or may not provide the opportunities and consumers for the new discourses they are "selling."

Often described as the inherent paradox of institutional change, entrepreneurs also need to create change while their rationality is conditioned by the institutions they wish to change (Battilana et al., 2009; Beckert, 1999; Seo & Creed, 2002). This paradox is why boundary spanners are often sources of change in an organization. Boundary spanners are individuals or units that attend to and filter information about the organizational context and serve to link organizational structure to environmental elements, whether by buffering, moderating, or influencing the environment (Aldrich & Herker, 1977; Fennell & Alexander, 1987; Leifer & Delbecq, 1978; Thompson, 1967).

In answer to the paradox of institutional entrepreneurship, Seo and Creed (2002) argue that change within institutional environments is more likely to happen if an organization is exposed to multiple institutional fields and discourses within these fields, an occurrence that is more likely to happen at the boundaries of these fields. Greenwood and Suddaby (2006) argue that organizations that operate on the boundary of organizational fields are more exposed to field-level "contradictions," resulting in lower levels of embeddedness and a greater propensity to act as institutional entrepreneurs. Therefore, it follows that individuals who sit at the boundary of their organization are the people most likely to be exposed to multiple fields and, thus, are more likely to be both institutional translators and entrepreneurs.

For corporations, the role of boundary spanners in the realm of environmental science can be filled by corporate scientists, whose job it is to collect and absorb scientific information from various sources (Furukawa & Goto, 2006). These scientists bridge the scientific and corporate worlds by working for a company while at the same time being members of their professional community. This membership is made manifest by publication in academic journals, participation in academic conferences, and membership in professional organizations, all of which encourage a discourse that supports the process of change (Furukawa & Goto, 2006; Greenwood, Suddaby, & Hinings, 2002).

One view of the link between research-based knowledge and action is that good research will be taken up by practitioners, and this research will be introduced into the public domain by the researcher publishing in peer-reviewed journals (Kerkhoff & Lebel, 2006). In line with this view, as explained by Kerkhoff and Lebel, there have been some cases, such as the Montreal Protocol, where policy development in response to scientific discoveries was relatively swift and effective. However, this simple relationship between science and policy is more often the exception than the norm; the relationship does not exist for the environmental issues that are more diffuse and ambiguous, such as climate change.

For environmental issues where the science is highly contested, the science does not, as stated by Gieryn (1999), "move naked from the lab or scientific journal into . . . boardrooms." Instead, he suggests, what we see are "elaborate representations of science" designed to show why one set of findings is better than the other. This circumstance is no truer than in the area of climate change, where the science has been highly contested, with most disagreement focusing on the extent and magnitude of global climate change, the specific rates of change and timelines and on global climate change outcomes, such as local and regional impacts (Rosenberg, Vedlitz, Cowman, & Zahran, 2010). Despite increased scientific agreement as to the seriousness of the climate issue, the extent of this conflict can be seen as recently as 2010, when email messages of climate scientists discussing ways to hinder the efforts of climate skeptics, such as freezing them out of peer-reviewed journals, created a scandal that impacted international climate change talks (Satter, 2010). Adding fuel to this fire is that the climate change debate is value laden, involving issues of equity, autonomy, and rights (Jiusto, 2010). The uncertain and contested nature of climate change leaves the door open for multiple interpretations and agency (Battilana et al., 2009). This condition is where corporate scientists play a critical role.

A company's perception of climate science can thus have a significant impact on their product, technology, and political strategies. For large multinational corporations, their climate stance affects not only their own decisions but also the behavior of competitors, policy makers, and other stakeholders. Given that society's response to climate change depends on strategic decisions taken by these companies, it is critical to understand how corporate perceptions of science develop and influence the industry. In this article, the authors focus on the role of corporate scientists in order to examine a few central questions. How are the views of these scientists shaped by their personal position and networks, and their perception of corporate interests? What is the influence of the company's history, structure and culture, and its location in a particular national and industry institutional context? How do these scientists function as organizational gatekeepers and translators across organizational boundaries? Of most significance, perhaps, what impact do they have in shaping corporate strategies on climate change?

Method

Case study methodology is most appropriate to this area of research because of the complex relations among the actors and variables (Eisenhardt, 1989; Miles & Huberman, 1994; Yin, 1994). This study draws primarily from the experiences of two U.S. automobile manufacturers, Ford and GM, with a focus on the late 1980s and 1990s. The authors chose these two companies because though they were similar in size (as compared to smaller Chrysler) and product ranges, they took different approaches to the climate science debate. The authors chose the time frame because though there is a great body of literature on the responses of energy intensive businesses to climate change, most of it focuses on the later stages of institutional field development. This study's focus on the late 1980s and early to mid-1990s offers insight into how these firms act in the early stages of institutional change, and these early stages of translation can have a lasting impact.

The authors utilized several methods for data acquisition. The authors conducted a total of 33 personal interviews over the course of several visits to firms in the automobile industry, primarily from 1998 to 2000. Interviewees included a cross-section of experts in the field of climate science and firm employees, including environmental staff, strategy, product development, marketing, and R&D. Most interviews were conducted in person, though a small number, particularly those that focused on the more historical data, were performed over the phone, using a predeveloped semistructured interview format (see Appendix A). The authors gathered additional material through an

extensive review of secondary source material. This procedure included a Nexus/Lexus search from 1986-1999 using the terms "climate change," "global warming," "greenhouse gas," "Auto(mobile)," and "car" for the following news sources: *New York Times*, *Business Week*, *Financial Times*, *Wards Auto World*, *Auto News*, and *Wall Street Journal*.

The authors analyzed case material through coding and display of data. Interviews were coded using QRS nudist (Nvivo). The authors used two primary display formats, both of which are suggested by both Miles and Huberman (1994) and Yin (1994). The first format is a temporal ordering of the data, in which specific events were placed in time lines created in order to gain a sense of historical development. The second format is a comparative matrix, in which segments were categorized and placed in a matrix in order to explore how cases, in this instance companies, differ from one another. The authors used the secondary source material to develop a general picture of the institutional and scientific background of the climate change issue.

Overview of Industry Response

This section discusses the industry response. First, the authors explain the emergence of the field of study. The second subsection discusses the response of Ford and GM. The final subsection examines the change in tide.

Field Emergence

The notion that human emission of greenhouse gases might warm the earth's climate dates back to the work of Baron Jean Baptiste Fourier in 1827, and Svante Arrhenius's first published estimates of the amount of warming caused by GHG-related radiative forcing in 1896. Scientific resources devoted to the issue grew rapidly during the 1960s and 1970s, and policy makers began to turn significant attention to it during the 1980s. Figure 1 illustrates the number of articles mentioning climate change *and* the automobile industry in four of the leading outlets for business news—the *New York Times*, *Financial Times*, *Business Week*, and the *Wall Street Journal*. As can be seen from this diagram, activity and interest of the auto industry in the climate debate only began to emerge in the 1980s and early 1990s. One of the critical events during this time in the United States was the testimony of James Hanson before Congress. This pattern is similar to the notion of "precipitating jolts," an enabling factor in the creation of change in institutional fields (Greenwood et al., 2002; Meyer, Brooks, & Goes, 1990).

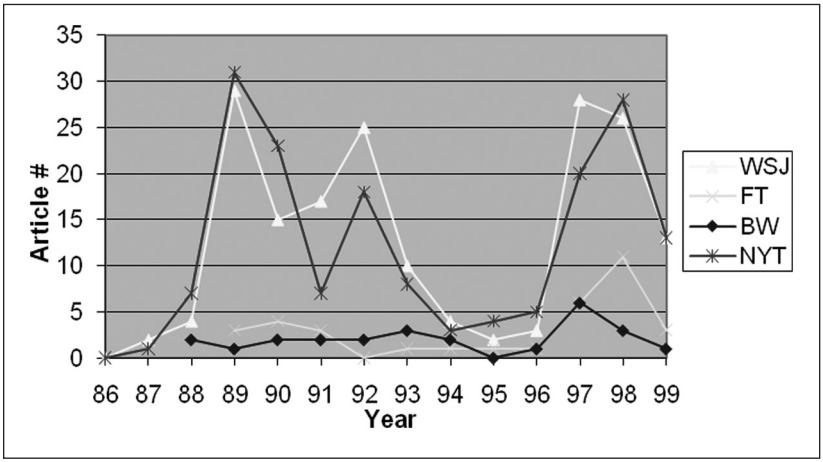

Figure 1. Number of news articles (*New York Times, Financial Times, Business Week*, and *Wall Street Journal*) mentioning the automobile industry and climate change from 1986-1999

Within a larger context of opposition to regulation of GHG emissions from industrial sectors related to fossil fuels, the American automobile industry has been among the most vocal opponents of mandatory emission controls, though it has not, of course, been alone in this opposition. The automobile industry's response has largely been channeled through industry associations, the most prominent being the Global Climate Coalition (GCC), an organization that represented about 40 companies and industry associations, primarily major users of fossil fuels. GM, Ford, and Chrysler, along with the American Automobile Manufacturers Association (AAMA), were all members. A senior GCC staff member, discussing motivations for the creation of the GCC, expressed the view that industry had become involved late in the negotiations leading to the Montreal Protocol. As he expressed it, "Boy, if we didn't like the Montreal Protocol, we knew we really wouldn't like climate change! This is the mother of all issues!" A key strategy of the GCC and its member companies in its opposition to mandatory emission controls was to challenge the science of climate change, pointing to a spectrum of opinion rather than consensus among scientists, and highlighting the uncertainties.

The Response of Ford and GM

The response of Ford and GM to climate change science closely mirrors the more general story just recounted. Despite the debate in the scientific arena on climate change for many years prior, and the participation of some internal scientists in this debate, corporate attention to the climate issue picked up speed only in the late 1980s. As noted earlier, managers and scientists at both Ford and GM recalled James Hansen's testimony before the U.S. House Energy Committee in June 1988 as the catalyst that catapulted climate change onto corporate radar screens. Hansen, from NASA, testified during an unusually hot spell in the Eastern United States that he was "99 percent certain" that recent warmer temperatures were attributable to greenhouse-gas-induced climate change, a claim that generated considerable media attention (Edwards & Lahsen, 1999). Scientists at both companies were aware of the emergence of the scientific literature, and at GM there was more widespread discussion of it prior to 1988. But climate change did not become a high-priority issue beyond GM's relatively autonomous research laboratories until 1988. At Ford, one manager described his shock at how quickly "climate went from zero to sixty." Thus, Ford's participation in the International Panel on Climate Change (IPCC) activities and more formal scientific scanning also started in the late 1980s.

This delayed and "surprised" response suggests that the automobile industry paid little attention to the development of scientific concern around greenhouse gases or to early interest in the policy community. The President's Science Advisory Committee had discussed greenhouse gases and climate as far back as 1965, and in the early 1970s two major scientific studies put climate firmly on the U.S. policy agenda. The White House proposed a U.S. climate program in 1974, leading to the National Climate Program Act of 1978, which authorized US$50 million annually in research funding. The U.S. Department of Energy initiated a CO_2 research and assessment program in 1977, and in 1979, the White House Office of Science and Technology Policy requested a study on climate from the National Research Council. The ensuing Charney report predicted global warming in the range 1.5 to 4.5 degrees Celsius over the next century. In 1983, the U.S. EPA published a rather alarming report on climate based on Hansen's modeling work. Yet management in the U.S. automobile industry appears to have paid much closer attention to the mass media coverage of Hansen's Congressional testimony than to scientific developments. One GM scientist recalled, "We lived by the Wall Street Journal and the New York Times."

Another reason cited by managers for the attention to climate in 1988 was the rapidity with which the ozone depletion issue had moved from scientific concern to the Montreal Protocol in 1987, mandating a 50% reduction in chlorofluorocarbon (CFC) production. Indeed, attention to CFCs in the mid-1980s might have diverted industry attention away from greenhouse gases. To the extent that corporate managers take their cues from the U.S. institutional context and media (Levy & Kolk, 2002), with their rather parochial national focus, they would have been less likely to hear about major international conferences on climate. Although Detroit is closer to Toronto than to Washington, D.C., almost none of the managers interviewed recalled the June 1988 Toronto Conference on the Changing Atmosphere, which culminated in a call for a 20% cut in greenhouse gas emissions from 1987 levels by 2005. Even less known was the earlier series of workshops in Villach, Austria, held from 1980 to 1985.

Although all three major U.S. automobile companies, through their industry associations and independently, questioned mainstream climate change research and advocated a "wait and see" attitude, they did so with differing intensity. GM was the only company of the big three to refrain from strong direct attacks on the science. Ford's Trotman and Chrysler's Eaton, on the other hand, were especially vociferous in the early 1990s, through speeches and editorials, in castigating concerns about climate change and emphasizing the high cost of precipitate action in the face of uncertainty. Interviews revealed that these views were not just those of top management, but had permeated throughout various departments and management levels. One manager commented, "We have followed the science as a company and we would like to see more science and less hot air! What we'd like to see is good science driving good policy."

In the mid- to late-1990s, the automobile industry followed the GCC in focusing on climate model uncertainties. In a 1998 paper, Ford environmental scientists publicly attacked the science, stressing that the most significant oversight in current climate assessments appears to have been inadequate study of the role that the Sun may have played in climate change. They state:

> Because of this, confirmation and quantification of the human capacity to influence climate beyond natural variability remains blurred. This fact alone does not completely eliminate all reason for concern, but it does loudly cry out for the scientific knowledge necessary to support far reaching global policy decisions. . . . Real science needs to be verified first before such massive global changes in emissions ever could be justified in the future. (Petrauskas & Shiller, 1998, p. 6)

Change in Tide

By the late 1990s, a shift in position was detectable in some sectors of the U.S. industry. On June 8, 1997, the Business Roundtable sponsored full-page advertisements in the U.S. press signed by 130 CEOs, which argued against mandatory emissions limitations at the forthcoming Kyoto conference, citing scientific uncertainties and the high cost of action. In sharp contrast, a much more public effort to coalesce an industry bloc supportive of emission reductions was led by the Pew Center on Global Climate Change in April 1998. Thirteen companies joined immediately, including Toyota. Pew then formed the Business Environmental Leadership Council, which signed on to a series of newspaper advertisements stating that they "accept the views of most scientists that enough is known about the science and environmental impacts of climate change for us to take actions to address its consequences" (Cushman, 1998).

Although Toyota was the only car company to join the Pew Center, the U.S. automobile companies also toned down their criticism of climate science as the December 1997 Kyoto international conference approached. According to the trade journal *Automotive Industries*, when the three U.S. auto CEOs and UAW President Steve Yokich met with President Clinton in the Oval Office in early October of that year, "they never questioned whether global warming was a scientifically proven concept" (Sorge & McElroy, 1997). Ford's Trotman recalled, "We did not argue the science with the President. We didn't think that was a good use of his time or ours. It's generally agreed that the CO2 in the air has increased in the last decades and that there's cause for concern, and that we should be doing something."

A purely rationalist explanation for the shift in industry position would point to the emerging scientific consensus since the Second Assessment Report of the IPCC in 1995 and the strategic benefits for companies to "board the train" once it was seen to be leaving the station. By 1997, the business press in the United States and Europe was conveying the impression of consensus (Raeburn, 1997; Sharing the Greenhouse, 1997; Stipp, 1997). From the perspective of a leading expert in this area, advances in basic science were fundamental to this change: "The whole fingerprint argument has become much stronger since the SAR. You've got the empirical data of record warmth, and the arguments about satellite measurements and solar effects have been resolved in refereed scientific publications." The growing body of scholarship in the field of science, technology, and policy should make us wary, however, of any simple linear connection between knowledge generated in the institutions of the scientific establishment and societal responses. Although the

evolving science has surely played an important role in shifting corporate perspectives on the climate issue, the impact of this knowledge is mediated by the institutional environments in which companies are embedded.

Transformation of Institutional Pressures Through Organizational Boundaries

This section examines the role of the corporate scientist. The first subsection considers the corporate scientist as monitor and filter of information. The second subsection discusses distortion of information at the boundary between inside and outside the organization. This discussion considers the scientist's context, institutional histories and leadership, and national context.

The corporate scientist as monitor and filter. Automobile companies construct perspectives on climate science based on multiple sources of information, both inside the company and in the external environment. IPCC-style assessments appear to be less important in determining the state of the science. As stated by one environmental manager at Ford, "IPCC reports had little effect, and caused few surprises. [Our internal scientists] already let us know what was coming down the pike." An in-house scientist thought that her lack of attention to IPCC perhaps was due to its perceived political nature. She commented, "The IPCC is the politics of science, not the science of science. I am inclined to stay out of the politics of it." Instead, companies are more likely to obtain scientific information by interaction with outside academic experts. Both GM and Ford invited in a number of academic experts, though the list tended to be dominated by climate skeptics. Companies might also obtain information through interactions with government agencies, particularly in the U.S. DOE and EPA, and through participation in programs such as Climate Wise or the voluntary EPA GHG reporting system.

Most of this climate science information in the automobile industry was formally filtered through internal scientists who acted as boundary spanners. Environmental scientists are usually trained formally in the sciences, such as atmospheric chemistry, and are actively involved with the external scientific community. GM, for example, employs a small group of environmental scientists who publish in peer reviewed journals, attend conferences, and participate in governmental panels. It is through their interaction with the scientific community that these internal scientists became the first employees to be aware of climate change as a potential concern for the firm. Thus, both Ford and GM used internal scientists, usually located in the R&D or environmental science department, to monitor the issue, filter and analyze the voluminous literature, and then translate the science through presentations and recommendations to

management. It was the job of the internal scientists to relay the state of the science to others in the organization, and they therefore played an important role in shaping corporate perspectives on the issue.

With a large and independent research staff, GM appears to have been the first company to follow climate science in a serious manner. The VP of Environmental Activities at GM heard about a 1971 scientific article concerning the role of particulates and greenhouse gases in the global climate system, and he took an interest in their potential contribution to atmospheric cooling, the predominant climatic concern of the period. Ruth Reck, a scientist working in GM's research laboratories, was assigned to examine the question. It is interesting that awareness of the climate issue occurred through research involvement in other basic scientific issues, such as smog formation, tropospheric ozone, and CFCs, and particulates, in which GM and Ford labs were actively engaged. Remembered one VP of R&D at GM:

> Although most of the action had to do with tropospheric air pollution and emissions, there were several people who were real players in air mass movements and so on, so that there was a base of sophistication about atmospheric science systems. The first time it came onto my radar screen was in the 60s and 70s. I was certainly conscious of the worries that the world was about to freeze to death, so I thought I would follow it along. At GM it was around me as a developing issue, but that was more as a scientist than specifically as a manager.

Interaction with the scientific community, therefore, can be an important mechanism for early and continued awareness of the climate issue. This interaction takes a number of forms. The most commonly cited activity was the regular scanning of journals such as *Nature* and *Science.* Membership in scientific associations and associated activities also brought scientists in contact with the climate issue.

At Ford, prior to 1988, though Ford managers had held a number of discussions on the subject, they did not have anyone specifically assigned to tracking the climate issue. In 1988, however, after the Hansen testimony, Ford formally assigned an internal scientist to track climate science, and an engineer to monitor and participate in the negotiations over an international climate treaty and the IPCC process. This position was created when he advocated for his participation in major assessment processes, such as the UN negotiation sessions and the IPCC. As recalled by the VP of Environment, "[He] recommended that if we wanted to understand the human, political, and scientific dynamics of the issue, he really needed to be there." Notably,

he performed this external monitoring function not just for Ford but on behalf of the U.S. auto industry and was funded and reported through the AAMA. As explained by Ford's VP of Environment, "He was our window on the issues coming over the horizon."

The particular role of these formal boundary spanners varies. Some of the information transfer is done on a more passive level, where the scientists serve as a resource rather than an active proponent of certain scientific concepts. When the issue becomes hot in the popular press, for example, scientists are often turned to for advice. Similarly, an internal scientist might be called upon to review material if an executive was going to testify to Congress or speak publicly about climate issues. Sometimes, however, internal scientists take a more active role in educating the organization regarding the state of climate science. In the case of ozone depletion, for example, Dupont finally reversed its stance only when its own scientists examined the theoretical and empirical evidence and concurred with external scientists about the gravity of the problem (Benedick, 1991; Rothenberg & Maxwell, 1997). This more active organizational stance taken by environmental scientists (both internal and external to the organization) represents their role as "institutional entrepreneurs" driving change in their firms.

The clearest example of this more active approach was seen in General Motors. As noted earlier, Ruth Reck, a scientist working in GM's research laboratories, was assigned to examine the climate issue. It is interesting to note that, at the time in GM, air quality was considered the more important and prestigious topic on which to be working. Nevertheless, Reck quickly became a world-leading authority on particulates and on cloud formations and was accepted into the closely knit climate scientific community. She published in refereed scientific journals and presented at numerous conferences and workshops. As chair of the first symposium on atmospheric chemistry in 1973, she actually turned down a submission from future Nobel laureate Sherwood Rowland on chlorofluorocarbons (CFCs) and later served as a reviewer for his landmark article in *Science.*

Reck, initially a climate skeptic, became an internal advocate for the issue by the mid-1970s, and also served as an important source of internal expertise, with regular access to top management. As remembered by Jimmy Johnston, GM's former VP of Government Relations, "[The environmental scientists] were very influential in putting the [climate] issues on the agenda. Ruth pushed what was really important, and was one of the more energetic people." In an effort to alert the company to the climate issue, and to find out what product divisions were already doing concerning GHG emissions reductions, she organized a large GM conference on the subject in 1985, which was attended by

more than 700 company personnel. External climate scientists were invited to give presentations, notably excluding skeptics, whom she considered dishonest. Product managers were asked to speak about what they were already doing with respect to emissions and how this activity would be valuable in terms of reducing greenhouse gas emissions. Reck understood that she "absolutely had to sell this issue" and used this and other company forums to that end.

The differing role of corporate scientists in the "filtering" of climate science may help to explain differences in response between Ford and GM. At GM, where the corporate scientist was involved at an early stage with climate change research in collaboration with external scientists, the "surprise" at the response to the Hansen testimony was much less pronounced. Similarly, though all U.S. companies were taking a more "wait and see" attitude to the science, GM, with an institutional entrepreneur that was an internal advocate of climate science, was the only company of the big three to refrain from strong direct attacks on the science. These differences are summarized in Table 1.

Distortion at the boundary. Despite their adherence to the scientific norms of objectivity and rationality, the authors found that with the exception of Reck, the internal scientists tended toward the skeptical end of the spectrum of legitimate opinion among respected climate scientists (Morgan & Keith, 1995). They all interpreted scientific uncertainties in a conservative manner, viewing them as a rationale for further research rather than seeing the potential for climate shocks from positive feedback or threshold affects. They pointed to the long time frame of atmospheric accumulation of GHGs as signaling a comfortable margin of time for reducing uncertainty rather than an urgent reason for early precautionary action.

Thus, the predominant voice within the automobile companies in the policy arena was one of skepticism that the climate change was a major concern requiring significant private investment or government regulation. To some degree, these perspectives can be attributed to interest-based posturing. For example, one climate scientist in GM recalled that "Jimmy Johnston was a skeptic. He had to assume this position because he was the chief lobbyist. I understand where he was coming from."

Yet the skepticism toward climate science that the authors encountered across many interviewees at various levels cannot all be understood as purely strategic positioning. Although managers in departments responsible for public and government relations might have been comfortable spinning the science in a particular way, there also appears to have been a process of internalization of these perspectives; the authors came away from their interviews convinced that most managers sincerely believed in the skeptical

Table 1. Summary Table of Ford and GM's Interface With Climate Science From 1970s Through Late 1990s

	Ford	GM
Date corporate scientist specifically assigned to track climate issue	1988	early 1970s
Company response to Hanson testimony	"Shocked" and corporate scientist began to participate in IPCC, which was called "the politics of science"	Less shocked, but still mobilized wider corporate attention
Engagement of corporate scientist with scientific community	Participation in the International Panel on Climate Change, partly representing the AAMA.	Highly respected researcher accepted by scientific community. Purposely did not represent GM in scientific activities.
Role of corporate scientist	Was "our window on the issues coming over the horizon."	Was the "clearinghouse for information" and understood that she "absolutely had to sell this issue."
Invited speakers	Invited in a number of academic experts, though the list tended to be dominated by climate skeptics.	Internal conference on the subject in 1985 where external climate scientists were invited to give presentations, *notably excluding skeptics*. Skeptics were brought in at other times.
Company response to science	Public attacks on climate science. Trotman was vociferous in early 1990s in castigating science. Paper presented by corporate scientist in 1998.	GM was the only company of the big three to refrain from strong direct attacks on the science.

position. While even Johnston admitted that the adversarial political system in the United States required some strategic exaggeration, it was clear that he was sincere in his skepticism about the science and the role of government regulation. After retiring from GM, Johnston joined the American Enterprise Institute where he wrote a book about his experiences (Johnston, 1997). In order to understand how this distortion occurred, the authors need to look at the context in which the scientist worked.

The scientist in context. The process by which these conservative viewpoints are institutionalized is complex and not directly evident from interview responses. One person suggested that there might be some element of self-selection in terms of who is willing to be a corporate scientist. This self-selection is in line with Noble and Jones (2006), who found that boundary spanners are selected based on having the skills and abilities of an effective boundary spanner, rather than volunteer for the job based on their interest in the task. Another person who worked closely with GM on these issues commented that it might have to do with where they get their information. "If they are reading GCC literature and the Wall Street Journal, then they get a particular impression of the issue." Lastly, the managers and scientists worked within an organization that felt threatened by the prospect of regulatory action to address climate change. One executive discussed the pressure to adopt a bottom-line perspective. She recalled that there was a need for credibility with the line guys.

There appears to be a subtle process of negotiation of identity between perceptions of corporate or departmental interest and an individual's own viewpoint. Psychologists have long observed that people are averse to "cognitive dissonance," holding conflicting ideas simultaneously, or conflict between action (such as work routines) and ideas (Festinger, 1957).

So people who work for a car or oil company can reduce their internal conflict, or dissonance, by embracing climate skepticism. As one ex-R&D manager expressed, "There is social pressure. For the [internal scientist], they are around people who don't pay attention to the climate issue and don't want to hear it. . . . People on the operational side are more conservative."

The "location" of these scientists on the boundary between the corporate world and the scientific world seemed to be important in determining the degree to which the scientists were influenced by these pressures to adhere to a more skeptical perspective on the science. Reflecting the tensions of their location, corporate scientists strive to adhere to the norms of objectivity, rationality, and free investigation while being embedded in the business culture of bottom-line accountability and hierarchical subordination. This bridging of two cultures necessitates a subtle process of negotiation of identity for these scientists, who are not quite at home in either setting. The degree to which they

are embedded in organizations on each side of the boundary can have an impact on this process of negotiation. Past research on boundary spanning suggests the extent to which a boundary spanner interacts with people and organizations on each side of the boundary can influence the level of identification with these parties (Finet, 1993; Richter, West, Dick, & Dawson, 2006).

Thus, for Reck, who was clearly immersed in the scientific discourse, and the professional activities of the scientific field, the importance of identifying with the scientific community was clear. It was very important to her that she maintained her identity as a scientist and behaved in ways that would signal this identity to the scientific community. She reflected, "I was an independent scientist. I have refused to be bought my whole life. . . . It is a strange hybrid culture being a corporate scientist." This approach stands in stark contrast to Ford scientists who were relatively insulated from university or government-based scientists and who presented a scientific paper at the World Automotive Conference in 1998 that directly questioned climate science (Petrauskas & Shiller, 1998).

This influence of context becomes more complex when you examine it in more detail. Although companies attempt to speak with a single authoritative voice in public or to regulators, there were frequently significant internal tensions over controversial issues. These tensions had bedeviled the development of GM's electric vehicle during the early 1990s (Shnayerson, 1996). The influence of material interests on perceptions of climate science was particularly stark in comparing differences across departments and functional areas. For example, managers responsible for advanced automotive technologies, including hybrid and electric powered vehicles, tended to see climate change as a real problem that presented an opportunity for product innovation. The spirit of the research labs tended to be "we will show top management we can do it – we can change things."

Although the R&D people had a vested interest in developing solutions to problems and tended to view these solutions as technologically feasible, others in the organization were likely to take a more conservative approach. Managers in government relations and regulatory affairs departments, in particular, traditionally have seen their jobs as opposing governmental regulation and mandates. These managers were frequently concerned that the company might encourage more stringent regulation by demonstrating technological capabilities for reducing emissions, even if these technologies might be costly and unappealing to consumers. Managers responsible for traditional product divisions and strategy were particularly concerned about the high cost of low-emission technologies with little direct value to consumers. These managers clearly understood that both Ford and GM enjoyed a competitive advantage in

the large vehicle and truck segments of the market, so they were particularly vulnerable to emission regulations that would raise fuel prices and encourage demand for smaller vehicles.

Again, given these competing interests, the organizational location of the internal scientist, in addition to his or her location on the boundary, becomes very important. The greater the level of accountability of the scientific staff to other functions such as product management, marketing, and government affairs, the stronger the institutional pressures to conform to the climate skeptic position (DiMaggio & Powell, 1983). Ruth Reck, who was the strongest proponent of climate change, operated in the GM labs for the most part as an independent researcher, evaluated as an academic rather than as a business manager, with promotion dependent on external publications.

The role of the internal scientist as institutional entrepreneur is also dependent on their access to the power and resources needed to effect change (Kochan, 1975). Reck's unique access to information, for example, put her in a strong position in this regard. She recalled, "I was the only one working on climate. Everyone in the corporation had to come to me, as I was the clearinghouse for information. This was a powerful position." The credibility and authority of internal climate scientists were also enhanced by the aura of scientific objectivity. This status, however, appeared to be a double-edged sword. The scientists were also seen as remote from the core profit-generating activities of the company, and their location in R&D labs or headquarters staff tended to isolate them somewhat from managers with line responsibility for product design and development. This isolation was particularly true for the "research" arm of the R&D departments, whose research may or may not relate directly to near-term product development. As explained by one R&D manager, "Most of the time the R was separate from the D. Ninety-seven percent of the R was in [the] laboratory. D was sort of a molecular film spread out over the company." This separation was particularly true in GM with its highly decentralized structure; the relative autonomy of GM's R&D and basic science led to an overall perception that the scientists were not contributing to the needs of the firm. Therefore, though decentralization of R&D enabled corporate scientists to pursue their interests in climate and maintain a degree of autonomy, it may have also reduced the ability of these scientists to influence corporate policy or product strategy.

In recognition of this problem, there have been efforts to further integrate environmental scientists with the rest of the organization at both companies. As the climate issue gained in prominence, for example, GM realized that it needed a direct bridge between their climate scientist and their policy-making processes. Reck was directed to liaison closely with the executive VP for

government and public affairs. This liaison was a rather odd combination, given that the scientist had been the internal champion of the climate issue, and the VP's job was to convince the public and the government that mandatory emissions reductions were unnecessary and economically disastrous. Although this move gave Reck a voice near the top of the company, the new home also constrained her ability to promote the issue.

In the early 1990s, there was also an effort to increase the market relevance and accountability of research, and research projects were required to gain the sponsorship of a product division. In addition, both GM and Ford substantially eliminated basic scientific research during this period, reasoning that they should not waste their money generating nonproprietary knowledge to be disseminated in journals. The argument was that universities and government research laboratories were better positioned to conduct this research, and companies could draw from this body of expertise when necessary. This integration shifted the balance for corporate scientists from an academic culture to a more traditional corporate setting. By the mid-1990s, neither Ford nor GM had internal scientists who were major players in the climate science community. This shift may also explain the relative skepticism of corporate scientists by the mid-1990s.

Not only must internal scientists negotiate inside a firm with multiple coalitions, but they also need to balance their business role with the one they play in the scientific arena. The corporate scientists interviewed were particularly emphatic about their objectivity and independence, relating stories to demonstrate their refusal to be curtailed by narrow corporate interests. Ruth Reck was on an EPA advisory committee, and in her words, "GM desperately wanted to remove me from it. They thought I was not toeing the GM line. But . . . I was never on anything representing General Motors." Instead, she was on the committee as an independent scientist. Although not threatened with her job because of her independence, Reck knew there was dissatisfaction with this role. With their loyalty to the corporation in some doubt, corporate scientists needed to negotiate the border between these two cultures with some careful diplomacy. Reck recalled that "you had to speak strictly in terms of facts. Lots of people got into trouble for saying controversial things. I lived by the rule that anything you say might appear on the front page of the New York Times. Anything I said could always be backed by a reference."

If corporate scientists were not completely at home in the business world, they felt even less trusted in the public realm. Another industry climate specialist was chairman of EPA's Clean Air Advisory Committee and became heavily involved in overseeing a review of air quality standards. This review was the first time the EPA had used an industry person in this capacity, and

for 2 years, he spent most of his time on EPA work. This arrangement, however, was not wholly successful. From the perspective of the specialist, EPA had already made up its mind and did not follow his advice in part because of his industry affiliation. Another industry specialist recounted an incident during an IPCC plenary session that was negotiating text of the IPCC Second Assessment Report, in which he suggested a particular change, which was supported by one of the lead authors and then endorsed by a plenary vote. The IPCC chair, Bert Bolin, later reportedly took that lead author aside and warned him not to support other industry interventions.

Although participation in EPA and IPCC panels might be considered prestigious professional activity for academic scientists, the corporate culture views it not just with suspicion but as a waste of valuable corporate resources. A number of scientists mentioned that external activity was viewed as unproductive and that their corporate departments were reluctant to bear such a "tax." In this atmosphere, it is not surprising that the IPCC has had difficulty recruiting authors from industry, despite IPCC Chair Robert Watson's redoubled efforts to do so (Watson, 1999).

Institutional Histories and Leadership

The skeptical discourse concerning climate change is rearticulated within each company in the context of its particular institutional history, market position, and corporate culture. GM had invested an estimated US$500 million in the development of its electric vehicle during the 1990s, but less than 1,000 had been sold. Although a few GM managers thought that the company had gained valuable expertise in electric drive trains, the experience was widely perceived as a commercial mistake. Similarly, GM managers felt that they had rushed too quickly to downsize their vehicles, particularly luxury vehicles like the Cadillac. The industry perception was that Ford was making more money in the late 1990s because it had maintained its full-size vehicles and expanded production of trucks and SUVs faster than GM. In this context, the perception of climate regulation as a major threat became the dominant perspective in GM. Ford managers also recounted a piece of company history to explain their collective wariness of low-emission vehicles. The firm had invested an estimated US$500 million in sodium-sulfur batteries, only to abandon the project because of safety concerns and because nickel metal hydride looked more promising.

The responses to climate change also need to be placed in the context of the "siege" mentality prevalent in the U.S. automobile industry. A senior executive at GM noted: "There is a broad agenda of efficiency, and against

large vehicles as poor choices. Climate is only the most recent driver of fuel efficiency. Before that there was oil dependency, the energy crisis, urban sprawl, and smog." Johnston put it in more political terms: "There are people who have cast the automobile as a villain. It is a puritanical view, that we are having too much fun that we have too much mobility and freedom, that suburban sprawl is bad. They think we should all live in beehives. So when scientists say that CO_2 is a greenhouse gas, they jump on board." This mindset tended to make managers see climate change as part of a larger ideological and political attack on the industry, justifying their skepticism. At the same time, managers saw the continuing pressure and momentum toward fuel efficiency and carbon regulation and felt compelled to accommodate them to some degree.

National context. The debate over the strategic value of challenging climate science also needs to be understood in the context of the particular nature of the science–policy interface in the United States. The congressional hearings on climate exemplify the adversarial, legalistic courtroom style through which the scientific basis for regulation is developed and contested. This U.S. approach contrasts sharply with the more integrated, consensual approach found in Europe (Edwards & Lahsen, 1999; Jasanoff, 1991; Kruck, Borchers, & Weingart, 1999). The institutional governance structures in the United States cause companies engaged in contested policy arenas to make their case in a vociferous, public manner. As one auto executive put it, "The Hill works by compromise, so you need to go to the extreme. The more strident one side gets, the more the other side must. It ends up completely polarized." GM's Johnston made the case that the automobile industry ended up with Corporate Average Fuel Economy (CAFE) in the first place because of a misplaced strategy of conciliation: "The Neville Chamberlain approach doesn't work. We offered voluntary fuel economy goals, with the usual rationalization that the train is leaving the station and we have to get on board. But the government turned around and made it mandatory. If we offer to do X, they will demand two X." Another auto executive compared the situation with Europe: "In the US, it doesn't help to have Al Gore getting up and saying that people are dying in Chicago because of climate change. We are forced to be strident to counter that misinformation. In Europe, with some balance between the Commission and the Parliament, it's possible to have meaningful discourse."

The geographic structure of U.S.-based auto companies reflects a national basis to their organizational fields, which might also be a factor in the conservative response of the U.S. companies. Although these companies have been multinational for many years, the orientation of top management is primarily domestic. In numerous interviews, corporate managers, many with worldwide

responsibilities, spoke about the difficulty of reducing emissions with gasoline at US$1 a gallon, consumers who care little for fuel environment and are hungry for large SUVs, and a Senate unlikely to ratify Kyoto. These views were reinforced through membership in industry associations dominated by U.S.-based companies. This situation only began to change for Ford and GM during the mid-1990s, as Ford implemented its Ford 2000 project that pushed toward the rationalization and integration of production and management worldwide, and GM began to move in a similar direction. By 1998, top management in both companies included a number of people with significant overseas experience.

Discussion and Conclusions

How companies perceive the risks of environmental threats such as climate change can have a significant impact not only on their own behavior but also on the overall dynamics in the larger institutional field. Perceptions formed in the early stages of institutional change are particularly important since they can have lasting impacts. In this article, the authors aimed to better understand the role of the corporate scientist interpreting and filtering the discourse on climate science, thus influencing corporate perceptions of this science. Moreover, the authors wanted to understand the factors that influence this process of translation.

As expected, the authors found that the context in which these scientists work influences the frames they use to interpret this discourse. In particular, the authors found that the placement of these scientists on the organizational boundary may be critical in this dynamic. Corporate scientists need to balance their business and science roles, and the corporate scientists interviewed were particularly emphatic about their objectivity and independence, relating stories to demonstrate their refusal to be curtailed by narrow corporate interests. However, the more independent organizational location and external professional orientation of GM scientists enabled them to engage earlier with the climate issue and become internal advocates for change. With this identification, the norms of objectivity, rationality, and free investigation played a larger role as the scientists attempted to translate the "truth" for their organizations despite facing institutional pressures to view the scientific discourse through the frames of market interest. As a result, GM's product, market, and political strategies were more appropriate to the emerging climate issue. The company did not follow Ford in condemning climate science or lobbying heavily against Kyoto. It continued development of an electric car, the EV1, despite skepticism in some parts of the company. Though the EV1 program was discontinued in 2002, GM's

development of the electric Volt, launched in December 2010, demonstrates the importance of corporate institutional history in shaping strategy.

The authors also found that despite the tendency to institutionalize conservative and skeptical perspectives on climate change, at the very top levels in both companies there was a genuine concern to "know the truth." As one put it, "The trick from a management standpoint is how to get information through the layers of the organization and be able to make a judgment. We want to know what's really going on, not just what we want to hear." Managers acknowledged that if the more pessimistic forecasts were borne out, the Kyoto commitments would need to be substantially strengthened, with drastic implications for the industry. Another ex-VP commented on how top management prefers certainty, even if the news is unwelcome. Recalling the story of DuPont and CFCs, he stated, "[There,] the head scientist came back and said—'guys—I am convinced it is real.' Then DuPont could move. In a sense, if the scientists were able to say 'I saw yesterday's data and its certain.' the industry would breathe a sigh of relief. . . . But as it stands, we are uncertain about the science and what the politicians are doing." In an ironic twist, top management expressed a sincere desire to understand the true scope of the climate problem in order to make strategic plans, yet the automobile companies and the scientists in them, were to varying degrees constrained by institutional perspectives that reflect the perceived threat to their interests. Corporate scientists do not deliberately distort the scientific literature, but this research does suggest that, through their role as filters, monitors, and advisers, the companies are perhaps not receiving access to the full spectrum of opinion.

Given the focus of this study on two American companies, the question remains whether these findings are generalizable to a broader range of companies in the automobile industry, particularly those companies that operate in different national contexts. Yet these differences can play an important role in the dynamics within an institutional field (Levy & Kolk, 2002). The study is also limited in that it only looks at the early stages of institutional change. In the later stages of institutional change, the discourse within the scientific community changed as consensus grew among scientific community. It is not clear what role corporate scientists would play in these later stages once they move to the "theorization" and "differentiation" stages as described by Greenwood et al. (2002).

Another issue for consideration is the translation process for companies that do not have dedicated environmental scientists, a likely scenario as companies increasingly outsource their basic research (Quinn, 2000). It is possible that these companies would turn to industry associations or to external university-based

scientists, who might provide very different perspectives. The boundary-spanning role for environmental issues has historically been given to the Environmental Health and Safety department, though increasingly to sustainability teams. These are frequently established as a response to a demand for socially legitimated roles. Under this situation, as found by Rao and Sivakumar (1999) in the establishment of investor relations departments, it may be that the boundary spanners act more as buffers or simply signal to the external environment a corporate engagement with environmental issues. These managers would not be professional scientists and are unlikely to serve as internal advocates for change. They follow a different set of "scripted roles" that are enacted by themselves and their spectators, such as the media and government (Lamertz & Heugens, 2009). In the adversarial U.S. policy-making process, these roles call for exaggeration and contestation.

This study points to the importance of corporate scientists in interpreting institutional discourses around environmental issues, particularly in the early stages of institutional change. Some suggest that the environmental issues of the future will be similar to climate change in that they will be global, value laden, and fraught with uncertain science. Thus, there is much to learn from this phase in the change process. The authors found that the less embedded the scientist is within the external scientific profession, the greater likelihood that the translation process is shaped by their organization's institutional frames. The result is that corporate perspectives on key scientific issues are largely shaped by operational and commercial logic. The risk for companies is that these market logics are conceived and institutionalized in the context of historical experience rather than future pressures arising from issues such as climate change.

Appendix A

Interview Protocol

1. Tell us about yourself and history with your company.
2. Can you explain how/why your strategy regarding climate change has evolved?

a. How has this strategy affected your research and development priorities? Which technologies are you most optimistic about and why? How important is it to develop these two technologies in-house or can they be acquired from outside? Which are the most promising?

b. How did your company's stance with regard to government policy change over time?

i. Probes: tolerance of a mandatory carbon trading system, higher CAFE standards in the United States, standards in the EU.
ii. How was this influenced in your firm's recognition of climate change as a problem?
1. Where does the company (you) get information on climate science?
2. Does the perception of the science vary within the organization? How? Why?
a. Has there been a convergence of climate change strategies between North American auto companies and European ones? If so, what is behind this?
3. Has your company shifted its climate-related institutional affiliations over time?
a. Joined any climate initiatives?
b. Developed relationships with external environmental and scientific organizations?
c. Become more involved in the IPCC process?

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