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Comment

ROAD MAPS FOR THE 21ST-CENTURY RESEARCH IN SCIENCE COMMUNICATION

Coming of age in the academy? *The status of our emerging field*

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ABSTRACT: Science communication is certainly growing as an academic field, as well as a professional specialization. This calls to mind predictions made decades ago about the ways in which the explosion of scientific knowledge was envisioned as the likely source of new difficulties in the relationship between science and society. It is largely this challenge that has inspired the creation of the field of science communication. Has science communication become its own academic subdiscipline in the process? What exactly does this entail?

What is "science communication"?

American television audiences of my generation will readily recall this famous exclamation, spontaneously uttered by awed crowds at the point at which an unknown object, at first seen only dimly on a far horizon, quickly zooms closer and comes into focus, identifiable overhead as a flying man sporting the signature tights and cape of one of our earliest fictional superheroes: "It's a bird, it's a plane, it's Superman!" This example from popular culture nicely illustrates the active human desire for precise classification that forms the foundation of language itself, and thus of all human communication. So, in response to this seemingly universal human need for clarity, how should we best think of the field of science communication? What kind of a thing is it? Is it a field of professional communication, a subdiscipline of academic study, or both? Just what does it mean to claim that the field is a subdisciplne, does science communication qualify for that description, and to what full-fledged field might it rightly belong?

Information scholars have been predicting for many decades (and accurately so) that the explosive growth in scientific knowledge would ultimately create new problems for those charged with organizing, storing, synthesizing, and communicating that knowledge. The digital age has brought new forms of distribution and archiving that, albeit with difficulty, appear capable of keeping up with the challenge in terms of sheer volume. Yet the parallel challenges of making advances in science, engineering, and medicine accessible and comprehensible outside the specific scientific disciplines that created them, and of appropriately explaining not only the benefits but also the risks associated with those developments to a wide range of non-expert publics, remain formidable. This has become especially apparent as traditional news media, themselves revolutionized by these same developments in digital communication technology, undergo major economic restructuring.

The term "science communication" refers both to a range of related fields of professional practice and to an interdisciplinary field of study. The fields of practice (from the design of museum exhibits to the practice of science journalism and the conduct of science-oriented public information, public outreach, public engagement, and public relations activities) all involve active attempts to communicate scientific subject matter to a variety of broader publics. Adding to the challenge is the recognition that dissemination alone is not enough, however. Public communication "best practices" advice generally encourages this activity to be two-way, inviting further public involvement in broad discussion of social and ethical issues involving emerging science, rather than simply entailing one-way dissemination of information and ideas. This is good advice but adds new layers of complexity to both the understanding and the practice of science communication; few sound mechanisms exist within modern democracies for actively incorporating popular thinking into governmental and regulatory decision-making, especially for

the most complex and novel policy issues presented by emerging scientific developments. Both academics and practitioners struggle to meet this added challenge.

The practical work of science communication typically takes place in informal settings outside of the ordinary school system (whose complementary efforts are more often described as "science education" rather than science communication). Science communication in this sense brings knowledge of science (and, ideally, opportunities to think about its ramifications) to citizens and consumers making decisions in today's societies, societies generally characterized by dependence on advanced scientific and technological developments for their food supplies, economies, built environments, transportation systems, medical care, and general health and welfare. (These same societies are generally beset with complex environmental problems, as well.) Science communication reaches audiences who are not "captive" within formal educational organizations, and – implementing a "two-way" approach – it also tries to help facilitate more awareness of public and consumer perspectives on the part of various experts such as policy-makers and regulators; promoters, advocates, and marketers; and even scientists themselves.

Science communication in the more academic sense of a field of social or behavioral science involves attempts to understand, influence, improve, and critique these processes, including attempts to grasp their broader social, political, and philosophical significance and dynamics, alongside their immediate impact on individuals and groups.

It is probably fair to argue that science communication emerged first as a field of professional specialization, but one with strong academic roots appropriate to its subject matter, science itself. But we have learned over the years that science communication is not just a translation problem – not, in other words, a simple matter of using familiar words and phrases to convey complex subject matter, nor even a matter of communicating a particular set of facts or ideas more accurately. Rather, it is something more subtle that invokes questions about a host of profound philosophical issues such as what is scientific truth, as well as sociological ones such as whose truth most matters in society. At the same time as we attempt to grapple with these abstract issues, science communicators have also struggled to answer more tangible practical questions about what works and why, questions most commonly addressed using the tools of empirical social and behavioral science.

Interdisciplinary versus multi-disciplinary

The field of science communication has evolved into a rather complex and somewhat unique area of study that clearly crosses disciplinary boundaries. Both multi- and interdisciplinary inquiry is common in science, and often considered cutting-edge. "Hybrid" fields ranging from biochemistry to ecology illustrate how science often draws on, even draws together, multiple disciplines. Interdisciplinary inquiry also characterizes social science (as, for example, in social psychology), humanities studies (as in the philosophy of science, for instance, or the history of technology), and professional fields such as engineering, agriculture, or medicine (as in the development of nanobiotechnology, which transcends all three of these). Clearly, science communication is a similar hybrid, drawing as it does from so many other disciplines.

Interdisciplinary projects, programs, and fields are generally defined as those that bridge, integrate, or combine work from more than one traditionally defined discipline, whereas the term "multi-disciplinary" more commonly is restricted to the description of activities that require input from different kinds of experts but in more of a collaborative, rather than an integrative, sense. So, for example, a multi-disciplinary committee composed of biomedical specialists, ethical experts, geneticists, counselors, and so on might be convened to consider a decision about implementing a risky experimental treatment for a child's rare disease. But to determine the cause of the disease could require an interdisciplinary approach, one that not only takes various forms of expertise into account but develops a research plan that integrates some of these fields more closely (for example, by considering both genetic and nutritional or other environmental factors as variables in a single study).

Some of these "hybrid" interdisciplinary fields ultimately become recognized as independent academic fields of study that might be reflected in the definitions of new academic degrees and even the creation of free-standing academic departments. Others remain as subspecialites within existing academic areas: social psychology is most commonly taught in departments of sociology or psychology, with the specific "flavor" of social psychological inquiry observably varying according to the department of affiliation. There are academic journals that specialize in social psychology, but usually not whole academic departments. The future configuration of science communication programs and majors is still uncertain;

just where science communication will end up on the academic landscape (assuming it continues to survive and thrive in the academy) remains to be determined. But most likely, the field will continue to exist as a subdiscipline rather than spawning new stand-alone departments.

While there are a few cases where independent science communication departments or major fields have been established, most remain attached to larger, broader, and better-established types of programs – in the academic world of the U.S., this commonly involves communication or journalism programs, but occasionally programs in science communication or science journalism are attached to engineering, medical, or scientific units or even to departments of English literature that may have begun by offering courses in technical writing. Environmental journalism and environmental communication are close cousins that also exist only rarely as entirely independent academic programs; they are similarly most likely to be part of communication studies programs, rather than forming units within broader departments of environmental studies.

Regardless of where it is located, science communication is *both* interdisciplinary and multi-disciplinary – and likely to remain so. A good science communication specialist – whether scholar or practitioner – has to understand something about the science from a scientific point of view (even where the goals of his or her project include critical evaluation of this view). This is something arguably best accomplished by interaction with scientists, especially if the subject matter is a form of science that is currently emerging. For this reason, science communication is inherently *multi*-disciplinary. Since science is also both political and philosophical, interaction with political scientists and philosophers (to take two examples among many others) also contributes to our understanding of science communication processes, but in a different, more integrated, way. This is the *inter*disciplinary part.

Science communication is also multi- and interdisciplinary *within communication studies.* Many scholars in science communication, and in communication studies more generally, are social scientific in their orientation, meaning that they rely most heavily on some form of systematically gathered empirical evidence, whether qualitative or quantitative, in their research; they may use experimental or survey methods, analysis of content or conversation, or observational and other ethnographic methods, among others. But other science communication scholars use primarily the tools of the humanities – rhetorical or discourse analysis of narrative features, historical and social analysis uncovering and interpreting trends or other important elements of social context – in their work. And a handful combine insights from both.

Science communication encompasses variations of all of these, united more by its subject matter than its methodology. Many of us draw our ideas about research (and our tools for conducting it) from a wide palette of potential choices. Further, communication studies programs (home base for most science communication scholars) may have one of several overarching emphases, from journalistic practice to public relations work on the professional side, and from interpersonal to mass communication research on the academic side.

As the late sociologist of science communication Dorothy Nelkin once noted (in conversation), interdisciplinarity is rarely accomplished by a single individual's mastery of more than one discipline – by someone's becoming an "interdisc," as she jokingly put it, although this certainly does happen on occasion. Rather, interdisciplinary inquiry is more commonly a sort of team sport – a matter requiring close cooperation and mutual respect among a group of people with diverse training. Yet the persistence of specific patterns of interdisciplinary inquiry is what generally spawns new disciplines and subdisciplines – from biochemistry to science communication.

Mapping the science communication territory

The future configuration of science communication programs and activities remains uncertain, but in the present the field clearly draws insights from the full spectrum of more traditional academic disciplines. This circumstance seems to come with the territory – a feature likely to remain, rather than a transient characteristic of a newly emerging area of study. And science communication draws not only from other established disciplines in so-called "natural" science, the social and behavior sciences, and the humanities, but also from other important interdisciplinary fields, in particular from "STS" (Science, Technology, and Society) studies that often seek to unite philosophical, historical, and sociological themes to grasp the ways in which science and society interact.

As science communication is inherently both multi-disciplinary and interdisciplinary, organizing the basic requisite knowledge at the core of its study is a particular challenge. Indeed, there is not a single "canon" of

literature or research that is prescribed for aspiring science communication students. In creating the *Encyclopedia of Science and Technology Communication,*[1] the work of several hundred specialists from a variety of fields working in various contexts around the world was combined. The result is a diverse collection of information from a varied group of science communication specialists, social scientists and humanities scholars, experts in environment and policy, and in some cases scientists themselves whose disciplines all contribute to understanding science communication processes and implications.

The result is comprehensive but necessarily incomplete. Each area is an invitation to whole new disciplines of study, none of which could be fully represented, even in an 1100-page compilation. If science communication is its own subdiscipline, it is a subdiscipline whose strong multi- and interdisciplinary connections encompass an ever-evolving constellation of perspectives. Perhaps this is what keeps it interesting to many of us in the field. However, it is also what makes it hard to imagine science communication becoming its own, largely independent, formal academic discipline.

As an inherently *inter*disciplinary field, science communication is likely to continue to be shaped by the contributions and interpretive insights of many allied disciplines, including not only communication studies but also research on the history of science and technology, the philosophy of science, political science as it relates to the development of science policy, the study of social movements such as environmentalism, and the sociology of the professions – both the knowledge-production professions and the communication or knowledge-dissemination professions. As participants in a *multi*-disciplinary field, both theorists and practitioners of science communication work in symbiotic partnership with colleagues in the fields of science, engineering, environmental science, and medicine that contribute the new technical knowledge that forms much of its subject matter.

Of course, science communication contributes its own new knowledge as well – both new scholarship about the relationship between knowledge and social processes and new perspectives on best professional practices. These unique interwoven contributions are at the core of what gives science communication the potential to continue its emergence as a true interdisciplinary subdiscipline and not just a set of activities or practices or a list of interesting subjects. To be recognized as an academic discipline, or even a subdiscipline, implies a certain level of scholarly depth and maturity.

This is equally true of interdisciplinary fields; as a colleague once put it, to be interdisciplinary certainly does not mean to be "without discipline." In the academic world, this level of depth is expressed by an ability to cite books and journals that cover the subject matter and to create coherent programs of study that reflect an important accumulation of scholarly knowledge. Science communication can certainly point to this kind of accumulation, as reflected in journals such as *Science Communication, Public Understanding of Science,* and the *Journal of Science Communication*, as well as the encyclopedia project cited above and a growing number of journals that deal with specific subareas such as health communication and environmental communication.

Another vital defining characteristic of an academic discipline is its utilization of a coherent theory – or a set of theories, as most established disciplines are also characterized by lively and interesting disagreements as to just which theory is most valid and useful for elucidating the subject matter at hand. While others may disagree, it seems to me as though communication studies (broadly defined) continues to provide most of the theoretical grounding used in contemporary science communication scholarship. Often, theories from other social and behavioral sciences seem to reach science communication through having first been incorporated into communication studies approaches more generally (for example, by being incorporated into political communication research or media effects theory). If this observation is accurate, it would place the field of science communication squarely in the position of being a subdiscipline of communication studies.

Of course, the assertion that science communication scholarship draws most commonly from communication studies for its theoretical inspiration is itself an empirical claim, and we might benefit from empirical research on this point. Regardless of how this research might turn out, however, being an academic discipline (or subdiscipline) *always* involves the use of theory, as this is what builds cumulative bodies of knowledge rather than mere collections of disconnected facts – and what provides any field with the scholarly "weight" to be taken seriously. Arguably, science communication has not spawned many unique theories of its own as yet, relying as it does on its use of theories from other fields (especially communication studies). The future of science communication scholarship might productively place more emphasis on theoretical development; to do otherwise would risk us being defined merely as the "outreach departments" of the institutions that produce new knowledge.

This issue is not confined to the academic end of the field. The existence of a professional subdiscipline should also rest on a recognizable and valued concentration of knowledge and skill; the skills of a surgeon are different from those of a pediatrician or an immunologist, for example. While anyone with journalistic skills can write about science, sometimes very effectively, and anyone with networking skills can organize science outreach activities, sometimes quite successfully, have we reached the point where we can reasonably claim that education and experience specifically pertinent to science communication at least make success in such endeavors more likely (and also provide useful insights as to what might constitute "success")? One hopes that this is the case, and yet a weak global economy seems to be reducing the numbers of specialist positions in our fields, especially on the professional practice side of things.

Science journalism in particular seems to be treated as an expendable luxury these days, and some of the leaders of our field are concerned this may mean that daily news about science and medicine will consist, in future, largely of reprinted press releases from universities, medical research centers, and government agencies, while environmental journalism similarly risks being reduced to advocacy on behalf of particular environmentalist (and anti-environmentalist) organizations.

If science communication is to continue to mean something more than a kind of translation function, we had better learn how to articulate a good case for it – the case that it is a prime example of a whole that is greater than the sum of its parts. This essay is an attempt to facilitate that effort by setting out some of the considerations that should, or do, define the field as an established subdiscipline (if not yet a full-fledged discipline on its own). We plan to explore the future of science journalism in more specific detail in a future issue of *Science Communication.*

Notes and references

[1] S.H. Priest ed. (2010), *Encyclopedia of Science and Technology Communication*, Sage.

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