

to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. New York: Cambridge University Press.

- Ostrom, E. 1995. "Self-organization and Social Capital." *Industrial and Corporate Change* 4 (1): 131–59.
- Stern, N., S. Peters, V. Bakhshi, A. Bowen, C. Cameron, S. Catovsky, D. Crane, S. Cruickshank, S. Dietz, N. Edmonson, S.-L. Garbett, L. Hamid, G. Hoffman, D. Ingram, B. Jones, N. Patmore, H. Radcliffe, R. Sathiyarajah, M. Stock, C. Taylor, T. Vernon, H. Wanjie, and D. Zenghelis. 2006. *Stern Review: The Economics of Climate Change*. London: Her Majesty's Treasury.
- Tingley, Dustin, and Barbara Walter. 2010. "The Effect of Repeated Play on Reputation-Building: An Experimental Approach." Unpublished paper.

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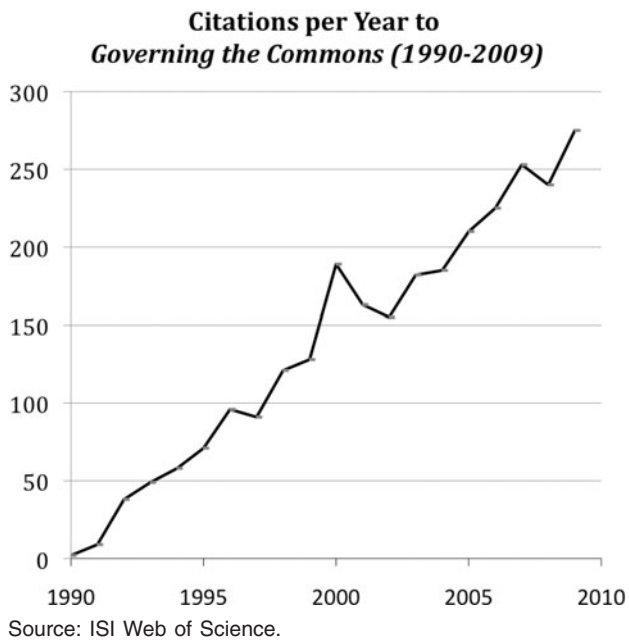
Elinor Ostrom's *Governing the Commons* is an outstanding example of interdisciplinary research, and a particular example of how much the discipline of political science has to offer other disciplines.¹ Starting with the problem of maximizing the economic value of common resources, the work demonstrates how core concepts of political science—such as voluntary organizations, institutional development, and norms—can illuminate a problem that was previously seen in narrow economic terms.²

Ostrom's contribution was made possible by her reframing the debate about the "tragedy of the commons" (Hardin 1968). In this famous debate, the alternatives were framed as private property vs. central authority. The theoretical questions asked tended to be shaped by these two frames.³ Implicit in both the frame of private property and the frame of central authority is the notion that decisions are made by one or more individual decision makers operating independently. But Ostrom's observations in real-world settings such as inshore fishing and allocation of irrigation water showed that repeated interactions among the users of a common resource often allowed them to build institutions that could provide effective monitoring and discipline of free riders, thereby achieving efficient and sustainable use of the resource. In effect, Ostrom introduced a new frame, a frame based on the concept of management by the users themselves. Eventually, even Garrett Hardin agreed that he could have called his article "Tragedy of the Unmanaged Commons" (Hardin 1994).

Ostrom herself is well aware of the problems of doing interdisciplinary research. As she once put it, "the disciplinary huts of many modern universities do not really enable one to have effective intellectual exchange across disciplines" (as quoted in Zagorski 2006). Her own background is in political science, from her undergraduate major through her doctorate and her entire career spent as a professor of political science. But she and her husband, Vincent Ostrom, saw the need to go beyond political science. They took matters into their own hands when they arrived at Indiana University. Starting in 1969 they began a weekly informal seminar to discuss ideas across the social sciences, and within a few years this was institutionalized in a form that lives on to the present day, further encompassing business and the biological sciences. As a full professor, Elinor Ostrom spent eight months in 1981 and again in 1988 working closely with economists and others at the Center for Interdisciplinary Research at Bielefeld University in Germany to develop further interdisciplinary research networks.

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Figure 1



It is interesting that after being published in 1990, *Governing the Commons* caught on slowly. In terms of annual citations, it gained prominence steadily year by year (See Figure 1). Rather than following the common pattern of tapering off after a few years, the book actually had three times as many citations in its second decade of publication as in its first decade.⁴ Apparently it took a while for the broad relevance of the work to be appreciated. Perhaps this was due in part to what William Mitchell decades ago described as Elinor Ostrom’s “gentle, inconspicuous and unassuming manner” (Mitchell 1988).

In *Governing the Commons*, Ostrom was careful to define the domain of her study as common-pool resources. Common-pool resources are resources that are renewable and are present in situations in which substantial scarcity presents the possibility that users may substantially harm one another; yet the possibility of producing major external harm is foreclosed (p 26). My proposition is that Ostrom’s insights are valuable even for situations far beyond the common-pool resource domain of her original project.

To test this proposition, I will identify some insights that her work suggests for a quite different realm, namely, the Internet.⁵ The Internet relies less on common-pool resources than it does on both private goods and public goods. The physical means for sending messages from one computer to another are provided largely by private goods in the form of bandwidth rented from service providers. Today, transmitting a message around the world is so inexpensive that for most purposes the cost is negligible. Because of this, the private goods aspect of the Internet can often be ignored. The reliability and security of the Internet,

however, is a public good that cannot be ignored. The security of the Internet is a public good because availability to one user does not diminish its availability to another user. Unlike the common-pool resource of a fishery, one party’s use of the reliability and security of the Internet does not diminish anyone else’s use of the same resource.

For the sake of concreteness, consider a particular kind of challenge to the security and reliability of the Internet, namely, the existence of what have been called “cyber riots.” A cyber riot is an Internet attack by a large number of individuals seeking to disable the normal functioning of institutions they oppose. For example, in April 2007, Estonian authorities announced that they would remove a Soviet-era memorial to World War II. In the following days and weeks the Web-sites of economic and political institutions in Estonia were severely disrupted by attacks coming from Russia (Arc Lander and John Markoff, “Digital Fears Emerge After Data Siege in Estonia,” *New York Times*, 29 May 2007). While this cyber riot may have been aided by the Russian government, there is little doubt that it also expressed the genuine anger of hundreds or even thousands of Russian individuals. Since the 2007 cyber riot against Estonia, there have been news reports of cyber riots against institutions in China, Georgia, India, Russia, South Korea, and the United States.

While cyber riots may not represent “an electronic Pearl Harbor,” they do reduce the degree to which everyone can rely on the availability of the Internet (Wu 2007, Carr 2010). As such, users have a shared interest in effective governance of the resource. What does Ostrom’s work suggest about this problem?

First, governance by users is often helped by having explicit rules about the actions that are allowed or constrained (p. 51). The analogy with physical riots against foreign embassies is useful here. In the case of physical riots, governments are responsible for protecting the foreign embassies in their countries. Presumably this includes not only preventing damage from a riot underway, but also for not promoting potentially damaging riots, and—if necessary—for actively discouraging potential riots. Ostrom’s work suggests that analogous rules, perhaps made explicit by international agreement, might be helpful to promote the shared interest in the security and reliability of the Internet.

Second, when monitoring is costly, it helps to provide private benefits for a monitor, as well as joint benefits for others (pp. 59, 97). It is interesting that cyber riots are already subject to private monitoring by about a hundred researchers in more than 70 countries (Kim Hart, “A New Breed of Hackers Tracks Online Acts of War,” *Washington Post*, 26 August 2008). Ostrom’s work suggests that these efforts should be rewarded, for example with favorable attention, when they are successful at providing early warning of an emerging cyber riot. These private monitors should also be rewarded when they are successful in

detering a riot, or when they are successful in identifying individuals or governments who facilitate a cyber riot. In this way, social capital (Putnam 2000) on the Internet can be strengthened.

Third, in large and complex systems, there should be multiple layers of nested enterprises (p. 101 f). In the case of the Internet, individual users operate at a low level, while organizations and user communities operate at a middle level. At the global level, governance of the Internet is relatively thin, limited mostly to agreements on coordination mechanisms, such as domain names and Internet protocols. Thinking of the governance of the Internet as existing at multiple nested layers suggests that one layer can help govern another. In the case of cyber riots, Ostrom's approach suggests that institutions at all levels should realize that if their own supporters riot against hostile institutions, there is a good chance that people loyal to those institutions may retaliate. Since institutions are better able to monitor their own members than outsiders are able to do (Fearon and Laitin 1996), relatively strong institutions such as national governments should recognize their interest in policing their own supporters.

Fourth, in order to promote compliance, graduated sanctions are better than all-or-nothing sanctions (pp. 94–100). Moreover, tolerance for infractions should be high during stressful periods, so long as the infraction seems temporary and does not threaten the survival of the cooperative regime (p. 99). In the case of cyber riots, this suggests that if citizen anger is especially high against a foreign government or institution, some tolerance for disruption might be acceptable provided that the disruption is temporary and does not seem to threaten the survival of the norm against causing serious damage.

Fifth, institutions that are successful in governing common-pool resources often take decades of trial-and-error learning to develop. Such institutions need to be capable not only of dealing with immediate problems but also of adapting over time to new circumstances (pp. 137–42, 207–16). In the rapidly changing environment of the Internet, this suggests that norms will need to evolve rapidly in order to keep up with new possibilities for citizen-based attacks on institutions and for detecting, deterring and preventing such attacks.

Sixth, and most important, is Ostrom's approach to institutional design. She carefully studies how users manage to govern in real settings, and then derives theoretically-based design principles for when and how user-based governance can be achieved. Her success suggests that the careful study of the way in which governance of the Internet is developing at all of its multiple levels can lead to a deeper understanding of how user-based institutions can manage the threat of harm from cyber riots and worse.

In sum, Ostrom's *Governing the Commons* demonstrates that the future of interdisciplinary work involving political science will involve not simply the continual

importing from other disciplines, but will also provide valuable opportunities for exporting political science to other disciplines and to a wide variety of problem domains.

Notes

- 1 For a discussion of interdisciplinary research in terms of imports and exports, see Axelrod (2008).
- 2 While political scientists can take pride in the fact that the Nobel Prize in Economics recognizes the contribution of a political scientist to economics, the Nobel citation took the opposite tack, saying that Ostrom's research "demonstrates that economic analysis can shed light on most forms of social organization."
- 3 Ostrom (p. 7) notes that another frame—the two-person iterated Prisoner's Dilemma—is insufficient to deal with common-pool resources since it does not include the problem of monitoring.
- 4 The counts from ISI's Web of Science are respectively 663 and 2077.
- 5 I thank Jeffrey Cooper of SAIC for pointing out that Ostrom's work is relevant to the governance of cyber space.

References

- Axelrod, Robert. 2008. "Political Science and Beyond: Presidential Address to the American Political Science Association." *Perspectives on Politics* 6 (1): 3–9.
- Carr, Jeffrey. 2010. *Inside Cyber Warfare*. Sebastopol, CA: O'Reilly Media.
- Fearon, James D. and David D. Laitin. 1996. "Explaining Interethnic Cooperation." *American Political Science Review* 90 (4): 715–35.
- Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 162: 1243–1248.
- . 1994. "The Tragedy of the Unmanaged Commons." *Trends in Ecology & Evolution* 9 (5): 199.
- Mitchell, William. 1988. "Virginia, Rochester, and Bloomington: Twenty-five years of Public Choice and Political Science." *Public Choice* 56 (2): 101–119.
- Putnam, Robert D. 2000. *Bowling Alone*. New York: Simon and Shuster.
- Wu, Xu. 2007. *Chinese Cyber Nationalism*. Lanham MD: Lexington Books.
- Zagorski, Nick. 2006. "Profile of Elinor Ostrom." *Proceedings of the National Academy of Sciences of the United States of America* 103 (51): 19221–23.