The Social Shaping of Digital Research*

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Abstract

The social shaping of technology has become a broad umbrella term to cover a variety of theoretical and methodological perspectives in the social sciences. It has also defined a set of funded projects in the UK focused on a particular technical initiative around e-social science – digital social research. This paper seeks to clarify how the social sciences, generally, and the social shaping of technology, more specifically, can be applied to the study of digital research. This overview is designed to illuminate the diversity of perspectives that can be brought under the social shaping umbrella, and explain why this set of perspectives is important to policy and practice in this field. Continuing advances in digital research make it ever more important to bring the social sciences to bear on the trajectories of its applications and its implications for the quality of research across the disciplines.

Introduction

There is no simple answer to the questions: What is the social shaping of technology (SST)? How can study of SST be of value to digital research? This paper describes the emergence of research on the social shaping of digital research and then moves to an explanation of the complexity of any answers before providing a overview of two key topics. The first is how the social sciences support digital research across all disciplines, including the social sciences, such as by providing a social context to the interpretation of data. The second is a brief summary of the many different social science perspectives on SST and digital social research. This overview shows that while there are many approaches to the social study of digital research, this is not a problem, but one symptom of a rising number of social scientists and theoretical approaches being brought to bear on this phenomenon.

Genesis of a Strand of Social Research

The invention of the Internet (ARPANet at the time) was motivated in large part by efforts of researchers to share computing resources. Likewise, Tim Berners-Lee and his colleagues at CERN developed the Web as a means to share documents of relevance to their collaborative research. In turn, in the first decade of the twenty-first century, more recent technological innovations in Grid and Cloud computing, for example, have fostered visions of a new generation of information technologies tied to step jumps in the networking and computational capacity available to researchers.

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These visions have led to a wide range of initiatives aimed at using advanced technologies for applications in support of research through collaboratories, e-Science, e-Social Science, computational social science, e-Humanities, e-Research, and 'digital scholarship' – some of the many labels assigned to this new wave of initiatives around digital research (Nentwich 2003; Borgman 2007; Dutton and Jeffreys 2010).

Since 2005, following initiatives focused on e-Science, a group of academics have sought to study the 'social shaping' of digital research. Social shaping work emerged as one strand of research when the UK's Economic and Social Research Council (ESRC) established the National Centre for e-Social Science (NCeSS) at the University of Manchester in 2004. This centre was the major focus of the first phase of research on e-social science. Most projects that were funded within this program focused on building applications – tools for conducting digital social research, which originally pivoted around proposals for creating 'grid-enabled' data sets or applications to handle the integration, management, or analysis of very large data sets – what is increasingly popularized as 'big data'.

An exception was a project led by myself along with several colleagues at the University of Oxford that proposed to study the social shaping of e-science (not just e-social science), rather than to design and build tools for doing social science. There had been several pilot projects within a social shaping framework, but our project, entitled 'Oxford e-Social Science' (OeSS), was the only social shaping 'node' among 11 nodes, which were linked to NCeSS.[1] In 2009, the ESRC revised its strategy for fostering e-social science and replaced the NCeSS with a National Strategic Directorate for e-Social Science[2], which developed a 'digital social research strategy to develop an '… inter-agency approach to maximize the uptake, use and impact of new digital technologies across the social science community.'[3] Through this shift, the OeSS project remained the only social shaping node in the mix of funded nodes reporting to the Directorate.

Explaining the Social Shaping of Digital Research

Since its inception, computer science colleagues have had difficulties in understanding just what exactly OeSS did. What do we mean by the social shaping of technology? What value is this study to the advancement of digital social research? The most obvious example of this was during a review of UK e-Sciences, when our social shaping of technology node was given the last slot in a review of projects, which had run over time. The chair of the review admitted that he did not understand what was entailed in the social shaping of e-Science.

It should be easy to explain since conceptions of the social shaping of technology (SST) have been prominent for decades. Donald MacKensie and Judy Wajcman (1985) developed this concept in the introduction to their widely used reader, entitled *The Social Shaping of Technology*. Since then, many scholars have sought to clarify and apply this concept to the study of any number of information and communication technologies (e.g., see Williams and Edge 1996).

However, it is difficult to convey this approach, and for several reasons. First, non-social scientists expect a simple answer. The question is most often asked by computer scientists and engineers, who might imagine that the SST is a single, unified perspective on how people, mainly users in the case of ICTs, influence the success or failure of technologies, such as by not using systems in the way they were designed to be used. From this perspective, if social scientists could provide better insights about users, systems could be designed and used more effectively. However, social scientists would not limit any definition of the SST to 'users' as if they were the one set of actors among many that shape technical change. They would reject any characterization of taking account of 'people' or 'users' as overly simplistic. For example, conventional social science definitions of technology include people, and their practices, and are not limited to technical artifacts.

Secondly, there is not a simple answer across the social sciences. When asked for their own characterizations, social scientists have a difficult time conveying a unified perspective. And any such answers are inevitably at too general of a level to provide meaningful ways forward, such as applying perspectives of the social sciences to technology. This is because the SST is not a unified perspective but a broad umbrella that covers a number of alternative perspectives on the ways in which people – users, developers, policy-makers, managers, and more – shape technology, which itself is a social as well as a technical system. Moreover, social scientists disagree – even the members of our social shaping node – over how to conceptualize and study the social shaping of digital research and even over the value of this broad perspective.

This lack of a unified perspective is in part because the SST perspective was primarily a reaction against two prevailing determinisms (Williams and Edge 1996):

1. A technological determinism that posits a rational logic of technical development towards the one best way to do things, and with the implications of this development flowing logically from features of the technology; and
2. A social determinism that posits technical change following a specific economic or other social rationality, where technology does not matter *per se* since it is driven by and follows a social process.

Most students of the SST view both determinisms as overly simplistic and misleading, but they are not unified around a single framework or conceptual framework for describing the more complex ways in which a multitude of factors shape the development, implementation, use and impacts of technical change.

Therefore, it might be more helpful to explain how social scientists differ over the social shaping of digital research than to continue to search for a simple, common denominator, that would pin down exactly what social shaping means in the context of digital research, and why it is useful. The next section of this paper provides an overview of several ways in which the social sciences can be brought to bear on digital research, including study of the social shaping of digital research. I will then develop a number of different perspectives on SST that can be and have been applied to digital research, and in the process, hopefully convey the diversity and promise of perspectives on digital research within the social sciences.

How the Social Sciences Support Digital Research

SST is a set of perspectives on the factors shaping technology and its implications. But there are other ways in which the social sciences are valuable to digital (social) research that are useful to introduce before going into more depth about the SST. These include the role the social sciences can play in challenging conventional wisdom, avoiding methodological pitfalls, contextualizing data, and understanding the social, ethical and legal issues raised by digital social research.

Challenging Taken-for-Granted Assumptions about Digital Research

Discussions of technological innovation, generally, and digital research, in particular are replete with assumptions about the progress tied to technical advances. Cyber-research is expected to increase the creativity and productivity of researchers in numerous ways. Optimism about the implications of digital research is what drove many national investments in e-Science and cyber-infrastructures (Atkins 2005). However, social research has had a role in challenging some of the expectations, such as by describing the slow pace of change, and the failure of many early investments to bear fruit (Nentwich 2003). Many social scientists see their role as one of questioning conventional wisdom, what Steve Woolgar (1999) has called a stance of 'analytic skepticism'. This can and has played a positive role, just as opening the computer sciences and engineering up to more involvement of social scientists since they see many disappointments tied to failures to understand the behavior of users and other actors critical to the success of technological innovations.

Understanding Methodological Opportunities and Limitations

Digital research has generated great enthusiasm in part due to its novelty, such as around 'big data', but also given the potential for economically mining existing data sets in more illuminating ways. Nevertheless, big data and other digital data resources, particularly around social behaviors, are subject to the same issues of sampling bias, reliability, and validity, as other social indicators. Large data sets do not escape problems of sampling, which need to be recognized as limitations of many big data sets. In 1936, the *Literary Digest* (31 October 1936), having tallied post card returns from over 2 million Americans, predicted that Alfred Landon would win the presidential election against Franklin Delano Roosevelt,[4] failing to take into account the bias of those responding to a poll, and not recognizing the bias of polling their own readers, who had a higher socioeconomic status than a random sample of voters, and more likely to vote Republican. Notwithstanding such famous mistakes, people continue to equate large numbers with accuracy, not understanding basic principles of sampling theory, and the biases that can be introduced by data that is skewed towards over-representing certain types of individuals, whether readers of the *Literary Digest* or Internet users who tweet.

Other basic aspects of social research methods need to inform digital social research, such as concerns over the reliability and validity of any given indicator. For example, is the indicator measuring what the investigator believes it is measuring? For example, do Web links represent any particular social attribution? This is the basic question of validity. Approaches to assessing the reliability and validity of

indicators are the core of social research methods, and have much to offer digital social research.

Providing Context to Data

Digital research has enabled remarkable advances in the display of data, enabling new approaches to visualization and identifying patterns overtime and across units of analysis. However, digital traces, whether a single Tweet, or even very large collections of data, cannot be interpreted without understanding their social context. This often requires methods than go beyond digital social research, such as the use of more traditional approaches to case study or qualitative research. For example, the number of tweets generated about the England riots can be usefully displayed overtime, but such a pattern is not meaningful or potentially misinterpreted without showing its relationship to particular events that provide a social context. This is critical to developing any interpretation of why tweets rose or fell at a particular time, or from a particular location. Tracking actual use of social media led researchers to conclude that these media played little role in instigating the riots, but a major role in the cleanup that followed.[5] Researchers need to go beyond the digital traces for this context on most occasions.

Identifying Social, Ethical and Legal Issues

The collection and analysis of social data often entails social, ethical or legal issues that are not salient to the researchers. The development of a grid-computing project, entitled eDiaMoND, sought to create a national database of mammographic images to conduct research and manage breast cancer and related diseases. This required a multidisciplinary team, including social scientists to understand and manage the ethical and legal issues such as over ownership and privacy that were raised on behalf of patients, hospitals, and other stakeholders (Warr et al 2007). But projects that do not even deal directly with humans, such as senor networks and the 'Internet of Things', can collect data about human behavior that are as contentious from an ethical or legal perspective. For instance, the collection of data from remote energy meter readings could be an invasion of person privacy by enabling researchers to know the living habits of individuals and households without their knowledge or consent. New research projects on the ethical issues of digital research have been fostered by studies of the social shaping of digital research (e.g., Jirotka et al 2012).

Studying the Social Shaping of Technology

While this is not an exhaustive list, a final way in which the social sciences can support the study of digital research is through what has been called the 'social shaping of technology', as noted in the introduction of this paper. The next section of this paper develops some of the perspectives that fall within the SST approach, again with the aim of illustrating the diversity of perspectives within the social sciences.

Multiple SST Perspectives on Digital Research

As noted above, SST is a broad school, but social scientists will defer on what they accept as within or outside the SST approach. The following are what I would regard

as illustrative of the diversity of approaches (Table 1). I will only briefly define each approach, recognizing that these depictions will be incomplete, but hopefully provide useful leads to further work in each particular area.

Table 1. Social Shaping Perspectives on Digital Research

Schools	Perspectives	Digital Social Research	Foundations
Bias of Technology	Bias of ICTs in Reconfiguring Access	Atkins (2005); Dutton (2011)	Innis; McLuhan, de Sola Pool (1983)
Technological Innovation	Diffusion of Grid & e-Research	Voss et al (2007, 2009)	Rogers (1983)
	Collaboratories, Collaboration	Olson et al (2008); Jirotka et al (2005)	Finholt and Olson (1997)
	Crowdsourcing	Nielsen (2011); Dutton (2008)	Surowiecki (2004)
Social and Technical Interactions	Human-Computer Interaction (HCI)	Warr et al (2007); De al Flor et al (2010)	
	Social, Computerization Movements	De la Flor and Meyer (2008); Power (2012)	Kling and Iacono (1988)
	Socio-Technical Interaction Networks (STIN)	Meyer (2006)	Kling et al (2003)
	Social Shaping of Technical Choices	Dutton (2011); Nentwich (2003)	MacKensie and Wacjman (1985)
New Institutionalism	Political Economy of Innovation	David; David and Spence (2010)	
	Ecology of Games	Dutton et al (2012)	Dutton (1992)
Science and Technology Studies (STS)	Social Construction of Technology (SCOT), e.g., Actor Network Theory	Woolgar and Webmoor	Latour (1987)
	Infrastructure Studies	Borgman (2007), US NSF (2007)	Sandvig (forthcoming)
Critical Political Economy	Industrialization of Research Practices	Carr (2008); Dutton & Meyer (2010)	Schiller; Garnham (1999)

Bias of Technologies: Technology Shaping Social Outcomes

One need not be a technological determinist to acknowledge that technology matters. One of the most prominent social perspectives on technology is focused on whether particular technologies exert a bias on social outcomes (Winner 1986). Major theoretical traditions in media and communication have been anchored in work by Innis (1950) and his former student, McLuhan (1964), for example, that focus on

the impact of different communication technologies being biased toward different patters of control, communication over a distance.

Ithiel de Sola Pool (1983) viewed computer-mediated communication systems, such as videotex, as 'technologies of freedom', which he characterized as a 'soft technological determinism'. More recently, the Internet is often viewed as inherently more democratic, and supporting more bottom-up innovation in science and technology albeit constrained by institutional and other constraints (Dutton 2011). Jonathan Zittrain (2008) made the case for the pc-based Internet being inherently more 'generative' as compared with post-pc Internet appliances, which is another take on a technological shaping of social outcomes.

Technology also shapes outcomes by shaping later technologies. Some social scientists have referred to this as technology shaping technology (MacKensie and Wacjman 1985), others as 'momentum' (Hughes 1994), and others as 'path dependency' (David 2005). Each of these concepts have different literatures and uses, but all generally refer to the observation that once a technology is in place it will influence future developments by making it easier to carry on in a similar path or direction. This is not only a technical path, but also one that has been adapted to institutions and users in ways that make technical change all the more difficult since change requires changes in the practices of institutions and users.

My own work argues that shifts in technologies of research will bias choices in such areas as collaboration, observation, data collection and retention, analytical strategies, and patterns of dissemination (Dutton 2011). Social shaping perspectives do not dismiss technology. However, even if technology matters, people and related social factors, such as their beliefs and attitudes, play a major role in shaping its adoption, uses, and implications in particular social contexts. This view has led to a number of social science frameworks that explicitly consider social and technical factors.

Innovation in Digital Research: Digital Research, Collaboratories, Crowd Sourcing

Most new technologies fail, so the social implications of technical innovation often depend on their successful adoption, implementation and diffusion. Studies of the diffusion and implications of innovation encompass a huge multidisciplinary literature (Rogers 1983). Innovation is generally defined as anything new to an adopting organization, and has therefore been applied across a wide range of fields, from hybrid seed corn to digital research. It has been criticized for positioning change as inherently positive, since it is difficult to oppose 'innovation', but it provides a framework for looking at change in almost any setting, including the e-social sciences.

In the early years of the NCeSS, Professor Peter Halfpenny, a sociologist who helped lead the centre, placed a priority on study of the diffusion of digital social research, and the factors constraining it. He viewed diffusion of these new approaches to research as the central issue for the social sciences, which appeared to be resistant to change, and doubtful of the relative advantage of large-scale networking or computational approaches in the field. This framing of the problem focuses research on identifying early and later adopters, seeking to explain their

characteristics, and also to identify the key factors shaping adoption, implementation and 'routinization' – or the embedding – of new practices in the work of researchers and research communities (Voss et al 2007, 2009).

The study of the adoption of digital research by individual researchers, for example, has highlighted the significance of bottom-up innovation, in which individual researchers often adapt existing infrastructures to approach research in novel ways (Meyer and Dutton 2009), and also the significance of early career researchers in the appropriation of new methods (Dutton and Meyer 2009). However, in line with studies of innovation, adoption alone is not as significant as whether or not new practices become embedded in everyday routines, and this issue has become a more central issue of digital social research over time, such as through the work of Marina Jirotka and her colleagues (de la Flor et al 2010).

Specific technological innovations can generate significant research communities that explore the success and failure of their diffusion, and their implications for organizations and researchers. Early research on collaboratories (Finholt and Olseon 1997) pre-dated much work on e-Science, and focused on the impact of digital technologies on collaboration. This work has broadened and continues around topics such as virtual research environments, and the study of digital technologies in collaboration more generally (Olson et al 2008).

More recently, a fascination with concepts of the wisdom of crowds (Surowiecki 2004) and the potential for distributed intelligence to be tapped by computer networks, and generated a greater focus on its application to research (Nielsen 2011). Again, research is focused around a technical innovation, such as crowd sourcing, and its potential for diffusion within particular populations, such as across research communities with implications tied to basic issues, such as whether more aspects of the research process will be 'democratized', such as involving citizen scientists in more phases of research (Dutton 2011; Power 2012).

Human-Computer Interaction (HCI)

A number of aspects related to the diffusion of innovations are tied to the social psychology of users as they interact with machines. How do individuals perceive various computer-based tools on such dimensions as ease of use or complexity, and their relative advantage over alternative tools. This brings to bear the entire burgeoning field of Human-Computer Interaction (HCI), which has underpinned a variety of studies on the usability of digital research tools (Procter et al 2006; Warr et al 2007). Generally, early e-Science tools, such as the Access Grid (AG)[6], were judged to be difficult to use, as compared with a number of Internet and Web based tools, such as Skype and Google+ that enable many of the same functions, such as multimode video conferencing. Likewise, some of the most promising innovations in digital research were viewed as easy for users to navigate, such as MyExperiment, which enabled researchers to get access over familiar Web facilities to a variety of tools for digital research.[7]

Frequently, when computer scientists acknowledge the need to involve social scientists in digital research, it is driven by a realization that understanding the perceptions and behavior of users is essential to the success of applications, and

that users are more varied and looking for different qualities than those who are developing the applications. However, while HCI is an important aspect to the study of digital research, it does not tend to focus on larger social contexts of application, and the larger set of actors involved in the success of technologies, beyond the users. This has led to an expanding view of HCI, but also to other approaches to study of SST.

Social Movements Shaping Digital Initiatives

Of course, humans interact with other humans and not just computers, and this is critical to understanding the degree to which social networks and influences shape the appropriation of new technologies. From time to time, there have been social movements in support of particular scientific practices, such as movements within the science community for 'open science' and more recently, 'open innovation'. Rob Kling and Susan Iacono (1988) argued that such movements have often propelled ICTs, such as computerization generally or open source software development. They described these episodes as 'computerization movements', and a number of social researchers have focused on the relevance of such movements in the diffusion of information and communication technologies, such as the Internet, Web, and social media (Elliott and Kraemer 2008; Dutton 2008).

Grace Eden and Eric Meyer (de al Flor and Meyer 2008) argued that digital social research has gained the social support to claim itself as a computerization movement, and there are aspects of digital research, such as the enthusiasm around visualization and big data that has indeed generated a band wagon effect that could support greater interest in digital research more generally.

Socio-Technical Interaction Networks (STIN)

The idea of computerization movements combines social and technical concepts, and much work on the social shaping of ICTs explicitly looks at the intersections and interaction of social and technical factors. For example, Rob Kling (et al 2003) and his students have developed the concept of Socio-Technical Interaction Networks (STIN) as a framework for studying new computer technologies in social contexts (Meyer 2006). The framework is focused on how social choices shape technical choices that account for the success and sustainability of computer systems, and how social choices are complicated by the multiple and often overlapping roles of key actors. STIN and other social perspectives lead researchers to identify the wide set of actors that shape the design and implementation of technical systems, such as the ecology of games, which is described below.

Social Shaping of Technical Choices

My own work on digital research has drawn from a wide range of case studies to develop a framework that identifies categories of factors that shape the choices made by researchers and other actors regarding the use of digital research for collaboration, observation, collection of data, analysis, and the distribution of findings (Dutton 2011). These include:

- Technical enablers and constraints, such as levels of expertise, and advances in equipment and techniques;
- Economic resources and strategies of nations, firms and research organizations, such around national competitions in sciences;
- Cultural, social and ethical values, such as concerning human participants in research;
- The geography of space and place, such as the physical location of researchers, institutions and the objects of study;
- Law and policy, including national and regional policies; and
- Institutional and disciplinary regulations, codes, and practices within universities, research units, and across disciplines.

To cite a famous example of the role of disciplinary and institutional policies, Tim Berners-Lee chose not to commercially exploit his invention of the World Wide Web, but also CERN's institutional commitment to open innovation was in line with his own values and interests, and dramatically shaped the course of its development.

Understanding the Social Construction of Technology

Social scientists, often within traditions of Science and Technology Studies (STS), have developed streams of research on the Social Construction of Technology (SCOT). STS work developed out of instrumentalist approaches to the philosophy of science that focused on what scientists actually do, rather than what they say they do, such as in textbooks on research methods. This was extended to technology by focusing on how technologies actually work or not work, as opposed to formal depictions of technologies that often omit the many social and economic aspects of technologies. Many STS researchers would not wish to be lumped with the SST, either because they view it as dated or encompassing approaches they would not subscribe to in their own work. However, seminal researchers of SST are core to the STS community, such as Donald MacKensie and Judy Wacjman, and I would view the SST as far broader and more encompassing than STS, justifying my placement of one within the other.

Actor Network Theory (ANT)

One of the most influential perspectives within STS is called 'Actor Network Theory' (ANT), which seeks to map the network of all the key actors (human and technical) involved in shaping an activity, such as digital research (Latour 1987). In the STS tradition, such a thick description provides an understanding of how technologies actually do what they do, often through a depiction of the pattern of relationships across multiple human and nonhuman actors.

Infrastructure Studies

A more recent stream of work in this general area is around 'infrastructure studies', often in the fields of information and communication technologies like the Internet (Edwards et al 2007; Sandvig forthcoming). Infrastructure studies dig deeply into all the elements of an infrastructure, whether transportation or communication infrastructures, and how changes in one aspect can have unexpected, unplanned consequences for other aspects, given their complex set of interrelationships. It is

here that social science can provide rich descriptions of infrastructures that can help convey a better understanding of how technologies, like the Internet or Cloud computing, actually work, moving beyond vague or formal depictions, such as the infamous power point slide of the cloud.

Institutionalist Perspectives

There are many similarities between STS approaches and approaches I have described as within the arena of the 'new institutionalism' (March and Olsen 1984). A basic difference is that one evolved from studies of science and technology, while the new institutionalism evolved primarily from research on organizations in a variety of institutional contexts. Users live and work in various institutional contexts, which motivate, structure, and otherwise constrain their choices and behavior more generally. In addition, institutions such as governments and universities are often actors in the design and implementation of technologies. For example, the development and implementation of Grid computing was often anchored in universities and university centers, such as in well funded centers for e-Science. Often such technological innovations as the Grid are envisioned as a means to keep institutional actors in front of technical change, but institutional interests can also act to constrain technical change, such as promoting open science and open innovation, or protecting the intellectual property rights of a particular institution. A number of influential researchers have focused on the institutional constraints on digital social research, paying particular attention to the interests of research services departments at universities and how their concerns for protecting the intellectual property of their faculty and labs can conflict with some of the aims of individual researchers and faculty in collaborating across institutional boundaries (David and Spence 2010).

However, there are many 'new institutionalist' perspectives on organizational change and the development of large technical systems. My own work has developed a framework called an 'ecology of games' as a grammar for describing the multiplicity of actors and motivations involved in shaping any technological initiative and its societal outcomes (Dutton 1992). From this perspective, these outcomes unfold from the choices made by multiple players in a variety of games that define the rules and shape the strategies of different actors. For example, the evolution of the Internet can be understood as the outcome of an ecology of games (Dutton 2008, and Dutton et al 2012), as opposed, for example, to the outcome of a social or computerization movement, which would not incorporate the multiplicity of actors and motivations that would be elicited from an ecology of games perspective. From this perspective, most actors understood not to be focused on a long-term technological objective. Instead, most are focused on more immediate and local goals and objectives, such as winning a grant, or completing a project. It is the interaction of the choices made in these multiple games that drives outcomes in unplanned and unpredictable ways.

Critical Turns on the Internet and Digital Research

Critical theorists have focused on the role of privatization in media and communications in exacerbating inequalities in society, and shoring up capital accumulation locally and globally (e.g., Schiller 1995). The growing prominence of

the billionaires and dominant firms created around the Internet and Web have led to a critical turn on the network society, and in a few cases on digital infrastructures that support research. Critical theorists examine digital research in ways that highlight the risks tied to collecting the contributions of users in an increasing variety of ways.

Since few mainstream critical scholars have yet to focus on digital research, it is useful to note a popular account of the transition from the PC age to the utility age and its consequences for users by Nicholas Carr (2008). Carr describes a switch from companies anchored in the client-server model, such as Microsoft, to a world in which the Internet is our computer. Organizations such as universities and firms will be reconsidering what IT services, including research tools, can be provided better by the new utilities than by themselves. Carr's technological forecast follows a relatively deterministic technical rationality, but treatment of the societal implications of this switch challenges the basic narrative of those promoting digital research.

He sees potential advantages, such as in the utilities reducing costs and enhancing security. And he acknowledges the creativity of user-generated content, from blogs to amateur videos. But he sees risks in the loss of personal privacy, threats to the quality and diversity of information sources, and the loss of jobs. Most importantly, from a critical perspective, he enables the reader to envision users becoming a 'global pool of cut-rate labor' for the 'digital elite' in the age of the information utility. Rather than creating an information utopia through user-content and open source, the new 'Edisons' of the digital age are reaping billions off the free labour of users, while at the same time they reduce the ranks of paid information workers, such as journalists and editors, and contribute to 'eroding the middle class and widening the divide between haves and have nots' (Carr 2008: 143).

Carr's account might be viewed as high-journalism, rather than that of a social or computer scientist, but he captured a growing theme of critical and neo-Marxist political economy around the exploitation of users by Web and Internet companies for private profit. What is a miracle to enthusiasts of crowd sourcing and social media is worrisome to critical researchers who see the function of social media and crowd sourcing to be the exploitation of the labor of users. Just as those who subscribe to newspapers, or watch television support the business models of these media – delivering eyeballs to advertisers, so do the providers of digital research seek to draw users to their applications in order to justify support for particular tools and the sustainability of their provision. Are users as a whole exploited in this exchange, or do users enjoy a net benefit in the same way that those who own various platforms and services profit from their use?

Conclusion

I have only been able to depict key aspects of a wide number of perspectives on how the social sciences can contribute to digital research, and how social scientists explore the SST in this arena. While providing to simple answer as to what the social shaping of technology offers to digital research, I hope this overview indicates the diversity of approaches to this field, and the value of more social scientific focus on the digital research across the disciplines.

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End Notes

[1] Information about all of the research nodes can be found on the archived Web site of NCeSS at: http://www.ncess.ac.uk/about_us/organisation/
[2] The National Strategic Directorate team consists of David De Roure of University of Oxford as Director with Marina Jirotka, Associate Director of the Oxford e-Research Centre (OeRC) as Deputy Director, Rob Procter, Director of the Manchester e-Research Centre, and previously Research Director of NCeSS, and Anne Trefethen, Director of the Oxford e-Research Centre.
[3] The DSR mission statement is more fully developed at: http://www.digitalsocialresearch.net/wordpress/about-2
[4] http://historymatters.gmu.edu/d/5168
[5] http://www.guardian.co.uk/uk/interactive/2011/dec/14/reading-the-riots-investigating-england-s-summer-of-disorder-full-report
[6] http://www.oerc.ox.ac.uk/facilities-assistance/access-grid-video-conferencing
[7] http://www.myexperiment.org/