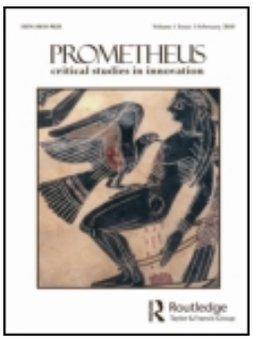

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Fostering Multidisciplinary Engagement: Communication Challenges for Social Research on Emerging Digital Technologies[1]

WILLIAM H. DUTTON, ANNAMARIA CARUSI & MALCOLM PELTU

Abstract *There is wide agreement on the value of multidisciplinary social research related to information and communication technologies. This paper provides insights into the dynamics at play in these studies, drawing on an in-depth analysis of exchanges among an international group of experts from many relevant disciplines who participated in a workshop on research into the social implications of emerging digital technologies. In addition to identifying some distinctive new challenges facing this field, the paper suggests how understanding ways to foster productive engagement in discussing and developing issues and joint work could lead to more useful multidisciplinary partnerships.*

Keywords: multidisciplinary research; social shaping of technology; innovation; futures studies; information and communication technologies; Internet; technology and society.

Introduction

The Internet and other information and communications technologies (ICTs) are being used so widely to help reshape social, institutional, economic, cultural, legal and other activities across the globe that research on the broad implications tied to these innovations requires various forms of collaboration across many related disciplines.

The nature of the transformations made possible by ICTs seems to pose some important new challenges to such multidisciplinary partnerships, which also face enduring constraints on enabling and rewarding their work. For instance, policy visions like the 'information society', 'network society' or 'digital age'[2] indicate the pervasive[3] and interconnected nature of digital ICTs, of a scale and with implications across a range of activities that appear to be unlike previous technological developments that have been used to create significant widespread change.

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Dystopian fears of the 'dark side' of ICTs have been prevalent since the dawn of the 'computer age' in the 1950s, for example about the potential use of computer databases to give significant additional power over people's lives to government and business.[4] Now, the growing relevance of ICT use to almost every aspect of human activity has generated a proliferation of interconnected anxieties about issues like perceived growing online safety threats to children and the potential for unprecedented levels of continuous data collection on people's activities and movements.

An examination of the nature of these new challenges to multidisciplinary research in this field was a key aim of a workshop in Oxford University in 2005 organized by the Oxford Internet Institute (OII) and Massachusetts Institute of Technology (MIT). This brought together participants from a broad range of disciplinary and methodological perspectives in the social sciences, computer science, futures studies, law, economics, new media, cultural studies, philosophy and other areas. In particular, it sought to open an interdisciplinary dialogue to explore the degree to which social scientists can contribute theoretical and practical insights of value to designers, engineers, business managers, government policy makers, civil society and others with a stake in using, developing, managing and regulating the Internet and related ICTs.

This paper reports on a systematic analysis of the discussions at this workshop and related material to help anyone undertaking similar multidisciplinary work to be aware of some of the key issues that need to be addressed to help develop productive partnerships involving stakeholders from many different backgrounds, sectors and disciplines. We have attempted to convey both where the conversations were smooth-going and incremental, and where they seemed to break down.

Although this workshop was a particular event, we believe the patterns we have identified in our analysis of its participants' discourse raise important issues about multidisciplinary communication that have wider resonances. Despite a large amount of contested ground revealed by our analysis, an important finding is its evidence of 'real engagement', where one participant responds directly to another and/or uses their terms—and is aware of doing so, even if they approach the topic from different backgrounds and conflicting values.

Such engagements enable people with competing and complementary perceptions, knowledge, values and experience to work within their agreed reference points in order to address problems and opportunities in ways that improve understanding and knowledge sharing. This suggests that more effective multidisciplinary collaboration could be supported by trying to ensure that people are better able to understand and share common points of reference and interpretations of each other's perceptions, rather than necessarily trying to strive for a perhaps unachievable 'consensus'.

The paper starts by identifying key emerging digital technologies, and then highlights some of their important social dimensions. The remainder of the paper discusses the main challenges posed to multidisciplinary social research on ICTs that flow from these innovations and their implications, beginning by describing the difficulties of identifying future potential pathways and outcomes related to these developments. A summary is then provided of the social research methods appropriate to studying such issues. After an overview of the barriers faced by multidisciplinary research in this field and an indication of how they can be overcome, there is a more detailed analysis of discussions at the OII–MIT workshop. This aims to assist the establishment more widely of the sort of real engagements observed at this event. In the concluding section, the authors identify some limits to the

current study and suggest ideas for facilitating more effective interdisciplinary conversations, including collaboration involving multiple stakeholders outside academe, and points to ways of building on the findings reported here.

Emerging Technologies for Unpredictable Emergent Futures

The term 'emerging' in the workshop's title was frequently contrasted with the concept of 'emergence', developed through interdisciplinary studies of complexity in natural and artificial systems. Such complexity sciences[5] view emergent outcomes as being unpredictable results flowing from the interplay and co-evolution at a micro level of numerous interactions involving a vast numbers of interrelated entities and variables.

The Internet exemplifies an emergent social technology that has co-evolved through the contributions of many individuals, groups and institutions, as was indicated at the workshop by one of the designers of the Internet, David Clark, Senior Research Scientist at MIT and a convenor of the event. He recalled:

> I have been working on the Internet since about 1975, when there were twelve of us and we could do anything we wanted. Sometime in the 1990s, I had this revelation that we had in fact designed the Internet to try and deal with the unknown application, to try and optimize for change. But when I have tried to understand what direction we were going in, what was pushing back on us and what was happening, I realize the forces that were shaping the Internet were not the forces of technical innovation. The techies were not in charge. We had to look at issues of investment and industrial structure which we had created inadvertently. It had not been obvious to us in 1975, as much as it is now, that the modularity of its interfaces defines an industry structure.

By facilitating the Internet's co-evolution with its users, this initial design approach provided an enduring basis for the Internet's growth and success by empowering its users to adapt its development and diffusion to meet, and often assist in reshaping, dynamically-changing social contexts and interactions. This is a vivid example of a design choice or 'lever' that could help provide interventions to encourage moves to shift outcomes in a desired direction, but without expecting to predetermine outcomes through a prescriptive set of detailed steps. In broader social policy areas, similarly, it is also important to identify policy levers appropriate to the needs of a dynamic landscape of social shifts and transformations, for example in relation to changes to authority and dependency in family and community structures.

Key questions would then relate to who gets to set these design and policy levers, and toward what ends. For instance, Clark argued that if the design allows levers to be set by the user at 'run time', such as defining privacy or security levels, then tussles over the setting of the levers will take place dynamically between actors in their social contexts. But the more settings are constrained at design time, the more intimate, and perhaps more exclusive, will be the group deciding the lever's setting. This also illustrates how choices over values can be inextricably bound up with technical choices.

The complexity of the issues that such levers need to address is illustrated by the ways in which the use of the Internet and other ICTs can affect personal, social and technical notions of 'identity', for example when verifying identities online or in negotiating online persona in virtual interactions. Social scientists tend to

emphasize that questions of 'identity' on the Internet go far beyond a technologically-identifiable name tag to encompass deeper psychological and social aspects of how people see themselves, how others see them, the ways in which people express themselves through different media and how they manage to operate simultaneously using different identities in different online and offline contexts. Notions of personal and social identities can also vary between different cultures.

According to Clark, most Internet designers generally understand that technical name tags are a lever with wider powers in the larger social context, and so are seeking help from those who understand the larger social contexts to better understand those powers and how this lever should be designed. However, his experience of finding difficulty in getting such advice seems to be shared by other ICT engineers and practitioners, while many social scientists are concerned that complex issues like value preferences related to identity may not be amenable to technological interventions. Finding ways to develop more productive multidisciplinary dialogues to support collaborative work on such issues is a challenge highlighted, and responded to, in this paper.

Although there was widespread recognition at the workshop of the importance of understanding the social contexts shaping technological use, many discussions were triggered by considering the implications of particular technological developments. Table 1 summarizes a few of the main actual, possible and imaginable technologies mentioned at the workshop.

Table 1. Key emerging technologies

Type	Examples	Brief description
Pervasive digital networks	Embedded sensor networks	Large-scale distributed systems composed of smart wireless-connected sensors and actuators embedded in the physical world (e.g. weather, traffic and pollution detectors)
	Global Positioning System (GPS)	Radio-based systems using information obtained via a satellite to identify accurately the location of a receiver, such as a navigational aid in a vehicle
	Radio Frequency Identification (RFID)	Microchips that identify their location via radio signals (e.g. attached to a criminal, an Alzheimer's Disease patient, a library book or vehicle)
	Peer-to-peer (p2p) networks	Non-hierarchical networks that bypass centralized control by communication directly between individuals' computers
	Wireless Fidelity (Wi–Fi)	Low-cost, flexible wireless networks
Integrating real and cyber worlds	Giving real objects a presence in cyberspace	Devices whose users view a real object while 'seeing' its cyber manifestation (e.g. buildings linked to a list of tenants or vending machines to online payments)
	X-ray cyber-glasses	Spectacles that allow people to see computer models overlaid on a world rich with sensors feeding those images
Personalization, customization	Intelligent agents	Software that adapts to a user's characteristics to help access information and services prioritized by the user
	Lab-on-a-chip	Computer-based technologies for tailoring medical or other drugs to an individual's specific requirements
	Desk-top production	Systems (e.g. three-dimensional printers) that can download physical designs for automatic production
Bio-electronics	Biological enhancements	Microchips for health support (e.g. heart monitors) or sensory assistance (e.g. intelligent 'sniffers' to detect pheromones attractive to an individual)
	Cognitive enhancements	Communication via brainwaves enabling non-invasive electronics to support or change states of mind

Living in Digitally-pervaded Social Worlds

Many of the most significant social issues tied to ICT innovation are anchored in the bringing together of assemblages of the kinds of networkable technologies identified in Table 1. However, much social research on ICTs has focused on disaggregated studies of particular technologies and specific user contexts. More studies of the use of assemblages of emerging and established technologies across a range of contexts are therefore needed in the future.

Networks including embedded sensors,[6] GPS,[7] RFID[8] and other technologies are opening avenues for private control of many data collection and analysis services, on a scale that previously only nation states could manage, such as traffic coordination and weather and pollution monitoring and forecasting. For example, a GPS-based vehicle navigation system could automatically direct its driver towards the least congested route to a destination, while data from GPS, RFID and other sensors and systems could feed information to a data coordination centre as part of a 'universal location infrastructure'.[9]

These kinds of developments also raise issues like: ownership of the information collected by embedded sensors; citizens' controls over others' use of such data; attitudes of government to such a shift of ownership; the types of monitoring that should and will be allowed to rest in private hands; what safeguards are feasible and appropriate in such vast data gathering exercises; and the potentially high costs of processing so much data.[10] Another important social implication of pervasive digital networks is that ICT-enabled communication is likely to mediate increasingly between people's interactions with each other and their interactions with sources of information and services. This could include automatic filtering of information and services, such as through intelligent software agents that can also be used to customize services to the personal requirements of individual users.[11] Important questions raised by this include what controls might be instituted to constrain the power of institutional gatekeepers and ICT-enabled mediators.

The embedding of networkable technologies in social environments means there will be a growing range of environments within which people will be continuously in interaction not only with passive digital data collection technologies but with actuators that are triggered automatically. This is likely to create a new deluge of digital data[12] and form complex new interactions between cyber and real worlds that could become very difficult to manage.

Table 2 summarizes these and other overlapping social implications of emerging technologies. As indicated in the earlier discussion on social and design levers, 'social policy' and 'design' questions often intertwine. The division of issues into two columns in Table 2 therefore aims only to help identify the most appropriate kind of lever, rather than to suggest a clear demarcation.

The range of issues covered in Table 2 indicates the proliferation of social issues that some see being threatened by the pervasiveness of converging, networked digital technologies. Some issues, like privacy and surveillance, are developments of older concerns about ICTs, but have been made more significant by political developments such as the 'war on terror' after the attacks on New York in 2001. Distinctively new and increasingly urgent issues are also emerging, for example the complex interactions between virtual and real worlds.

Many fears about the dark side of ICT use arise from inherent tensions flowing from the two-edged nature of ICTs' programmable flexibility. For example, the ease with which people use the Internet and create content for the Web to arrange family

Table 2. Key social issues arising from uses of emerging digital technologies

Issue	Sample social policy questions	Sample design-oriented issues
Power and control	How are economic and social divides affected? Should Internet data flows be restricted? What are the impacts of non-hierarchical nets (e.g. p2p)? How can the rights of content producers and users be balanced? What are the costs of 'user empowerment'?	What monitoring, filtering or blocking mechanisms should be placed in the hands of users or designed into networks, systems and devices? What levels of transparency are required to warn of the existence of pervasive digital networks?
Privacy, surveillance	How can regulation best balance privacy and surveillance needs? Are new data collection and privacy rights necessary? Are the costs of managing a data deluge socially acceptable?	How much, if any, user choice in privacy protection level (e.g. encryption) should be enabled? How should people be able to opt out of certain kinds of monitoring?
Trust	How can the trust/privacy tension between open communication and protection against malicious intrusions be balanced?	What capabilities can best help users and providers of ICT-based products and services to develop and sustain mutual trust?
Identity	How do networked ICTs change perceptions of identity? How do digital identification needs affect citizen–government relations?	What, if any, stronger forms of identification and accountability relating to the use of the Internet are appropriate?
Mediation	How should convergent digital media be regulated? Should automated communication mediators be constrained? What forms of counter-mediation are legitimate?	To what extent should mediation techniques (e.g. intelligent agents) allow for user intervention? Should any capabilities be provided to override such techniques?
Security, safety	What is the interplay between threats in cyber and real worlds? Is new legislation needed to protect children's online safety?	How can the design of security and safety tools meet different user needs in different contexts? What controls should users have?
Temporality (e.g. history, memory, future)	How will long-term information retention affect the intrinsic need for 'forgetting' in human and social development? How can history best inform the imagining of the future?	What criteria should be used to retain data? How should the deletion of data be controlled? What methods can best help designers to meet unpredictable future needs?
Spatiality	What are the key social and psychological factors in virtual and 'real' spaces? How are virtual public/private spaces delineated?	How does architecture and spatial organization affect information flows? What are key design aims for virtual or face-to-face spaces?

meetings or to help with school, academic or business work also enables paedophiles to make online contact with children or extremists around the world to promote and orchestrate terror attacks. But it is the combination of overlapping interactions of all such issues that is widely seen as the reason why uses of new assemblages of digital technologies are regarded by many as being of profound long-term importance across numerous social, institutional, legal and other activities at local, national, regional and global levels. This poses many new challenges for the kind of multidisciplinary research that is needed to address this vast landscape.

Challenges to Multidisciplinary Social Research on Emerging ICTs

How Far Can We 'See' into the Future?

Predicting future outcomes from the use of such a complex assemblage of technologies as the Internet and related ICTs is extremely difficult because of the numerous factors and interactions that shape, and are shaped by, the interrelated social and technical innovations involved.

Engineers and scientists have a good track record in inventing new devices and systems, as well as in predicting improvements in technology capabilities and performance (e.g. 'Moore's Law' that microprocessor capacity would roughly double about every 18 months). But these and other specialists have generally been less successful when forecasting first-order changes in terms of applications tied directly to the use of emerging technologies. Projections have been even worse for vital second and third-order changes in personal, social and institutional relationships that can transform the everyday lives of people and the strategic destinies of communities and states.

Prediction has also suffered from 'presbyopia': the ability to see a long-distance future vision clearly but not the near-view path to get there. This has led to much frustration when visions have not been realized. However, visions can play an influential role in shaping future innovation by creating policy frameworks that stimulate the focused provision of resources and in the direction of individual and institutional creative efforts.

Innovation is often 'recombinant', in that novel outcomes are socially shaped by what already exists and what has happened before. This frequently arises from incremental change to the use and nature both of existing technologies and in the reconfiguring of existing technologies with emerging ones. There can also be a socio-technical 'spiralling' of innovation as one change triggers another, for example in defence and counter-defence spirals of arms races or the development of counter-technologies in the digital world, such as blockers of RFID signals.

Many analyses of innovation diffusion[13] indicate how crucial social transformations are tied to innovation that typically occurs at a discontinuity or 'tipping point'. After this, there is a paradigm shift that breaks with previous concepts, norms and practices, as occurred following the industrial revolution. Assemblages of emerging and older technologies are then employed to change the contexts of innovation and the human capacities that thrive within them, which generates further social and technical innovation. Predicting the future from a pre-tipping perspective therefore has a very high risk of being inaccurate.

These and related problems in forecasting the future make most social scientists reluctant to draw firm and detailed predictions of innovation outcomes, rather than analysing and describing the underlying dynamics that could lead to different futures depending on decisions taken in different, interacting contexts. It is also one reason why social scientists are often reluctant to commit themselves to assisting designers and engineers in creating a system that is likely to meet specific future needs.

Mixing and Matching Social Research Methods

A wide range of social science methods are appropriate to investigating the social implications of emerging technologies, covering qualitative and quantitative approaches, micro-scale drilling down and large-scale studies, snapshot and longitudinal techniques. Table 3 summarizes a few of these.

There is no general 'cookie cutter' social science method that can be applied to all contexts and technologies. Different approaches need to be mixed and matched to particular investigations; even then, scholars from different traditions disagree on the merits of competing methods. For instance, in-depth ethnographic studies[14] of specific micro contexts can produce rich findings. So can large-scale social experiments, such as the RAND Health Insurance Experiment[15] starting in

Table 3. Examples of different social science methods and perspectives

Focal point	Examples
Conceptual	Ecology of games; new media processes/effects; philosophy
Future facing	Modelling; futures studies; backcasting; analytical development scenarios; gaming scenarios and models; risk management (risk analysis, perception, communication); panels of technologists, social scientists and others
Real time, action	Multimedia design and policy-formulation spaces; Living Laboratories; ethnographic studies
Historical	History of diffusion and use of earlier technologies, including Technology Assessment; rich post-hoc case studies (e.g. leading-edge users and failures); discourse analysis
Social	Social shaping of technology; science and technology studies; (new) media studies; survey research; interviews; focus groups; network analysis; complexity sciences; social and organizational psychology; communication sciences; political sciences; Technology Assessment
User facing	Domestic observation; family ethnography; user-driven design and human factors engineering; information sciences; psychology; cognitive sciences; product design
Institutional	Law and regulation; organizational behaviour; organizational psychology; decision support systems
Technology facing	Information systems design and development; computer science; telecommunications; information retrieval; database management; data mining; information filtering (e.g. intelligent agents, filters)

1981 that had much influence on health economics. But scientists anchored in one approach, such as ethnographic research, too often fail to acknowledge the contribution of potentially complementary approaches, such as experiments or quantitative survey research.

Conceptual frameworks include the 'ecology of games',[16] which provides a cross-cutting view of underlying social process and outcomes tied to the use of ICTs, in which overall outcomes emerge from the interaction between outcomes from a number of interrelated 'games' within which numerous actors pursue goals by making choices according to a set of rules and assumptions specific to that arena, such as in shaping the use of new media in the home. Other such frameworks include actor–network theories[17] and a conceptualization of new media[18] in terms of four distinctive characteristics (ubiquity; recombinant modes of access, use and content; dynamic, point-to-point network structures; and potential for personal engagement and interactivity), which are also relevant to the Internet's general enabling of users' creative collaborations.

The difficulties of predicting future outcomes were illustrated at the workshop by contention over many aspects, including the starting points from which scenarios are developed. For instance, there was much contention over the economic, ethical and political basis for a future scenario that articulated a vision in which there had been a radical shift from current notions of production and consumption to a situation in which people uniquely create products and services personalized to their own needs. Nevertheless, there was support for many aspects of futures studies,[19] such as rigorous analytical scenarios and modelling.

An illustration of the way even generalized imaginative visions of the future can influence current practice and planning is the video *EPIC 2014*,[20] created by students at the Poynter Institute in St. Petersburg, Florida. This 'backcasted' from 2014 to highlight milestones in the growth of what had become a new mega-corporation, 'Googlezon', which dominated the global media market through an

online news service personalized to an individual's choices. The *Financial Times*[21] has reported that this scenario has attracted the attention of some major global media players.

Experimental multimedia spaces and forms of dialogue can help to open new ways of sharing ideas among participants from multiple academic disciplines and policy, business and other stakeholder communities. For instance, the multimedia 'design studio' approach being developed at the INCITE centre at the University of Surrey[22] is examining new ways of communicating and translating ideas between specialists from different backgrounds. MindLab[23] involves novel high-tech policy brainstorming spaces that have been used by government departments in Denmark and Holland. The Living Laboratories[24] experiments in a number of European cities offer real-time proving grounds for prototyping and testing new technology applications involving individuals and interconnected firms and institutions.

The Technology Assessment approach,[25] which was popular about 20 years ago, uses historical analysis and future projection to provide insights into the social implications of technological change, like the videophone.[26] Another valuable method for helping to understand the social and institutional factors shaping the success or failure of ICT innovations has come from in-depth case studies in specific contexts, such as business enterprises, government departments, schools and the application of ICTs for economic development in less advantaged societies. Examinations of more advanced users and of instances of failed innovations can be particularly illuminating in revealing the potential and limitations of emerging technologies.

There are numerous socially-oriented approaches to researching the implications of technologies, from broad disciplines such as the 'social shaping of technology'[27] and media and communications studies[28] to more specific techniques like network analysis methods such as actor–network theory and Webmetrics.[29] The concept of the social shaping of technology provides an overarching approach to many disciplines in this area.

User-centred design studies[30] have produced some of the most productive detailed input from social scientists to ICT designers and engineers. These have led, for example, to widely used operational interfaces like the design of handheld devices and the point-and-click interactions used for Web surfing and in operating systems like Microsoft Windows.

Institutional, legal and regulatory factors are also crucial elements in the multidisciplinary mix. Organizational processes and business strategies can strongly influence the application and development priorities that shape technological innovation. Laws and regulations can protect or constrain citizens' uses of technologies, or enable or inhibit the innovation creating emerging technologies.

Addressing Barriers to Multidisciplinary Social Research on Technology

Major divisions between disciplines such as psychology, sociology and economics arise from their different understanding of the factors shaping technological change and its social implications. Overlaying these divides are methodological differences, such as between formal modellers (e.g. game theorists), quantitative empirical researchers (e.g. survey researchers) and qualitative researchers (e.g. ethnographers). But it is the gulf between computer scientists and other relevant engineers, technologists and scientists, on the one hand, and social scientists on the other that was seen as the crucial factor facing multidisciplinary collaboration in this area.

This divide is partly related to a difference of knowledge bases. For instance, in a collaboration on e-government, it is typical for a computer scientist to say that the political scientist knows nothing about the Internet, while the political scientist will respond that the computer scientist knows nothing about government. This might be the foundation for a useful collaboration, but it often marks the beginning of the end of collaborative work. However, it is also a divide over approaches to the study of emerging technologies. Engineers and computer scientists are more often wedded to logical reasoning about technologies. This can lead them to extrapolate likely social consequences stemming from technical features. Social scientists are more likely to rely on empirical observations and an inductive logic, making them less comfortable in speculating about the social implications of emerging technologies but also less capable of forecasting their social implications.

On the one side of the theoretical divide separating these groups are many computer scientists and engineers who view technological change as an independent force changing society. In contrast, there are social scientists who more often view economic, legal and other social factors as independent forces shaping technologies and their broad implications. Sometimes, at the extremes, this can be characterized as a struggle between 'technological determinists' and 'social determinists'. But degrees of separation divide individuals along this dimension, even when they veer far from an overly simplified determinism.

As explored later in the paper, such differences can be exacerbated by differing views and misconceptions of the research aims being pursued. In addition, some key institutional and legal frameworks are failing to keep pace with the needs of multidisciplinary social research on ICTs. For instance, virtual networks create new forms of layered spaces that can disrupt collaborative relationships, as when some people in a face-to-face meeting are interacting with others outside or inside the room via laptop computers. Collaborative research using the Internet and large-scale Grid distributed computing utilities, as in e-sciences research,[31] often involves work in centres in different institutions. Nevertheless, such projects are frequently implemented through institutional contracts that treat liability, Intellectual Property Rights (IPR) and other issues in different ways.

Long-standing constraints on multidisciplinary research also persist, most notably in academic assessment and reward processes that still prioritize single-disciplinary projects and publications over joint work. Different timelines between research and policy cycles are another established multidisciplinary stumbling block.

Despite these kinds of difficulties, there are many examples of successful multidisciplinary collaboration. For example, although seismology and structural engineering have been surprisingly separate fields, specialists from these areas are working together effectively in the Center for Embedded Networked Sensing (CENS) in California,[32] together with sensor network technologists and scientists, electrical engineers and communications technology experts.

Fostering Multidisciplinary Engagement

The following subsections provide more details of the analysis that informs the above discussion, in order to help explain the factors affecting the formation of real engagements that could help to meet the complex new challenges faced by multidisciplinary research on the social implications of ICTs. After exploring some key areas of contestation, the way engagement took place during the workshop is illustrated to show how it is possible to build on one of the key findings of this

analysis: the importance of establishing common reference points to enable people to, at least, 'talk about the same thing'.

Contested Grounds

Although differences between participants at the OII–MIT workshop ranged widely, they can be broadly categorized around the seven contested areas summarized in Table 4.

One of the strongest differences was between those who wish to start with a focus on the use and impacts of particular technologies (e.g. RFID, intelligent agents) and those who see social contexts and implications (e.g. on social exclusion, privacy, trust) as the prime framework. These perspectives underscore the competing views that the main issue is either to picture the trajectory of a technology through its possible social settings or to study the complex social dynamics shaping and being shaped by the use of ICTs. Some also highlight the value of beginning with a specific problem (e.g. sensor tags to track children) or a process (e.g. using the Internet for political campaigns). In addition, there are distinct differences in the emphasis given to focusing on future scenarios or first attempting to understand how the past and present shape future directions.

Deep-rooted ethical, cultural and ideological values seemed to lie behind differences in attitudes to research and other issues expressed at the workshop. Many revolved around differences between those who support the values represented by market-favouring economics (e.g. promoting individualism, consumerism and choice) in contrast with a more socially-oriented perspective (e.g. prioritizing social justice, informed citizenship, consumer protection and global inequalities). Other

Table 4. Examples of competing perspectives on multidisciplinary research

Contested area	Examples
Starting points for research and statements of the main problem	Technological capabilities v. social implications; technological determinism v. social shaping; problems v. processes; future focus v. historical and current analysis
Values	Individualism v. social focus; consumerism v. social justice; Western norms v. global inequality and difference; security v. civil liberties; identity as self-realization v. external designator
Aims of research	Generalizability v. proof of concept; materialist critique v. search for empirical evidence; market v. social goals; facilitating specific applications innovation v. understanding heterogeneous social needs; technology push v. social pull
Research methods	Holistic integration v. analytical decomposition; design v. observation; focus on individuals v. social wholes; specific emerging technologies v. assemblages of new and old ones; socially-embedded technologies v. the potential of technical capabilities; 'micro' v. 'macro' scope
Envisioning the future	Planning v. unpredictable emergence; rigorous imagining of long-term futures v. studying social implications of current uses and near-term futures; co-evolutionary pathways to the future v. discontinuity and disruption; prediction v. prescription; descriptive v. normative futures
Conceptions of the user and who 'we' are	Users as consumer v. citizen or as recipient of design solution v. part of design process; 'we' as researcher or designer v. 'ordinary' citizen, group with particular social, economic and culture characteristics
Politics of language: definition of terms	Privacy; identity; emergent v. emergence; user; we; methodology

values identified included ethical concerns (e.g. balancing civil liberties, security, privacy and safety issues in Internet use) and psychological factors (e.g. identity as self-realization or a mechanism for external designation, such as with identity cards).

Social researchers tend to seek understanding of long-term trends and heterogeneous social need and the identification of a critique derived from insights into the nature of social dynamics and personal motivations. Technical designers and engineers, however, often prefer to look more for empirical evidence targeted at testing and proving specific theories, with those involved in commercially-based research more likely to emphasize short-term market goals, lifestyles and new applications.

Underlying values play an important role in influencing these perceived research aims and the specific methods used, such as holistic approaches focusing on the social contexts of interactions with technology set against methods favouring analytical decomposition. This is also reflected in recommendations on whether to have more studies of assemblages of new and old technologies or to concentrate on individual users and the potential of specific emerging technologies. Important unresolved areas of contestation include the degree to which social research should participate in actual technology design and debates about the advantages of concentrating on the 'micro' details of smaller cases against research on a larger canvas.

Another major divide contrasts traditional notions of planning with concepts of unpredictable emergence and co-evolution. This was illustrated at the workshop by debates about the relative merits of, for example, the 'rigorous imagining' of possible future scenarios or through studies of the social implications of past, current and/or likely near-term patterns of uses. Some favour methods that envision the future through points of discontinuity and disruption, while others emphasize understanding the emergence of outcomes from co-evolutionary processes. Whichever method is chosen, what people see as likely future developments often reflect their underlying values and perceptions, such as a Utopian future where technology primarily brings positive increased 'empowerment' and 'choice' to individuals or those focusing more on 'dark side' threats to social justice and civil liberties.

The politics of language plays an important role in multidisciplinary discourse. Even an apparently unambiguous term like 'methodology' can lead to some misunderstandings, as it could imply a structured, largely prescriptive process favoured by some engineers or a more fluid mix of qualitative and quantitative social research methods adaptable to different contexts.

The important influence of values on choices made by those involved in multidisciplinary research, and the way they perceive each other, indicates that even apparent differences of terminology are often more than just questions of miscommunication. An important way of opening up new opportunities for more meaningful engagements could therefore be to attempt to clarify the meanings attached to key terms and the underlying assumptions and attitudes shaping those meanings.

Implications for Multidisciplinary Research: Addressing Differences in Perceptions

Even strong expressions of contested views can obscure underlying areas of more consensus and constructive engagement. For instance, workshop participants widely agreed that there is a positive value in being sensitive to the unexpected nature of future outcomes and the resultant need for design flexibility to enable adaptation.

However, participants spent more time questioning particular aspects of this flexibility than emphasizing its potential to provide a common point of reference.

Some argued that any approach to designing for unexpected consequences could not get away from the nature of the framing of what counts as the 'expected' or 'unexpected'. Designed-in adaptability and the ability to learn were also contested in terms of the types of systems that should be capable of adapting. For example, Clark recognized that despite adopting a design optimized for adaptability, the Internet technical pioneers did not anticipate some of the crucial non-technical forces that were actually shaping the Internet, such as the new Internet industries. Another set of competing perspectives revolved around questions of the degree to which technology should be adapted to social needs, or whether social innovation should fit technological capabilities.

Although the need for collaboration between different disciplines to address the complex social and technological issues at stake was another common point of reference, the contested ground here was over the precise nature of such collaboration and the expectations of what each party could or should contribute. For example, Clark would like to promote the role of social researchers as designers and engineers of technology-based solutions. However, Angela Sasse, Professor of Human-Centred Technology, University College London, suggested his may be an untypical view. She thinks a more typical view could be the comment of a networking quality-of-service specialist who she once heard exclaim in an off-guarded moment:

> Stuff the users—the whole thing is already too complicated without considering them!

This reflects a concern among many social scientists that some 'user-centred' design studies are driven primarily by 'business cases' that aim primarily to find and test new markets, products, services and styles of living, rather than a broader research concern for understanding the range of user needs. There is also caution about engaging in hands-on design among those social researchers who see a basic contradiction between social science research and that required in some industry-based engineering programmes. This difference was perceived to arise essentially from industry's prime interest in using social research to help define user needs and develop business cases for new products and services, whereas social scientists often employ critical tools to analyse powerful institutions, such as business.

Some typical perceptions among social scientists of their priorities in studying the implications of growing ICT diffusion are summarized in Table 5.

Table 5. Social science views of desirable research on emerging technologies

- Aggregated view of interaction between different technologies, rather than studies of particular technologies.
- Foregrounding social concepts rather than studies of individuals.
- Longitudinal rather than short-term studies.
- Start with what people are doing rather than 'user requirements'.
- Multiple method approach to 'construct' the world of those who will be using the technology.
- Taking account of historical analysis of current technologies.
- Highlighting how people are integrating different forms of technology.
- Comparing old and new technologies.
- Identifying different processes of ongoing social change tied to the use of technologies.

Social scientists were in the majority at the meeting and many participants from computer science and other more technical ICT backgrounds said relatively little in the open sessions. This in itself was an interesting finding, but means that it is beyond the scope of this case study to identify representative engineering-oriented views of research in this field equivalent to those we obtained from social scientists.

For instance, more investigation is needed into how engineers perceive their own research aims and what they expect from social scientists. However, our analysis clearly shows that there was a strong perception that what engineering, industry and government expect from social scientists is at odds with what the researchers themselves think is most valuable.

Social scientists often believe that too many designers, engineers and technologists, particularly in industry, see the main purpose of research as being to enhance specific technologies, in contrast to their own research aims as summarized in Table 5. This leads to their concern that engineers might expect them to be interested primarily in offering 'proof of concept', for example by assisting to develop a user requirement specification for ICT-based products, services and business applications. Expectations that social scientists may be able to smooth away negative social implications to facilitate innovation is another potential source of misunderstanding and/or conflict in multidisciplinary collaboration.

Clark's interest in understanding broader social dimensions of the concept of identity indicates that this view of the engineering approach to social research on ICTs is too limited and a misrepresentation of what many engineers think. Even when the ultimate point of research is seen to be to make the technology more usable or marketable, designers and developers also often aim to ensure that their innovations fit well into the contexts in which they will be used, and are therefore fully aware of the importance of understanding those contexts. In the intertwined web of technology and people connected through the Internet and other ICTs, the diversity and complexity of the different contexts of use could make engineers even more aware of the value of looking to the social sciences to help unravel that complexity.

The crux of many misunderstandings between engineers and social scientists, as well as the opportunities for greater engagements, was illustrated by a comment at the workshop by Clark:

> We are more and more, as technologists, being pushed to say, 'Look, it is no longer acceptable to invent something that is technologically cool'. You actually have to ask why are you building it, what the purpose is and, in many cases, we are being pushed very hard to think about design for values and being told that it is a really important part of your job to be able to explain the values of what you do. On the other hand, I have never seen a paper in computer science which was publishable because it was explained by some artefact of higher value than some other artefact. It is outside the space of what we know how to publish. What is cool in our discipline is to say 'Here is the goal, here is how I got that' … I came here listening to whether there were disciplines that were going to help us make value decisions … [but] when I came up with a social values question I was told [by people in other disciplines] that it is a values question not research.

Clarifying and understanding expectations of each others' contribution as part of a process of seeking common points of reference therefore seems to be one of

the most promising steps towards trying to establish more effective dialogue and partnership between researchers from social science, engineering and other backgrounds. Support for different viewpoints does not necessarily represent expressions of conflicting positions, as each perception or a combination of them could be appropriate in some contexts but not in others.

Achieving Real Engagement

The above analysis indicates a more complex picture of discourse undercurrents than the surface disagreements that may seem to dominate at times. As well as undercurrents of both consensus and dissensus, there were strong manifestations of workshop participants becoming involved in real engagements. These may begin with participants re-stating what others had said in their own terms, for instance by trying out different formulations, terminology or ways of framing the problems. In quite fast-moving and dense discussions this can contribute to a false impression that there is little real engagement.

A good example from the workshop of the way re-statements of a problem can progressively articulate an issue with greater depth or breadth comes from a discussion on the difficulties of being able to predict accurately the social effects of a new technology. This was first stated in quantitative terms by Walter Baer, Professor of Policy Analysis, Pardee RAND Graduate School, Santa Monica, CA:

> Anytime you get an order of magnitude [change] in some technology, it will be used in new and often unexpected ways. So one way of focusing on the social consequences of emerging technologies is to look where those 'order of magnitude' changes are likely to occur over the next five or ten years … [for example] in storage technologies that are becoming so cheap that essentially you don't have to throw any data away any more.

The linearity of 'orders of magnitude' gave way to talk of an alternative conception of 'technology spirals', as expressed by Helen Margetts, the OII's Professor of Society and the Internet:

> [Introduce] some kinds of innovation like that ['sniffers' that automatically detect smells] and you'd immediately have someone who is in the business of bomb-making innovating with something that couldn't be detected by sniffer technology or [the development of] some kind of mask for bad smells—that is technological innovation in itself … You get a spiral which is actually sometimes not entirely productive or entirely counter-productive.

This was subsequently taken up by John Taylor, Professor of Government & Information Management, Caledonian Business School, Glasgow, in moving the discussion on to synergistic effects:

> … I think we are seeing lots of synergistic technology as well … In the work that I'm doing … looking at identity management systems, looking at the way that CCTV is working with RFID, is working with smart cards. Or in a different application area, how identity management is working with big databases, and how all of this is being pulled together. Not only that but the way a lot of masking is going on, so a lot of these synergistic technologies are being put into place for

> very good customer service reasons of high quality service provision … But masked behind it are lots of other kinds of applications, [such as] security applications which I don't think [people in] everyday life have any knowledge of.

Here, important pegs for developing real engagement were provided by apparently shared understandings of terms like 'order of magnitude', 'technology spirals' and 'synergy'. These assisted participants from different perspectives to engage in ways that revealed overlaps and interactions. This highlights how explorations of one perspective can illuminate others, thereby facilitating more effective multidisciplinary collaboration.

The Politics of Language

A core dimension in multidisciplinary work is the need to get people from different backgrounds and cultures, with different knowledge, skills and values, to 'talk about the same thing' in ways that lead to real engagements. Language and terminology can be the root of misunderstandings, as well as the realization of shared knowledge and interest.

This was particularly clear in workshop discussions using the terms 'privacy' and 'identity', which emerged as two of the hingepoints around which revolve a broad range of technological and social psychological, cultural and political issues. Although wider associations of these terms were acknowledged as central issues from the outset, these concepts were initially mentioned as more-or-less standard technical terms (e.g. 'identity management'; 'data protection'; 'security'). However, different interpretations that could be associated with these concepts threaded through the discussions, leading to much debate about what was actually being meant when they were used. The important difference between the terms 'emergence' and 'emergent', discussed earlier, was another significant area of contention. However, some participants might have missed these nuances if they were unaware of the significance attached to co-evolutionary emergence in some complexity sciences.

Another frequently contested term was 'user'. One interpretation is that it is deployed as a distancing term to identify someone who uses the results of technical design, rather than a participant in the design and development process; another is as a designator of the citizens who should be the key stakeholders in outcomes tied to ICT innovation. Although it is therefore important to try to give life and a social context to more clearly delineate those being referred to as 'the user', some feel it is wrong to focus only on users as certain social implications are felt by users and non-users alike.

Even the term 'we' was hotly debated, for example in this comment from Sonia Livingstone, Professor of Social Psychology, London School of Economics:

> I wanted to make a point about 'we'. I heard two kinds of 'we' in the conversation. One is 'we' the elite, designing technologies for the next generation. But the other 'we' is the ordinary people struggling with this stuff and going about their everyday lives. I begin to hear, and I see it in the position papers as well, a lot of different types of claims about the 'ordinary we' who don't know how to find different types of information or who do not trust the Internet. I just wanted to make a point about how important it is to pluralize that 'we' and recognize the diversity here.

Making explicit through a constructive dialogue the diversity of assumptions and values among partners in multidisciplinary research could therefore help to improve mutual understanding and awareness of what each actor feels is achievable. Mediating artefacts, for instance 'mind map'[33] software, or the use of bulletin board design spaces, such as developed in creative ways by INCITE, can also help to support analysis and understanding. Similarly, ICTs can assist to create new forms of virtual and real environments for exploring multidisciplinary collaborations, such as Mindlab.

Conclusions: Towards More Useful Multidisciplinary Research

This paper has revealed some key intertwining threads of consensus, dissensus and engagement that are typical of the complex and nuanced nature of collaborative discussion, argument and engagement. The multidisciplinary OII–MIT workshop on which this analysis is based is just one example of such a collaboration, but one that is sufficiently illustrative of research in this field to enable the findings reported here to be of wider interest and value. This has shown that the preconceptions and values brought by participants in collaborative activities to help them make sense of what is being said or done also reflect wider frames of reference developed within disciplines.

When these frames are mismatched or inaccurate, any divergences can be exacerbated. The complexity involved in trying to forge more effective real multidisciplinary engagements was illustrated by the following comment from Leah Lievrouw, Professor, Department of Information Studies, University of California, Los Angeles:

> To get the computer scientists to know what is being done in inter-personal communications, to get the sociologists to know what is being done by the economists, to get the psychologists to know … back and forth. It is extraordinarily hard and one of the things I hope happens here is that we get a renewed commitment to multidisciplinarity approaches.

A number of ideas identified in our analysis which could contribute to overcoming these difficulties are summarized in Table 6.

Table 6. Guidelines for improving multidisciplinary research

- Attempt to make explicit the values of members of the collaboration and their perceptions of the aims of the research, including constructive discussion of these differences aimed at tackling misunderstanding and establishing realistic expectations for the kinds of input each partner is best able to bring to the partnership.
- Seek to build on real engagements around mutually understood points of reference, even in the absence of perfect agreement and without necessarily seeking consensus.
- Experiment with innovative multimedia spaces to stimulate new forms of productive dialogue.
- Enhance communication between disciplines and sectors through relevant training programmes and the provision of necessary ongoing resources and time allocated to improving communication skills.
- Establish appropriate assessment and reward frameworks and processes that give similar weight to multidisciplinary and within-discipline research, including joint authorship across disciplines.
- Encourage the migration of scholars to spend time in other disciplines.
- Explore ways of integrating the many academic staff now on short-term contracts into the collegiate experience that can breathe life into effective multidisciplinarity.
- Consider the inclusion of policy makers, business and industry practitioners, users and other stakeholders in collaborations with multidisciplinary academic experts.

Enhancing the Contribution of Social Research to Policy and Practice

In order to influence policy and practice more than has been achieved to date, stronger efforts are needed to involve a broad spectrum of stakeholders. These need to reach beyond those concerned with policies directly related to ICTs, such as those directed at digital divides[34] or telecommunications regulation. MindLab and INCITE exemplify experiments with innovatory collaborative spaces, processes and communication that could help to overcome long-known barriers to successful collaboration. Rethinking broader information flows and infrastructures used in policy analysis could also be valuable. For instance, networked digital technology could help to mobilize more stakeholders with relevant experience to play a more direct role in the interactions leading up to policy formulation, rather than relying primarily on a predesignated set of policy professionals to draw together knowledge from different sources.

Identifying the most realistic best practice advice can be greatly assisted by ensuring lessons learnt are shared between projects, departments, organizations, researchers, users and other relevant actors. However, government and the private sector have been generally reluctant to undertake open analyses of failures tied to the introduction of new ICTs as they could reveal serious management, operational and financial flaws. The use of consultancies can also militate against institutional learning as the contractor may preserve for themselves any lessons learnt, which has been a particularly acute problem in ICT developments in the public sector. Policy makers and researchers should therefore investigate ways of undertaking and sharing knowledge from studies of failure. This could also help policy makers to live with the likelihood of non-catastrophic failures by offering a better understanding of how an openness to studying failures can help to minimize future risk.

Issues of equity within and between countries pose crucial policy challenges for governance related to ICT development and use at all levels, for example in the allocation of resources to address urgent social problems like poverty and water shortages as well as for building digital infrastructures and capacities for using ICTs. The recent substantial shift in overall Internet use towards Asia is also creating ever-more varied Internet experiences around the world,[35] which is generating complex, often competing, demands on global Internet governance policies that seek to balance the Internet's open design principles with different cultural, national and international priorities.[36]

In some circumstance, a shock tactic of pointing to a potential catastrophic outcome if something is or isn't done can be an appropriate way of alerting the attention of a wide range of stakeholders, as in the 1980s when fears about the 'micro' creating huge unemployment alerted many governments to the need for policies to promote ICT literacy and use. Alternatively, the highlighting of 'pots of gold' that can accrue by following a certain course can have a similar effect in some contexts.

Future Research to Move Beyond the Limits of the Current Study

Although the authors believe the social researchers who attended the workshop could not be representative of this field as a whole, we believe the difficulties of engagement reported here are of general relevance. Beyond the representativeness of the participants, another key limitation of our analysis of the workshop discourse is that it deals only with the words of those who spoke at the workshop. While we

talked to participants informally over breaks, and in subsequent meetings about the workshop, further research is clearly required to hear more systematically the engineering voice on these matters. This would assist in fleshing out a more nuanced map of the aims and perceptions of different disciplinary approaches and in teasing out the reasons for misconceptions and different perspectives between disciplines. The views of policy makers, civil society advocates and other key stakeholders also need to be solicited, and the international scope needs to be extended.

The patterns and themes reported here are also part of the process of learning how to enhance similar events to the OII–MIT workshop studied here. For instance, there seems to be a distinct favouring of the use of concrete contexts examined by small groups or teams, whose findings could be input to plenary sessions that seek to identify wider generalizable findings. Experimentation with the new kinds of multimedia spaces and approaches mentioned above could also be of value, as would the formulation before a meeting of at least a general framework that aims to establish some basic understandings of the key issues to be explored and the established and emerging methods, and past insights, that can contribute to future multidisciplinary collaborations in this area.

Oxford University's e-Horizons Institute[37] is one specific effort to continue to build on the analyses reported in this paper. This is being done by engaging with others across institutions and disciplines, including with MIT and other collaborating centres, to further ongoing multidisciplinary research and training programmes that adopt a broad view of the future of digital technologies and their societal implications.[38]

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Notes and References

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38. Other similar activities in which the OII is involved include the Oxford e-Social Sciences (OeSS) Project and e-Horizons Institute and the development of a multidisciplinary PhD in Information, Communication and the Social Sciences at the University of Oxford (see http://www.oii.ox.ac.uk).