Reconfiguring Access to Information and Expertise in the Social Sciences: The Social Shaping and Implications of Cyberinfrastructure*

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Abstract. e-Social Science will transform not only how social researchers do their work, but also what they will discover, with whom they will collaborate, how they will share work, how they will report their findings, and what know-how they will require. Emerging technologies, such as the Grid and advanced Internet and Web developments, will reshape not only how researchers do what they do, but also the outcomes of their work as a consequence of 'reconfigured access' to networks of information and expertise at local and global scales. This paper will develop the concept of how communication and information technologies like the Grid can reconfigure access, and how this shapes the strategic choices of users and developers. In focusing on the centrality of these digital choices about the use or non-use of e-Social Science tools and datasets, the paper will then discuss the many constraints on the choices of different actors.

Discussion of the e-social sciences is dominated by a focus on the technical development of e-research tools tied to the Grid and advanced applications of the Internet. Less attention is directed at its potential to transform the social sciences. There is a more or less explicit assumption underpinning the promotion of e-social science that it will enable social scientists to do what they do faster, and better. However, this productivity focus might understate the transformative potential of information and communication technologies (ICTs) in the social sciences.

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Introduction

Choices about the design, use, and governance of e-social science — what I have called 'digital choices' — can change the communicative power of individual researchers, research groups, and academic institutions as they 'reconfigure access' — physical and electronic — to information, people, services, and technology in the social sciences. This process of 'reconfiguring access'[1] is entwined with the co-evolution of a diverse range of institutional and organizational structures with the layers of network services, platforms, and digital applications based on the ensemble of technologies encompassed by the Internet, Grid and related technologies of e-research.

The "digital choices" made by researchers, developers, companies and universities involved in these separate but interrelated social processes can result in many different outcomes for the same technology. These choices are bound up with a wide range of personal, disciplinary, economic, business, organizational, political, legal, and other dynamics shaping — and being shaped by — these innovations in the technologies underpinning academic research. An understanding of the relationship between networked technologies and social science research needs to be based not just on projections derived from the technical capabilities but on an appreciation of who has the skills, equipment, know-how, and motivation essential to design, produce, use, consume, and govern the relevant technologies (Dutton 2005).

The 'Net Effect' of e-Research: Why a New Perspective Is Needed

A growing number of social scientists have attempted to guage the impact of the Grid and advanced Internet technologies on social research (Procter et al 2006; Schroeder and Fry 2007). The thrust of most arguments are that, on balance, the these technical innovations contribute to the potential for researchers, centres, and institutions to be better connected as they are better able to share equipment, data and expertise in the research process. At the same time, it is evident that there is support for a diversity of "impacts," in the sense that the same technologies could isolate researchers not online. However, the search for the "net effect" of e-social science needs to look in the right place. Generally, the "impact" perspective that has dominated social research on technology and society from its emergence in studies of computers in the 1950s has been too long term, fragmented, narrowly focused, and technologically deterministic to be able to provide sound direction to understanding the full scope and diversity of the role of ICTs in transforming social research.

For instance, the emphasis in the dominant social-impact perspective on long-term impacts, such as on the advance of science, fails to take account of the more immediate role of ICTs in reconfiguring access to people, services, and technologies as well as information — with profound implications on whom we collaborate with,

[1] The concept of reconfiguring access originated in my synthesis of research within the Programme on Information and Communication Technologies (PICT) in the 1990s -- first discussing this idea as "shaping tele-access" (Dutton 1999). I have since moved to the concept of 'reconfiguring access' to avoid associations with any particular technology (Dutton et al. 2003; Dutton 2005).

from whom we obtain search and other services, what know-how we require, and what we can observe. Taking a long-term perspective can provide valuable insights, but it is only by looking closely at the more immediate role of ICTs in reshaping access that we will be able to grasp a fuller understanding of how individuals, research teams, and organizations can use e-Research in strategic ways to shape their communicative power.

Unfortunately, conventional analytical perspectives frame 'access' as a simple matter of adoption and view adoption as an independent variable shaping the use and impacts of a technology. The alternative perspective — reconfiguring access — does not see a technology like the Internet or Grid creating automatic impacts. Instead, it regards access as an unpredictable outcome of the choices made by individual researchers and institutions about the design and use (or non-use) of e-research. It also recognizes that the making of such digital choices changes the relative communicative power of different actors involved in a multiplicity of games. The interplay of actors in these games determines the ultimate social, economic, educational, and other outcomes tied to ICTs.

Reconfiguring Access in the Social Sciences: The Role of e-Research

The technical choices made in the design, implementation and use of e-research tools can reconfigure access to critical resources. The actual implications are unpredictable, given that they are shaped by the interaction of choices made by multiple actors, each influenced by a variety of social, disciplinary, institutional, economic, technological, and other related factors. There is evidence, even from traditional impact studies, to support the view that social processes shape outcomes of technology-based innovation in ways leading to different outcomes in different contexts (Dutton 1996, 1999).

The reconfiguring access perspective challenges the cliché that "information is power," which ignores the degree to which social and economic capital enable access to the expertise, knowledge, and data that is the basis of creating knowledge. The key is not information *per se* but the ability to control access to information. Access is also shaped not only by technologies but also by institutional arrangements, disciplinary codes, public policy, geographical proximity (such as in gaining tacit knowledge from direct observation), and other social factors, discussed in this paper.

The role of ICTs in shaping access to information, whether in society as a whole, or in a research community, might be called "information politics" (Danziger et al. 1982: 133–135; Garnham 1999). However, information is only one element in what can be viewed as a far more general politics of access. In social science research, for example, social and technical choices about the Internet and Grid can reconfigure electronic and physical access to four distinguishable but interrelated resources (Dutton 1999, 2005):

people (disciplinary, institutional, and global patterns of collaboration);

services (including the ability to render obsolete or create a new business or industry in supporting research),

technologies (including equipment, know-how, and techniques); and

information (shaping what data can be collected; making some researchers information rich and others comparatively poor).

There are many ways in which e-Research can reduce, screen, reinforce, or alter access, such as shaping information content and flow by accident or design. ICTs also change patterns of interaction between people, information, communities, and organizations, and likewise, the interactions between researchers, research organizations, disciplines and institutions.

How Digital Choices Reconfigure Access

The design, development, implementation, and use of ICTs can reconfigure access by: changing cost structures; expanding or contracting the proximity of access; restructuring the architecture of networks; creating or eliminating gatekeepers; redistributing advantages between senders and receivers; or enabling more or less user control (Dutton 1999; 2005).

Changing Cost Structures

ICT innovations such as the Internet, Web and e-mail have clearly contributed substantially to lowering the costs of accessing and distributing information and services. For instance, the costs of transporting and delivering purely digital services and products, such as an online journal, have been reduced to the often negligible cost of an Internet link that is already covered by an always-on broadband link. However, the costs of producing and promoting digital content, such as a major research report, or a large information database, can remain very high. This has meant that the free downloading of content, such as academic articles, or other professionally produced creative content, has posed a serious challenge to the cost structures in academic publishers, but also researchers, their institutions, their universities and research councils – such as in supporting the development of institutional repositories. The huge costs of providing search services borne by major Internet companies, such as Google, enables researchers to freely search, but keeps universities out of the picture in providing competing search services. Innovations can disrupt established cost structures, for instance as the development of an information utility envisioned for the Grid could do for the cost structures of computational tools.

Expanding or Contracting the Proximity of Access

Distance, time, and control were dimensions of access identified in the 1950s by one of the earliest “technology and society” scholars, Harold Innis (1972 [1950]). They remain relevant to contemporary discussions of the social and economic role of ICTs in all arenas. Changes in the ease, speed, and costs of gaining access to people, services, information, and technologies wherever they are located can have dramatic implications for research processes and for the structure, size, location, and competitiveness of research activities not only in academia but throughout every

sector. This is ever more apparent with the Internet and Grid, which enable researchers to keep in regular, informal touch with people in distant locations and delivers files from around the world to desktops as if they were stored on the researchers own PC.

Restructuring the Architecture of Networks

The architecture of a technical network often reflects the social and institutional forces shaping it. Vertical communication structures, such as those used by mass media, including publishers, allow a small group to broadcast to millions, following a more centralized distribution of communicative power. One of the most basic features of the Internet is its ease in supporting one-to-one, one-to-many, many-to-one, and many-to-many horizontal networks of communication. The idea that the Internet and emerging ICTs can support more distributed patterns of communication underpins much of the recent push for open access to science.

Creating or Eliminating Gatekeepers

Technological change can also alter the role of gatekeepers in the dissemination of information. In situations where there is a scarcity of media sources and outlets, “gatekeepers” such as producers, editors, and publishers play a critical role in deciding who gets in print, and what is regarded as science. But such gatekeepers can now be bypassed through desktop publishing operations and the use of the Internet and Web for one-to-many communications, such as through journals paid for by the publisher, project Web sites, and blogs feed by one or more academics.

Gatekeepers are relevant in communication as well as in publishing. Even in academia, the secretary was once the prime gatekeeper who screened and prioritized calls for an academic, but this role is becoming less common as e-mail is used increasingly. Social scientists are increasingly in direct contact with students (not the director of admissions), the press (not the press office) and their colleagues without the help of intermediaries.

Redistributing Power between Senders and Receivers

With electromechanical switching technology, telephone calls became anonymous. This shifted power to the person calling, since the called party would not know who is calling, and, therefore, be more inclined to answer a call in case it was important. With answering machines and call line identification, information about the identity of the caller has become increasingly available to the receiver. This shifted the advantage to the receiver, relative to that in circumstances of anonymity.

Although the Internet was created by a culture promoting openness and freedom of expression, it can take away the anonymity that made automatic telephone switching so attractive. For example, e-mail was originally designed in the 1960s to identify the person sending a message, as its agreed protocol standard required the header of every message to identify the person sending it, the recipient, the date sent, and the subject. This can be used by recipients to help prioritize and screen messages in order to better manage their communications but also creates a documented trail that can be followed to strip away anonymity.

New technologies such as the Access Grid can enhance the communicative power of senders and receivers, but also change the pool of individuals that are accessible to a researcher. They can shift more communicative power to the centres and research groups with the technology in place.

User Controls

The proliferation of global communications channels opened by the Internet and other ICTs has added an important new dimension to traditional concerns about who controls (or frees) the content and access to communications and information. The banning or restriction of traditional printed information or terrestrial broadcast channels could be implemented relatively easily by national governments. Censorship is less critical in academia, given relatively more general acceptance of academic norms on freedom of inquiry. It is arguable that new ICTs have enabled academics to have even greater unfettered access to sources.

However, concerns have been expressed by social scientists and other academics who feel they have lost control over student and public access to 'social science'. This feeling of loss of control over content – eliminating the social scientist as gatekeeper - has been heightened by the explosive growth of e-mail, Web sites and blogging, where social scientists need to compete with a world of information providers for access to readers.

All this again demonstrates that reconfiguring access involves many interacting and evolving dimensions and actors.

Social Factors Shaping Digital Choices

As shown in the above discussion, choices concerning ICTs, and their social implications, are not random or unstructured. For example, the distribution of information "haves" and "have-nots" and other patterns of access are enabled and constrained by the social and economic contexts within which social scientists and other relevant actors at all levels make choices with immediate and long-range cumulative consequences on reconfiguring access to people, services, information, and technologies. The main factors facilitating and constraining these digital choices can be categorized along six dimensions summarized and discussed in the following subsections.

Economic Resources and Constraints: Social Science Digital Divides

The size, wealth, and vitality of nations, companies, universities and other actors place major constraints on the development and use of ICTs in all arenas of the social sciences. The e-research tools open to a prestigious American university department could dwarf those available in the a distressed area of the global South. Major initiatives in the US, China, Japan and the UK and Europe seek to place particular nations and regions in advantageous positions in the global research community.

ICT Paradigms and Practices

ICT concepts and practices can become the foundation of powerful belief systems or "paradigms" that create a way of interpreting reality that is very different from that perceived by people whose thinking is embedded in another paradigm (Dutton 1996). For instance, visions generated by the notion of an information society, such as "virtual organizations," have been important shapers of social, political, and technological choices irrespective of their descriptive validity (Bloomfield et al. 1997). The very idea that we work in a virtual organization or live in an information society can influence public policy and the behaviour of individuals, for instance, in the development of "virtual universities" using the Internet and other ICTs to reconfigure how, when, and where faculty teach, students learn, administrators manage, librarians work and interact with users, and so on. In the UK, prominent developments in the development of Virtual Research Environments (VREs) were enabled by experiences with using Virtual Learning Environments (VLEs).
At the same time, experience and knowledge about ICTs can influence or even create a paradigm change, for instance, in the overall shift of work from manufacturing to services industry that has occurred in the "information age" (Freeman 1996; Bell 1999 [1973]). The growth of e-business and e-commerce in online shopping, banking, news media, and numerous other activities has been enabled by the Internet and Web and is having transformational effects within and between many sectors. Technologies therefore do make a difference, even if they do not determine social outcomes. For instance, ICTs can bias social choices by making some avenues more economically, culturally, or socially rational than others.

The ways in which ideas like the information society shape views about how the world works and, thereby, influence the decisions of individuals, firms, and governments is a major reason why alternative perspectives on the role of the Internet in society, such as the reconfiguring of access, are more than competing theories. They are also ideas that can shape decisions in everyday life, and in once-in-a-lifetime choices.

For instance, the underlying philosophy that shaped the emergence of the Internet from the 1970s—open access to information, communication, and collaboration between people—reflected the noncommercial and academic culture that infused the perceptions and motivations of those most influential in determining Internet capabilities (Reid 2000; Castells 2001). This culture also gave rise to the key trigger to the popularization of the Internet: the World Wide Web and its simple "click" user interaction. This was developed at the European Laboratory for Particle Physics (CERN) as a means of giving researchers quick and easy access to an online "hypertext library" (Reid 2000).

It was only in the 1990s that a strong push towards the e-commerce and e-business value of the Internet emerged. However, the culture shaping Internet technology had already created and embedded capabilities in Internet standards and infrastructure that were based on notions of trust and sharing. This proved to be at odds with many commercial and business interactions, where more priority is given to confidentiality, security, profitable pricing, protection of intellectual property rights (IPR), and other factors. The more recent focus in Internet developments has therefore been more

oriented to business needs, for instance, in the establishment of greater online trust (Guerra et al. 2003) and security firewalls.

Conceptions and Responses of Users

The conceptions and responses of a wide variety of users, workers, consumers, managers, citizens, audiences, etc. also play an active role in shaping the implications of ICTs, often in ways very different from those expected by simply extrapolating from the perceived potential of the technology. Misconceptions of the user can therefore undermine the diffusion of ICTs (Woolgar 1996). Many innovative technological and market failures can be understood as a consequence of having a weak conception of the user, for example, in the notions of a "paperless" office that failed to take account of the many attractive features of paper for users.

The reconfiguring access approach also underlines how users' roles are not confined to being passive recipients of whatever is designed for them. Much motivation for the development of the Internet, personal computers, WiFi, and other technologies came from users with the skills and motivation to design and build their own systems—PCs were first known as "home brew" computers. There are parallels in e-social science, where the use of some technologies has been frustrated by a lack of 'usability', while other so-called Web 2.0 applications have gained prominence. The apparent success of 'MyExperiment'[2] in the UK is one example.

Geography of Space and Place

One of the most prominent attributes of ICTs is the relative ease with which the new electronic media can overcome constraints of time and distance. This has been a key reason why e-mail has proved to be such a popular communication medium, even for only the occasional Internet user. But although the Internet can be accessed at any time from numerous locations anywhere in the world, there is evidence that ICTs might actually make geography matter more. Rather than undermining the importance of space and place, as argued by some, there is evidence that ICTs bring new significance to locations, for example, by enabling researchers to be where they need to be for face to face communication.

Will e-research reconfigure what kinds of research are done where? For example, with Web-based survey tools, the location of researchers is no longer as relevant as before to the location of those they wish to survey.

Institutional Arrangements and Public Policy

Choices about access are constrained by a variety of institutional arrangements and public policies because technical, social, policy, and organizational innovation are interdependent (Freeman 1996). For instance, the design of an organization influences how the Internet is used within it, but the Internet also creates many new options for radically redesigning organizations and interactions between them, such as a "virtual organization" composed of separate private firms or public agencies employing ICTs to enable them to act as if they were part of the same real unit. Digital choices in universities are affected by institutional arrangements and policies in areas such as branding, intellectual property, copyright, and liability. Nevertheless, public policy at

[2] See: http://myexperiment.org/

local, national, and international levels can be responsive to technological change, as demonstrated in a variety of policy initiatives aimed at supporting advanced information infrastructures, including information superhighway in the 1990s and the expansion of broadband availability in the early 2000s, and e-Science and cyberinfrastructures in the current environment.

Strategies of Others: The Ecology of Games

The struggle for communicative power to control and influence the design and use of the Internet and other ICTs generally takes place in a variety of different arenas at the same time. All actors are not involved in the same struggle: Individuals and groups pursue different goals within their own domains in an "ecology of games" (Dutton 1999: 14–16).

A game is an arena of competition and cooperation structured by a set of rules and assumptions about how to act to achieve a particular set of objectives. An ecology of games is a larger system of action composed of two or more separate but interdependent games (Dutton 1992). Within each "game," players follow an established set of traditions, rules, and disciplines. All players have a role in shaping outcomes, playing different roles in different games, and often acting in many games at the same time. For instance, a specialist might pursue a technically elegant network design, while a top manager primarily seeks cost reductions. This places major constraints on the predictability of outcomes based on assessments of strategic aims, unless the varied goals of different actors in the wider ecology of games is well understood and orchestrated.

The complexity and significance of the ecology of games can be illustrated by looking at some of those related to the provision and use of the e-social sciences (Dutton et al. 2003). The many players and interests with a stake in these games include computer scientists engaged in software design and development, social science users across a range of disciplines, social scientists opposed to investment in e-social science initiatives, research units with grants to develop e-social science infrastructures, businesses developing e-research tools, companies or agencies with major information resources (from Google maps to national censuses), academics with entrepreneurial visions for creating a new business around their innovations, research service organizations at the respective universities, and more. The behavior and decisions of all actors affect those of other actors. The outcomes unfold as the products of countless strategic and everyday decisions made by a myriad of players in many different games in different arenas.

Understanding the Intrinsic Social Nature of the Internet

This paper has focused on shifting attention from the techniques of e-social science to the outcomes. It has done so by discussing how the Internet and other ICTs could reconfigure access to people, services, information, and technology in the social sciences through an ecology of games between multiple players. The reconfiguration of access viewpoint contrasts with the traditional perspectives on the social and economic implications of extensive ICT use, which depicted access to ICTs as leading to uses that result in impacts determined largely by the technology. The central issue

highlighted by the reconfiguration view is the design and use (or nonuse) of ICTs to reconfigure access strategically—opening up or closing off networks—will change the nature of social science and its outcomes. This should be the focus of debate about the e-social sciences.

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