DIGITAL NETWORK INFRASTRUCTURES, LEGITIMATION PROCESSES, AND THE COMING TRANSFORMATION OF NORMAL SCIENCE INSTITUTIONS

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The theme I proposed to address concerns “infrastructures” and the path-dependent character of normal science. This attempts to peel some of the bark off the issue of scholarship and science as a production system.

I proceed from several observations by Leigh Star and Karen Ruhleder in their paper “Steps Toward an Ecology of Infrastructure” that infrastructures are typically visible only on breakdown, that learning to use infrastructures is an important part of the socialization of new entrants to any community of work and action, that they are embedded deep into other social and technical structures, and that they are the embodiment of standards.

I am interested in the link between infrastructures and institutions, along the lines I have mentioned before: that technology is the carrier of work, that work is the carrier of culture, that culture is the carrier of institutions, and that institutions are the carrier of history. Infrastructures embedded through social mechanisms, and especially institutional mechanisms, are the abiding reservoir of path dependencies in the execution of most routine, human intellective behavior. Of course, this would include scholarship and science.

I have been particularly interested lately in two dimensions of the path-dependence of scholarly and scientific work, in light of the emerging “virtual house of Solomon.” One concerns the processes of legitimation, the other the mechanisms of dissemination of ideas into routine practice.

Legitimation Among Thought Leaders

Legitimation in this sense is a two-fold concept. Part of the concept lies in the inherent need in scholarship and science to establish among the thought-leadership of the specialized fields which ideas and lines of work are worth investment and which are not. Obviously, this begins by decisions among individual scholars and scientists as to what they will spend their time doing. But immediately upon recognition of the long-standing, and still very robust, character of patronage in scholarship and

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science, we see that very few players in the larger production system of those endeavors can survive long unless they convince opinion leaders in the patronage structure that their ideas are meritorious -- deserving of employment, tenure, research funding, fellowships, grad student support, etc. Given the intensely developed social networks of production that have long characterized the fields of scholarship and science, and the many mechanisms for maintaining such weak-tie networks (e.g., journals, conferences, sabbaticals), it is my conjecture that the new information and communication technologies will change this aspect of legitimation (among the thought-leaders, that is) mainly on the margins. That is, the existing mechanisms by which legitimation is conferred within specialized communities of scholarly and science practice will not be much altered.

What is likely to change is the cadence of the legitimation process, which will almost certainly be accelerated. This is already being seen, I think, in the effects of the various pre-print servers operating in fields with highly refined and rigorous legitimation processes such as high-energy physics. The nay-sayers complain about the problematics of letting material out before the traditional peer review process has a chance to do its work. But, in fact, the pre-print systems in physics are actually just much more decentralized variants on peer-review. As long as the "right" people examine the materials coming out in pre-print, and undertake the "normal science" processes of shakedown and replication, it is hard to see how the two systems (old vs. new peer review) are not equifinal. A key change from this new way of doing business is the cadence of legitimation, and equally important, de-legitimation. It is certainly going to be faster, end-to-end, than the old system, provided that the thought-leadership social networks adopt the pre-print mechanism as a legitimate form of discourse. This has certainly already happened in high-energy physics, and it seems likely to happen soon in biology, despite the ankle-biters who have opposed the first steps in this direction. It is also well underway in the humanities, although the mechanisms there seem to be a little different (a topic I haven't had time to research carefully as yet). The social sciences seem farther away.

The arts, of course, have been there all along. They have long realized that the fastest channel through the thought-leaders to the public at large is the best channel. Indeed, the tradition in the arts is that thought-leaders are just another kind of audience, and widespread public acceptance of a work of art that thought-leaders don’t like usually rebounds to the discredit of the thought-leaders. In contrast, thought-leaders in scholarly and scientific fields have been the key audience, and usually have the power to determine the ultimate fate (at least for the near term) of any piece of scholarship or science.

Another potentially significant change for the communities involved are the changes in positional power of the traditional leaders of the older peer-review system. Much authority has derived from the journal editor’s discretion over whom to ask to
review particular submissions, and what changes to require prior to publication. It seems likely that kind of power will wane under a pre-print model. However, that does not mean that no such power will be operating. Rather, it is probable that the power will shift to another key control node in the larger process of legitimation. I have not thought carefully enough about where the power will emerge.

**Legitimation In the Realm of Public Knowing**

I think the potential changes in legitimation from the "virtual house of Solomon" are much more significant once we leave the internal workings of specialized scholarly and scientific communities behind, and move into the realm of what I call "public knowing." This is the realm of scholarly and scientific literacy among the overwhelmingly larger population of non-scholars and non-scientists who use (knowingly or unknowingly) the products of scholarly and scientific work in their daily lives. Public knowing is very important to scholarship and science, for several reasons. The oft-touted rationales of university presidents are most obvious -- the general benefits for citizenship, economic welfare, and culture that arise from an educated population. Somewhat more to the point, the fact that the patronage structure of scholarship and science is irrevocably tied now to the commonweal means that scholars and scientists had better provide some ROI or they can kiss the patronage goodbye.

But of equal importance, and often overlooked, is the role of pre-scholars and pre-scientists in the larger production system of scholarship and science. This category clearly includes students of all ages, but it also includes non-traditional learners who, for whatever reasons, have cause to invest substantial time in knowledge discovery. A good example of the latter are disease sufferers or their domestic (e.g., family) caretakers who must, upon diagnosis, accommodate a new and strange reality in their lives that depends critically on having the right information. Another, more mundane but important example, would be day-traders and others who have suddenly taken an interest in financial markets and all they entail. Together, this class of pre-scholars and pre-scientists constitute the future feedstock of the knowledge-generating enterprize, and in many ways, they are the likeliest mechanisms for providing evidence of ROI from the enterprise.

It is no accident that the budget increases for the NIH have far outstripped the increases for the non-health sciences. This is not merely because everyone is interested in health when they or a loved one gets sick, although that helps. I think it is also because the improved mechanisms of access to health-related information for both the general public and the members of the press who write about/report on health issues have made it so much easier to bring the public at large into the discourse of the health sciences. The successful clamor of AIDS activists to accelerate clinical trials is one profound indicator of how influential a highly informed, health-related interest group can be. It is rare to see such interest groups arising from the other
fields of science and scholarship, partly because those fields lack the salience and immediacy of devastating fatal diseases. But there is some likelihood that, as the cost of access to specialized information in other fields drops, more activism around now-arcane issues will arise. This is particularly likely in the environmental sciences, where a combination of new legislation requiring disclosure of data from government-funded research, coupled with powerful technologies for dissemination of data, will make any arbitrary interest group a "partner" in ongoing environmental science work.

The controversy over environmental science, which stems at the moment from conservative politicians and their business patrons complaining that too many regulations are based on "junk science," is just one example of the ways in which legitimation becomes an important consideration in the realm of "public knowing." It is an interesting conundrum of scholarship and science that, as the importance and salience of both have grown in the emerging "information age," the quaint old images of the scholar and scientist as especially honorable or truthful have eroded.

Put simply, the more important scholarship and science become to the society at large, the more political they become. The Kansas School Board decisions against biology (the neo-Darwinian evolutionary theory) and physics (cosmology such as the Big Bang theory) is another, and possibly more gravid example. It seems probable that we are entering a period in which scholarship and science will, to paraphrase the old saying, become too important to leave to scholars and scientists. It isn't clear whether this is the kind of problem that scholars and scientists want to have, but it is clear that they will not be able to stop such a trend if it gets going.

This brings me to the subject of legitimation in the realm of public knowing. I am specifically interested in the mechanisms by which the legitimation conferred within specialized communities by thought-leaders produce (or don't) legitimation in the realm of public knowing. If, as some suggest, scholarship and science are embodied in their products (meaning, first and foremost, publications), it seems axiomatic that the legitimation mechanisms governing publication are essential to legitimation in public knowing. Indeed, this is the case, as a quick glance at academic libraries will reveal. It is said that scholarship and science begin and end in the library. It's largely true for the internal workings of scholarly and scientific communities. For many decades, and perhaps centuries, public knowing was a secondary effect of the legitimation represented by the embedded infrastructures of legitimation found in libraries. Interestingly, the professional library workers do not, or have not for a long time, provided the actual legitimation of the work contained in academic libraries. Rather, they have become experts in legitimation processes external to the libraries themselves, and they have selected those who are already-legitimated, according to their understanding of those mechanisms. Thus, bibliographers and selectors know that certain presses, journals, monograph series,
reference providers are "good" and others are "not good" when it comes to legitimated scholarly and scientific materials. In other words, they have depended on their intimate knowledge of already-established legitimation structures to construct collections that are, by extension, legitimate.

As argued above, it seems likely that the mechanisms of legitimation internal to scholarly and scientific communities will not change greatly in the coming few years. But most of the actual dissemination of scholarly and scientific work takes place through intermediaries outside those communities. To the extent that the communities control the legitimation processes at all, it is through tenuous relationships of an advisory nature in the dissemination process -- as editors and reviewers who are, in a very real sense, employed by the publishers.

The virtual house of Solomon presents an interesting challenge to this model of control over legitimation. By opening in a dramatic way the number and variety of channels of dissemination, it can simply swamp the traditional channels, thereby eroding their enforcement of their claim to legitimating authority. In effect, anyone with a web server can be a publisher. When the number of scholarly (i.e., refereed, in the current parlance) publications jumps from the current level of about 14,000 to, say, 100,000, it is likely that the very concept of scholarly publication will take on new meaning. Among the first casualties of this will be the accepted definition of what really constitutes a scholarly or scientific publication. In the past, the barriers to entry in publication of limited-readership publications was simply so high that few non-traditional channels could be opened. As those barriers fall, it seems unlikely that the traditional gatekeepers of legitimation will be able to control the processes of legitimation in the realm of public knowing simply by ex-cathedra declaration of some outlets as "OK" and the condemnation of others as "not-OK." In the emerging political realm of scholarship and science, the rantings of traditional legitimators who find themselves being displaced appears to be just a different source of "opinion."

Under this new model, who are the gatekeepers of legitimation in the realm of public knowing? We can already rule out the traditional thought-leaders internal to fields of scholarship and science. While their opinions will carry weight, they cannot carry the weight they once carried. Who makes up the residual? Academic librarians seem a most unlikely source of help, given that whatever authority they once held to make legitimating decisions has evaporated long since. In spite of the fact that many of our best bibliographers and selectors are genuine subject-matter specialists in the fields they handle, they would not know where to begin in playing such a role. Moreover, they are not institutionally empowered to play that role. One possible source of legitimation is the press -- a frightening thought to many scholars and scientists, just as a similar thought was once frightening to public officials and heads of large companies. Yet, among all the institutionalized actors in the emerging virtual house of Solomon, the press seem the most likely beneficiaries of
power to legitimate or de-legitimate scholarship and science in the coming years.

Perhaps most interesting is the notion that we are beginning a kind of reformation that is similar in startling respects to that seen in Europe during the sixteenth and fifteenth centuries. In that reformation, a combination of the flowering of knowledge, the increasing internationalization of viewpoints and trade, and the rise of a vital information technology (printing, and by extension, reading) produced a sea change in human self-conception and endeavor. The most striking change might have been the re-centering of the human condition from Human-vis-God to Human-vis-Nature and Human-vis-Human. The essential elements of that change was the erosion of a long-standing hierarchy in which a very small number of secular and spiritual authorities had the power to legitimate the most fundamental dimensions of human intellective activity, including what could be thought and what could not. The resulting liberation of diversity in public knowing, including not only substantive knowledge but in methods of knowing, produced profound changes in human welfare.

It is easy to drift into hyperbole about the import of the information age; many have argued that this era surpasses in importance all historical epochs. That kind of rhetoric always makes me cautious, simply because it is a natural tendency of people to think that the most important period of history will certainly be the time when they are alive. Nevertheless, one has to wonder what the effects might be if the current set of changes produces a realignment of legitimation in public knowing similar to that seen between 1500 and 1700. The notion is likely to be somewhat disarming to scholars and scientists, who like to think of themselves as the products of that great liberation, and the heirs to intellectual freedom. It suggests that leading scholars and scientists now sit in the same positions of legitimation, for better or worse, as those who once condemned Galileo and directed the Inquisition. Of course, today's mechanisms of legitimation are kindlier and gentler, so the comparison is not entirely effective. Nevertheless, I am still searching for a priori reasons to assume that a massive dis-empowerment of the traditional structures of scholarly and scientific legitimation in the realm of public knowing will be negative in its consequences.