THE NEW KNOWLEDGE ECONOMY AND SCIENCE AND TECHNOLOGY POLICY

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Contents

Summary

The new knowledge economy has significant implications for the practice of scientific and technological development. There is the possibility in theory of producing a democratic global scientific community, with open access to technoscientific knowledge and practices—from the production of very large shared databases, to the use of Internet tools by a distributed scientific community. There are also some very real difficulties with effecting this vision. Some of these difficulties are technical, some are social and political.

1. Introduction

For the past few hundred years, many books and articles have begun with a phrase such as: ‘We are entering a period of rapid change unimagined by our ancestors’. The statement is both as true and as false now as it has been over the previous two centuries. It is true because we are as a society adjusting to a whole new communication medium (the Internet) and new ways of storing, manipulating and presenting information. We are, as Manuel Castells and others remind us, now in many ways an information economy, with many people tied to computers one way or another during our working day and in our leisure hours. It is false because we are faced with the same old problems—getting food, shelter and water to our human population; living in some kind of equilibrium with nature—as ever we were. How is the new knowledge economy impacting and potentially can impact science and technology policy concerned with sustainable life?

2. The New Technoscientific Information Infrastructure

2.1 What is Infrastructure?

Central to the new knowledge economy has been the development of a new information infrastructure. When we think of infrastructure in a common-sense way, we picture that which runs 'underneath' actual structures – railroad tracks, city plumbing and sewage, electricity, roads and highways, cable wires that connect to the broadcast grid and bring pictures to our TVs. It is that upon which something else rides, or works, a platform of sorts. This commonsense definition begins to unravel when we populate the picture, and begin to look at multiple, overlapping, and perhaps contradictory infrastructural arrangements. For the railroad engineer, the rails are only infrastructure when she is a passenger. Almost anyone can flip an electric switch, for a variety of purposes. When the switch fails, we are forced to look more deeply into the cause – first check the light bulb, then the other appliances on the same circuit, then look at the circuit breaker box, then look down the block to see if it is a power outage in the neighborhood or city, and finally, depending on one's home repair skills, consider calling an electrician. Finally, increasingly many of us are faced with infrastructures designed by one group, that may not work for us. For instance, someone in a wheelchair appreciates the tiny (and not so tiny) barriers that are considered 'wheelchair accessible' by the able-bodied. Four steps can be a mountain if the specific conditions of usability are overlooked.

Infrastructure is not absolute, but relative to working conditions. It never stands apart from the people who design, maintain and use it. Its designers try to make it as invisible as possible, while leaving 'pointers' to make it visible when it needs to be repaired or remapped. It is tricky to study for this reason.

We can begin with Star and Ruhleder's definition of the salient features of infrastructure in order to bound and clarify the term:

- *Embeddedness*. Infrastructure is sunk into, inside of, other structures, social arrangements and technologies;
- *Transparency*. Infrastructure is transparent to use, in the sense that it does not have to be reinvented each time or assembled for each task, but invisibly supports those tasks;
- *Reach or scope*. This may be either spatial or temporal – infrastructure has reach beyond a single event or one-site practice;
- *Learned as part of membership*. The taken-for-grantedness of artifacts and organizational arrangements is a *sine qua non* of membership in a community of practice. Strangers and outsiders encounter infrastructure as a target object to be learned about. New participants acquire a naturalized familiarity with its objects as they become members;
- *Links with conventions of practice*. Infrastructure both shapes and is shaped by the conventions of a community of practice, e.g. the ways that cycles of day-night work are affected by and affect electrical power rates and needs. Generations of typists have learned the QWERTY keyboard; its limitations are inherited by the computer keyboard and thence by the design of today's computer furniture.

- *Embodiment of standards*. Modified by scope and often by conflicting conventions, infrastructure takes on transparency by plugging into other infrastructures and tools in a standardized fashion.
- *Built on an installed base*. Infrastructure does not grow *de novo*; it wrestles with the inertia of the installed base and inherits strengths and limitations from that base. Optical fibers run along old railroad lines; new systems are designed for backward-compatibility; and failing to account for these constraints may be fatal or distorting to new development processes.
- *Becomes visible upon breakdown.* The normally invisible quality of working infrastructure becomes visible when it breaks: the server is down, the bridge washes out, there is a power blackout. Even when there are back-up mechanisms or procedures, their existence further highlights the now-visible infrastructure.

Something that was once an object of development and design becomes sunk into infrastructure over time. Therefore an historical, even archeological approach to the development of infrastructure needs to complement sociological, regulatory and technical studies.

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Biographical Sketch

Geoffrey C. Bowker is Professor in the Department of Communication, University of California, San Diego. His PhD is in History and Philosophy of Science at Melbourne University. He studies social and organizational aspects of the development of very large scale information infrastructures in scientific and technological work. His first book (*Science on the Run*, Cambridge, MA: MIT Press) discussed the development of information practices in the oil industry. He has written with Susan Leigh Star a book on the history and sociology of medical classifications (*Sorting Things Out: Classification and Practice* – published by MIT Press in September 1999) and has co-edited a volume on Computer Support Cooperative Work (*Social Science, Technical Systems and Cooperative Work: Beyond the Great Divide,* LEA Press, 1997). He is currently working on a project to analyze the mobility of knowledge in distributed scientific collaborations using high end collaborative software. He is also writing a book about archival practices in the sciences over the past 200 years. His main interest in these areas is the development of biodiversity science as a massively distributed scientific endeavor (covering many scientific disciplines and being carried out all over the world) which has implications for major government policy questions (how to save the environment?) and local political struggles (how to represent knowledge about flora and fauna in such a way that it respects local ways of thinking and is usable by local communities?). More information can be found at his website: http://weber.ucsd.edu/~gbowker.