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Boundary Organizations in Environmental Policy and Science: An Introduction

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Scholarship in the social studies of science has argued convincingly that what demarcates science from nonscience is not some set of essential or transcendent characteristics or methods but rather an array of contingent circumstances and strategic behavior known as “boundary work” (Gieryn 1995, 1999). Although initially formulated to explain how scientists maintain the boundaries of their community against threats to its cognitive authority from within (e.g., fraud and pseudo-science), boundary work has found useful, policy-relevant applications—for example, in studying the strategic demarcation between political and scientific tasks in the advisory relationship between scientists and regulatory agencies (Jasanoff 1990). This work finds that the blurring of boundaries between science and politics, rather than the intentional separation often advocated and practiced, can lead to more productive policy making.

If it is the case, however, that the robustness of scientific concepts such as causation and representation are important components of liberal-democratic thought and practice (Ezrahi 1990), one can imagine how the flexibility of boundary work might lead to confusion or even dangerous instabilities between science and nonscience. These risks could be conceived, perhaps, as the politicization of science or the reciprocal scientification of politics. Neither risk should here be understood to mean the importation to one enterprise from the other elements that are entirely foreign; that is, science is not devoid of values prior to some politicization, nor politics of rationality, prior to any scientification. Rather, both should be understood to mean the rendering of norms and practices in one enterprise in a way that unreflexively mimics norms and practices in the other. These concerns have been central to the so-called science wars, and to the extent that they are implicated in public discussions of such policy issues as health and safety regulation, climate change, or genetically modified organisms, they are real problems for policy makers and publics alike.¹

Recognizing both that there is no unbridgeable chasm between science and nonscience and that the flexibility of boundary work may threaten some important values and interests, scholars have discussed some possible factors that contribute to linking the two domains and stabilizing some boundary work. These include the identification of *boundary objects*, *standardized packages*, and now, *boundary organizations*.

From Boundary Objects to Boundary Organizations

Boundary objects sit between two different social worlds, such as science and nonscience, and they can be used by individuals within each for specific purposes without losing their own identity (Star and Griesemer 1989). For example, a patent on research results can be used by a scientist to establish priority or for commercial gain. It can simultaneously be used by a politician to measure the productivity of research (Guston 1999). In some cases, entire organizations can serve as boundary objects, as did many of the public interest organizations created by scientists in midcentury to facilitate political goals while protecting scientific ones (Moore 1996). Standardized packages are more robust than boundary objects, changing practices on both sides of the boundary (Fujimura 1991). For example, model agreements for cooperative research between government scientists and private firms can encourage both parties to engage in more frequent and productive cooperation, but for their own purposes (Guston 1999).

To the extent that boundary objects and standardized packages provide stability, however, they do so only through the consent of actors on both sides of the boundary, for example, to the extent that researchers voluntarily engage in patenting or politicians accept patents as a measure of productivity. And even if blurred boundaries can be more productive for policy making, there is little sense of how much blurring is productive and how much might be destructive. Moreover, the existence of boundary objects or standardized packages may not be all that is necessary for stabilization. More general changes in culture or more specific changes in practices may be necessary as well.

The Logic of Boundary Organizations

Boundary organizations attempt to solve these problems by meeting three criteria: first, they provide the opportunity and sometimes the incentives for the creation and use of boundary objects and standardized packages; second,

they involve the participation of actors from both sides of the boundary, as well as professionals who serve a mediating role; third, they exist at the frontier of the two relatively different social worlds of politics and science, but they have distinct lines of accountability to each (Guston 1999, 2000).

In this third criterion, the concept of boundary organizations borrows from principal-agent theory (also known as ideal contracting), which holds that organizational relations may be understood as (a series of) delegations of authority from principals to agents within or between organizations. These delegations may be modeled by contracts. Regular problems of adverse selection and moral hazard plague the delegatory relationship and elicit regular solutions of incentives and monitoring (Arrow 1991).² The conduct of research for both basic and applied purposes can be viewed as such a delegation from research sponsor to research performer (Caswill 1998; van der Meulen 1998; Guston 1996; Braun 1993). The principal-agent perspective leads to regular questions about the integrity and productivity of research and regular strategies such as monitoring and the application of incentives for responding to them (Guston 2000).

The success of a boundary organization is determined by principals on either side of the boundary, both of whom rely on the boundary organization to provide them with necessary resources. A successful boundary organization will thus succeed in pleasing two sets of principals and remain stable to external forces astride the internal instability at the actual boundary. The success of the organization in performing these tasks can then be taken as the stability of the boundary, while in practice the boundary continues to be negotiated at the lowest level and the greatest nuance within the confines of the organization.³ This dual agency makes the boundary organization a site of what Sheila Jasanoff (1996, 397), following Bruno Latour, has labeled “co-production,” the simultaneous production of knowledge and social order. Boundary organizations are involved in coproduction in two ways: they facilitate collaboration between scientists and nonscientists, and they create the combined scientific and social order through the generation of boundary objects and standardized packages.

The concept of the boundary organization differs in subtle but important ways from German political scientist Dietmar Braun’s (1993) description of intermediary agencies. In his international comparative study of mission agencies that sponsor research in the United States, Great Britain, France, and Germany, Braun appropriately critiques the dyadic structure of principal-agent theory and situates the mission agencies as intermediaries between a political system and a scientific system. He concludes that this three-part, or triadic, structure improves the communications between politics and science but continues to concede significant power to science over the choice of

research. Rip (1994) has a similar vision of the dual nature of research councils between the scientific community and the government, embodying values from both sides. Moreover, Rip (1994) generalizes from this observation, arguing that “because they have two patrons, the state and the scientific community, the research councils are relatively independent with respect to either of them” (pp. 12-13).

Braun and Rip attribute to the research councils narrower functions, apart from actually funding research, than boundary organizations perform. Braun introduces the triadic structure merely to account for complexity, and the need of his intermediary agency for the scientific community is limited to the latter’s providing reputational assistance to the former. In the case of the boundary organization, however, the professionals in the agency and the scientists and potential consumers on the outside collaborate to produce mutually instrumental boundary objects and standardized packages. To the extent that Rip focuses on the consequences of the dual nature of the research councils, he argues that it permits them an independence that they can exploit in an entrepreneurial way. Although the boundary organization may behave entrepreneurially, it is crucial to recognize as an important characteristic the stability it induces by successfully internalizing the boundary negotiations. Its dependence is as important as its independence.

This boundary organization also differs from the boundary-spanning organization previously defined in the sociology of organizations. The concept of boundary spanning helps explain how organizations insulate themselves from external political authority (Aldrich 1979; Bozeman 1987), akin to Rip’s idea. Organizations engage in such activities to draw resources, exploit opportunities, or respond to threats from their environment (Scott 1992). The boundary organization draws its stability not from isolating itself from external political authority but precisely by being accountable and responsive to opposing, external authorities. Boundary organizations may use co-optation, the incorporation of representatives of external groups into their decision-making structure, as a bridging strategy (Scott 1992), but they attempt to balance it precisely between scientific and political principals.⁴

Illustrative Organizations

The logic of the boundary organization’s stability is akin to the logic, for example, that Bimber (1996) uses to describe the situation of the congressional Office of Technology Assessment (OTA). Prior to its elimination by the new Republican Congress in 1995—primarily as a sacrifice to the agenda of

fiscal discipline—OTA had established itself as a respected and politically neutral institution for the analysis of policy problems with high technical content. Wondering why OTA did not suffer the same fate of politicization over time as other organizations for policy analysis (particularly those in the Executive Branch), Bimber points to the dual accountability of OTA to both Democrats and Republicans on OTA's governing board and in OTA's congressional audience. Enhanced further by its clientele in many congressional committees with overlapping or competing jurisdictions, the decentralized demands on OTA elicited a strategy of neutrality that channeled its pursuit of policy analysis. The need to respond to two (or more) principals prescribed a balanced and, with respect to the role of politics and science in the performance of analysis, stable approach to OTA's mission.⁵ As a politically neutral organization, OTA did not teeter atop a narrow divide between Democrats and Republicans but internalized partisan differences, negotiated them for each study, and produced in its studies a boundary object or standardized package that either party (or any of several congressional committees) could use for its own purposes.

In a similar way, Jasanoff (1990, 209-16) alludes to how the Health Effects Institute (HEI) stabilizes the deconstructive tendencies of an adversary approach to regulatory science through a "public-private partnership for science." In an environment in which government scientists and industry scientists are often on opposing sides of interpreting evidence about environmental health and safety, HEI's experience suggests the benefits of constructing dual agency. Because both government and industry fund HEI, neither party could productively accuse it of being captive to the other. Supplemented by two peer-review committees, HEI has been relatively successful in constructing a reputation for objectivity.

Perhaps more critical for managing the real problems between politics and science than the identification by scholars of organizations—like OTA and HEI—that demonstrate the logic of boundary organizations is the understanding of that role by practitioners themselves. A recent review for the European Environment Agency (EEA), for example, identifies the description of boundary organizations as a "most important observation" for EEA because it elaborates a strategy that EEA can adopt in pursuit of its preexisting mission. Boundary organizations

perform tasks that are useful to both sides, and involve people from both communities in their work, but play a distinctive role that would be difficult or impossible for organisations in either community to play. This is exactly the gap that the EEA can now fill in disseminating environmental research. (Scott 2000, 15)

The articles in this symposium deepen the exploration of such organizations.⁶ In the first contribution, Terry Keating further elaborates the role of HEI in the production of high-quality research relevant to air pollution policy. Beyond the unique financial balancing that other analysts have noticed, Keating explores how HEI's response to recommendations from a study by the U.S. National Academy of Sciences reestablished and even extended the organization's credibility through strategies of engagement and inclusion of interested parties rather than insulation from them. By appealing to and balancing between multiple principals, HEI has become an arbiter of the quality of policy-relevant research.

In the second article, David W. Cash examines agricultural extension in the United States, a program with more than a century's experience in disseminating useful knowledge. In his case study of the role of extension in managing the Ogallala aquifer in the High Plains region of the United States, Cash not only identifies the particular characteristics of the boundary organization but also provides evidence that its presence is causally related to more effective information flows. Furthermore, he argues not only that the boundary organization augments the creation and transfer of usable knowledge but also that it facilitates the coordination of science and decision making across boundaries of scale or levels of organization, for example, county, state, and federal jurisdictions.

Both of these organizations operate exclusively in the political system of the United States. The final two articles examine international organizations, although one is housed in the United States. Shardul Agrawala, Kenneth Broad, and David H. Guston study the International Research Institute (IRI) for Climate Prediction, based at Columbia University's Lamont-Doherty Earth Observatory. IRI performs what it calls an "end-to-end" mission, from modeling the physics of the climate system and forecasting precipitation and temperature at seasonal-to-interannual scales, to research and capacity-building efforts on the use of climate information by decision makers in a range of socioeconomic sectors, including agriculture, water resources, fisheries, health, and disaster management. The authors document this strategy, oriented at principals in both scientific and user communities, and some of the boundary objects and standardized packages that help IRI implement it. They also document, however, a number of challenges that IRI faces as an emergent boundary organization operating at the interface between knowledge and applications, on one hand, and between the developed and the developing world, on the other.

In the final contribution, Clark Miller offers a supplementary framing to boundary organizations he calls "hybrid management." Derived from

Miller's research on the Subsidiary Body for Scientific and Technological Advice to the United Nations Framework Convention on Climate Change, hybrid management focuses on the functions of organizations engaged in coproduction, including such functions as hybridization and deconstruction that are apparent in the other boundary organizations. Miller finds this approach to thinking about boundary organizations particularly useful in the fast-changing institutional landscape of global governance.

Conclusion

Like Latour's (1987) Janusian visage of science itself, the boundary organization speaks differently to different audiences. Latour's science is able to project authority by appealing to either face in a strategic fashion—for example, by claiming that science is a messy, creative process and also by claiming that it is a neat, rational process. Similarly, the boundary organization is able to project authority by showing its responsive face to either audience. To the scientific principal, it says, "I will do your bidding by demonstrating to the politicians that you are contributing to their goals, and I will help facilitate some research goals besides." To the consumer, who is also a principal, it says, "I will do your bidding by assuring that researchers are contributing to the goals you have for the integrity and productivity of research." The boundary organization thus gives both the producers and the consumers of research an opportunity to construct the boundary between their enterprises in a way favorable to their own perspectives. This solution is almost Madisonian in its use of a balancing of interests to reduce the threat that either side will find the boundary organization inimical, because it will actually pursue the interests of both parties.⁷

Don K. Price (1954) argued against the old idea of unitary sovereignty and in favor of a new kind of federalism in the sponsorship of academic research. Likewise, boundary organizations suggest that the old idea that politics and science should be neatly cleaved should be abandoned in favor of the newer attempt to mix the interests of both. It should not be worrisome that the implementing of boundary organizations may at times be characterized by a political intrusion into the workings of science, largely because there is a reciprocal intrusion of science into politics. The politicization of science is undoubtedly a slippery slope. But so is the scientization of politics. The boundary organization does not slide down either slope because it is tethered to both, suspended by the coproduction of mutual interests.

Notes

1. In 1995, for example, the U.S. House of Representatives Committee on Science held hearings that framed research into the depletion of stratospheric ozone as a problematic threat to scientific integrity encouraged by a left-wing political agenda. A converse example might be the more current debate over genetically modified organisms, in which American politicians readily scientize their perspectives by substituting their reading of scientific consensus for a more robust discussion of costs, benefits, and values. Ehrlich and Ehrlich (1996) document examples of what they call “brownlash,” or antiscientific attitudes directed at environmental science and policy.

2. Adverse selection, the difficulty in the principal’s choice of an appropriate agent, is a problem of hidden information. Moral hazard, the difficulty in the principal’s assuring the conduct of a chosen agent, is a problem of hidden behavior.

3. This function is akin to the “boundary-ordering devices” of Shackley and Wynne (1996, 293), which “produce a consistency of effect, even though the precise position of the boundary between science and policy is not consistent.”

4. The idea of spanning is also explicit in the bridging institutions described by Powers (1991), although the balancing was only implicit and the role of boundary objects and/or standardized packages was absent.

5. The congressional Republicans’ primary substantive criticism of the Office of Technology Assessment (OTA) was that this product was not best suited to the congressional client rather than that OTA’s analyses tilted one way or the other.

6. The articles included in this symposium were originally presented at the Workshop on Boundary Organizations in Environmental Policy and Science, held 9-10 December 1999 in New Brunswick, New Jersey, under the sponsorship of the Environmental and Occupational Health Sciences Institute—a cooperative endeavor of Rutgers, the State University of New Jersey and the University of Medicine and Dentistry of New Jersey—Robert Wood Johnson Medical School—and the Global Environmental Assessment project—a collaborative, interdisciplinary effort based at Harvard University to improve the linkage between science and policy in society’s efforts to deal with problems of global environmental change. For the workshop report, see Guston et al. (2000).

7. It is realized, of course, that the ultimate success of this technique may depend not just on a balanced institutional design but also on such contingencies as leadership and the characteristics of cases handled by the organization—as the cases amply show.

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