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Experience with New Tools and Infrastructures of Research: An Exploratory Study of Distance From, and Attitudes Toward, e-Research[1]

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Abstract *e-Research initiatives have been launched around the world, but have they captured the imagination of researchers across the disciplines? This paper reports on a web-based survey designed to gauge awareness of and support for e-Research initiatives. Early adoption and interest in e-Research practices represent a wide range of methodological traditions, but those most interested in e-Research tend to be among a cohort of more recent graduates of doctoral programmes. However, greater certainty and support is driven largely by proximity to e-Research. This finding reinforces the value of efforts to engage more social scientists and other researchers in e-Research, such as through demonstrations, training or other ways of providing hands-on involvement. Doctoral and early career training might be the most fruitful arenas for engagement.*

Keywords: e-Research; e-Social Science; attitudes; survey

Introduction

Advances in information and communication technologies (ICTs), from the Web to the Grid, are enabling transformations in the ways in which scientists and researchers ranging from the natural sciences to law and social sciences to the humanities do their work. Much of the work to develop research and technologies in this area falls under programmes going by names including e-Science, e-Social Science, digital humanities, cyberinfrastructure and others, depending on national funding contexts. Like Borgman, we subsume all of these more specific efforts under the more general term of e-Research.[2] Following Meyer and Schroeder, by 'e-Research we mean the use of digital tools and data (collectively research materials) for the distributed and collaborative production of knowledge'.[3] This includes the use of advanced Internet, Grid and related information and communication technologies

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(ICTs) to support research. In practice, this includes such ICTs as Web 2.0 research tools, simulation environments and virtual research environments.

The changes in everyday scientific practice associated with e-Research extend to what researchers discover, with whom they collaborate, how they share their work, what methods are used to report their findings, and what knowledge they require to remain current in their field. As significant as these innovations could be, there is a perception among early adopters of e-Research that awareness and support for e-Research is quite limited.[4] In fact, with regard to the e-Social Science initiatives active in the United Kingdom, some proponents had been reluctant to promote e-Research more aggressively due to concerns that many social scientists would see technological change as a threat to existing practices and technologies that underpin their present stature in the field.[5]

To empirically explore whether these concerns have merit, we designed an approach for gauging awareness of e-Research, focusing on the social science community, and exploring the range and determinants of attitudes toward e-Research.[6] A web-based survey anchored this effort. We employed mailing lists, listservs and websites to obtain responses to the survey from 526 respondents within the UK and worldwide.

Theoretical Expectations

When trying to understand new technology adoption, there are a multitude of theoretical frameworks from which to choose. Approaches used elsewhere in the literature include the theories of the diffusion of innovations,[7] a Technology Acceptance Model (TAM)[8] and literature on computerization movements (CM),[9] among others. Each of these frameworks, while appropriate in certain contexts, was not the best choice to follow in this research. The diffusion of innovations approach focuses on how innovations diffuse over time, resulting in the now familiar S-shaped adoption curve with early adopters at the leading-edge and laggards at the tail. For e-Research and particularly e-Social Science, we do not have the time series data necessary to understand patterns of diffusion, although the present research can provide some baselines. That said, e-Research was in the early adopter phase in 2008, as majority uptake had not occurred. The TAM model, and its offshoot the Unified Theory of Acceptance and Use of Technology (UTAUT),[10] posits that within organizations, acceptance and use of technology can be modelled using a number of key measures, including those relating to experience, voluntariness, gender and age.[11] Again, for our purposes, this model is not appropriate because of its focus on behaviour within organizations implementing technology projects, as opposed to our focus on researchers working in fields and disciplines that operate outside the organizational boundaries within which individuals conduct their work. Finally, the CM framework focuses on understanding the claims made about technologies and how the discourse surrounding these claims takes place within an ecosystem of competing institutions and organizations. However, in this research we have focused less on the discourses about e-Research and more on the self-reported behaviours and individual attitudes of researchers toward early developments related to e-Research and e-Social Science. To do this, we drew on four alternative theoretical expectations about the diffusion of e-Research tools and techniques: research cohorts, methodological politics, the certainty trough and experience technologies.

Research Cohorts

The first potential explanation for the relationship between attitudes toward e-Research and intellectual proximity to developments in e-Research is a cohort explanation. This model posits that different cohorts of researchers will be exposed to different types of methodological tools and fashions, which will shape their uptake of tools and methods throughout their careers. Since recent graduates are more likely to have been using the Internet and related information and communication technologies (ICTs) during their training, it is likely that they will be most comfortable in extending the use of ICTs into new methodological approaches. A number of studies have documented the shifting media habits of students and the potential implications for their acceptance of digital technologies, such as the Internet.[12] From this perspective, older cohorts of researchers are more likely to be conservative in their approach to new research technologies because many technological transformations require change in research practices—behaviour change. Since researchers' practices have in most cases proven effective in the past, successful practitioners are likely to be resistant to change.

Any cohort of researchers will include considerable variation across individuals. Nevertheless, this model would suggest a general trend toward greater innovative practices over time, as newer cohorts replace their more conservative elders.

Methodological Politics

An alternative expectation relates to the political economy of disciplines and methodological camps. From this perspective, certain disciplines (such as humanities) have been viewed historically as being less actively engaged with e-Research, because of factors such as the highly contextual and interpretive nature of much of the evidence.[13] Many expect that the humanities are not as amenable to digital approaches as are the sciences.[14] In contrast, some methodological approaches, such as quantitative analysts working with large datasets, might have more to gain than qualitative researchers, and therefore be more pro-actively engaged in e-Research. This perspective suggests that support for e-Research could be driven by the momentum behind different methodological approaches that are more or less compatible with e-Research. Those methodological approaches more advantaged by e-Research will, from this perspective, have more positive attitudes toward e-initiatives. Those who stand to benefit most, will be more supportive.

Certainty Trough

An alternative expectation is linked to one's distance from a technology or practice. MacKenzie's[15] notion of a 'certainty trough' provides a theoretical perspective on the likelihood that social proximity to e-Research would be a strong factor shaping opinions about its potential. The certainty trough posits a U-shaped relationship between distance and certainty with peaks of uncertainty at both ends of the social proximity scale.[16] Those alienated from a particular technology, or committed to another technology, would be uncertain of the value of the technology. Those committed to or using any given technology, such as the tools of e-Research, would be more certain of its value, and thus display low uncertainty. However, those directly involved with the production of the technology, such as those building e-Research infrastructures, would be aware of all the possible risks

and uncertainties, and therefore would be less certain than the committed. The difficulty with this model is accurately measuring social proximity and certainty, each of which must be constructed using multiple measures.

Experience Technology

A variant on the certainty trough is the concept of an 'experience technology' in which greater proximity to a technology, such as experience with use, leads to greater certainty and trust.[17] This is not in opposition to the idea of a certainty trough, but suggests that uncertainty only rises among those very proximate to an innovation, directly involved in its production, and who are thus most aware of the uncertainties. In this model, rather than a U-shaped curve, we would have something closer to an S-shaped curve, with non-users displaying high levels of distrust toward a given technology and expert users displaying high levels of trust toward the technology in question. Only at the high end of this experience scale, where individuals such as system developers would be placed, would there be a downturn in trust over the details, given higher levels of awareness of the specific limitations of a particular implementation of the technology. However, for most users, greater experience with using a technology fosters more certainty toward that technology, in general, compared with those more distant from the technology. Experience can be operationalized at the most basic level as elapsed time using a technology as well as by taking into account more detailed levels of exposure to a technology, such as through training, frequency and intensity of use, and the number and types of tasks accomplished using the technology.

Methods

In order to explore awareness of, and attitudes toward, e-Research, we designed a web-based survey instrument. It was targeted at social scientists, but open to researchers from any discipline, since computer scientists and researchers from other disciplines were often involved in e-Social Science initiatives. It was also designed to be completed by non-researchers, such as administrators, who were also part of e-Social Science teams.

The survey instrument sought to describe the ways in which the respondents use software tools to enable research, and to measure attitudes and awareness of developments in e-Research. The survey covered the use of e-Research tools, such as the uptake of specific e-Research tools in the social sciences, enabling us to determine the extent to which researchers are engaging in e-Research, and how this shapes their attitudes. This article reports the results of this exploratory survey that are concerned with the relationship between methodological practice, proximity to e-Research, and attitudes toward e-Research, generally, and e-Social Science in particular.

Sampling Strategy

The survey was pre-tested in November 2007. From January to March 2008, the revised survey was distributed using two complementary mechanisms.[18] The first mechanism relied on a targeted mailing to a set of mailing lists obtained from the UK's National Centre for e-Social Science (NCeSS) (N=615) and the Oxford Internet Institute (OII) contact database (N=1,761). The NCeSS list incorporated

Table 1. Response rate

Source	Invitations (*N*)	Responses (*N*)	Response rate (%)	% of Sample
NCeSS List	615	141	22.9	26.8
OII List	1761	180	10.2	34.2
Open mailings	n/a	205	n/a	39.0
Total		**526**		**100.0**

individuals who specifically asked to receive information about e-Social Science. The OII mailing list was more general, covering individuals interested in the work of the OII, which is much broader than e-Research. Individuals on these mailing lists were sent personalized invitations to the survey, with a follow-up request sent approximately two weeks after the initial request only to those subjects who had not yet completed the survey (Table 1). The invitations were sent and tracked using DatStat Illume, which tracks responses via a code embedded in the invitation to participate and can follow up only those people who have not started the questionnaire, or who have started it but not completed it. The survey responses were also collected using Illume, and exported to SPSS and SAS for analysis.

The second distribution mechanism was a separate, generic version of the same survey that allowed anyone to complete the survey by visiting a project webpage. This generic version was announced on a number of mailing lists, including the ESRC National Centre for Research Methods newsletter, the NCeSS weekly and monthly newsletters, the Cybersociety Live mailing list, the Association of Internet Researchers (AoIR) mailing list, and the Communication and Information Technologies section of the American Sociological Association (CITASA) listserv. Recipients were also asked to forward this request to other appropriate lists.

The survey received a total of 526 complete responses (Table 1). There were also some additional respondents who did not complete the survey, but 85% of people who began the survey completed at least 70% of the instrument. These complete and nearly complete responses were included in the total sample of 526. The responses that were excluded from the analysis due to non-completion were predominantly those who dropped out immediately after the initial introduction, which explained the focus of the survey on e-Research. While the introduction invited all researchers to complete the questionnaire, even if they were not personally aware of e-Research or e-Social Science initiatives, the overall pattern of feedback and responses indicated that the dropouts were primarily those completely uninterested in e-Research who decided that they weren't sufficiently interested or informed to complete the survey once they read the overview information.

Characteristics of the Sample

The sample for this survey is far from random, as it is skewed towards those interested in e-Research through a process of self-selection. However, recognizing this bias, the response itself can be interpreted as helping to illuminate the focus of this research. The bias results from a combination of the characteristics of those invited to take the survey, and further by the characteristics of those who chose to complete the survey. In regard to the former, we targeted the survey towards those likely to be interested in e-Research. In particular, the NCeSS mailing list mainly includes individuals who have expressed an interest in following developments

occurring at this centre and within the subject area of e-Social Science. To balance this somewhat, the invitation sent to the additional e-mail lists identified above was designed to elicit participation from a wider variety of users by asking for their participation in a survey focusing 'on the role of information and communication technologies such as the Internet in social research' and continuing with 'Even if you aren't currently using research tools, we encourage you to complete the survey'.

The inclusion of the OII mailing list also potentially expanded participation, since that list is made up of people interested in research about the Internet in general, but not, in most cases, about e-Social Science. As described below, however, the respondent profile shows that the survey was able to attract responses from those interested in e-Research, but considerably less so from the disengaged.

The NCeSS list, comprised of individuals who had already expressed an interest in e-Social Science, yielded a response rate of 23%, which approaches the rate achieved by other web-based surveys. The OII list captured a larger range of individuals, with a more general interest in the societal implications of the Internet, and had a significantly lower response rate of 10%. This differential response rate reinforces our view that dropouts and non-responders are primarily those unengaged with e-Research; the OII list is more general, and shows a much lower response rate. In addition, those respondents originating from the OII list showed a much higher propensity to reporting that they were sceptics about e-Social Science (56%) than those recruited either through the NCeSS (25%) or general (19%) lists.

The data in the survey itself also support the interpretation of the sample being skewed towards those with an interest in e-Research and e-Social Science. Across the sample, when asked: 'How would you describe your interest in e-Social Science initiatives?', only 7% said they were 'not interested at all', while 57% reported that they were either 'interested' or 'very interested'. This underscores the difficulty in assessing the attitudes and habits of the truly disengaged, without field interviews or incentives for participation by the disengaged. However, the survey does incorporate variance in interest levels and provides a useful perspective on the characteristics of those interested in, and using, e-Research.

In addition to being skewed towards those interested in e-Social Science, the sample was also predominately composed of respondents from the UK (47%), doctoral degree holders (56%), and social scientists (55%), as shown in Table 2. This geographical and disciplinary mix of responses is understandable as the survey was fielded by a UK social science unit, based primarily on UK mailing lists. Gender was biased towards males (57%) in the sample, with males more heavily represented than females across all disciplines, which is characteristic of the e-Research area as observable by attendance at relevant conferences.

With respect to age and cohorts, the sample was reasonably distributed across age groups, with about one quarter of respondents in each 10-year span, but is skewed in terms of the date they earned their highest degree. Some 43% of the respondents received their highest degree after 2001, compared to 25% of the sample earning their highest degree in the 1990s, and 13% from the 1980s. The relative prominence of those with recent degrees supports the expectation that a cohort of early researchers (regardless of age) might have more interest in e-Social Science (Table 2).

For the aims of this study, even with the limits discussed here, the sample provides sufficient variance to allow us to describe the attitudes, demographics and

Table 2. Characteristics of the sample (n=526)

Category	Response	% of sample
Age	25 or under	4.1
	26-35	25.6
	36-45	29.3
	46-55	23.7
	56-65	13.6
	Over 65	3.7
Gender	Male	56.6
	Female	42.1
	No answer	1.2
Degree	Lower than a doctoral degree	44.5
	Doctoral degree or higher	55.5
Year of degree	1970 or before	9.3
	1971-1980	10.3
	1981-1990	12.7
	1991-2000	24.9
	2001 or after	42.8
Discipline	Social Sciences	54.9
	Computer Sciences & Engineering	15.6
	Arts & Humanities	5.5
	Natural & Medical Sciences	4.2
	Law	3.0
	Other	11.6
	Don't know / no answer	5.1
Country / region of residence	UK	46.8
	Other Europe	17.7
	North America	14.1
	Australia and New Zealand	4.6
	East Asia	1.9
	Global south	15.0

tool uses of those interested or engaged in e-Social Science and e-Research. Therefore, while this sample is not representative of a random sample of the population of researchers, it does reflect a larger sample of researchers with some interest in e-Research than has been collected previously.

Findings

There is a general perception, expressed in public and private by leaders of e-Social Science efforts, that the social science community lacks a sufficient level of awareness of e-Social Science, and that this has had a braking effect on the uptake of advances in information and communication technologies as tools for social research. However, this perception has been based on the experience of project managers, rather than on empirical research. To begin to bridge this gap, this survey was designed, in part, to answer the following questions: are levels of awareness, and support, related to patterns of methodological approaches, and disciplines, cohorts, or to the researcher's proximity or distance from e-Research? Do the generational differences across cohorts account for different levels of support for e-Research? Is there evidence to support the notion that e-Research is a technology exhibiting a certainty trough, as discussed above, or alternately, does the evidence support the idea that e-Research is an experience technology?

We sought to gauge awareness and support for e-Social Science through a series of questions that focused on three areas: (1) perceived impacts on the quality of research; (2) the usability of e-Research tools; and (3) funding. These attitudes form the basis of indices of support and uncertainty. After describing basic attitudes toward e-Research, we will describe the indexes created to examine the relationships between fields, proximity and attitudes toward e-Research.

Attitudes Toward e-Research

Overall, we found two general aspects of the beliefs and attitudes toward e-Research. First, there was widespread uncertainty across the sample, with many respondents not expressing an opinion about many issues. Secondly, among those with opinions, there was a generally strong level of support.

The top portion of Figure 1 displays the responses at each end of the scale for four items concerning the perceived impacts of e-Research on the quality and nature of research.[19] Generally, there is a positive attitude towards the role of e-Research in that respondents tend to believe that e-Research does not undermine the quality of social science research, and enhances both their personal and their team's productivity (Figure 1). The greatest level of agreement (59%) is with the claim that 'Many new scientific questions will require the use of e-Research tools', suggesting a widespread belief among those interested in e-Research developments that new otherwise inaccessible avenues of research are being opened by these technologies. However, large proportions of the respondents indicate that they are uncertain about these impacts, saying they 'don't know' or have 'no opinion'.

The middle portion of Figure 1 indicates that there is a similar pattern of responses concerning the usability of e-Research tools. Most respondents believe that these tools are 'already useful' (60%). Less than one quarter (21%) believe e-Research is 'more hype than reality'. Very few (20%) believe these tools are 'easy to use', and three quarters (77%) believe that more training is needed in e-Research. Also related to usability, nearly three quarters believe that e-Research raises 'new ethical issues' (Figure 1). As with quality, many respondents were uncertain about the usability of these tools, with fully 43% not knowing if they are easy to use (Figure 1).

There is a generally positive view towards increasing funding for e-Research, as shown in the bottom portion of Figure 1. Given that respondents to this survey over-represent those who are more interested in e-Research, it is perhaps not surprising that only one in five respondents believe e-Research is adequately funded. Respondents indicated that more funds should be targeted to 'developing e-Research infrastructure' (52%) and 'supporting e-Research project proposals' (52%). Nevertheless, here again, there is a high level of uncertainty, with over half of respondents not knowing whether or not e-Research is adequately funded.

This general pattern of support, with high levels of uncertainty, is reinforced by a self-categorization of respondents. Respondents were asked: 'With respect to e-Social Science, would you say you are a critic, sceptic, observer, enthusiast, or advocate or promoter?' Only 8% of respondents said they were a critic or sceptic, which we have called 'opponents', while about one third (33%) are promoters, saying they were an enthusiast or advocate-promoter. However, the largest proportion (43%) said they were an observer, which we've called the 'spectators'. In short, we have found among those with an interest in e-Research a large proportion of spectators and a smaller proportion of promoters, and a marginal number of opponents (8%) and the disengaged (10%) (see also Table 5).

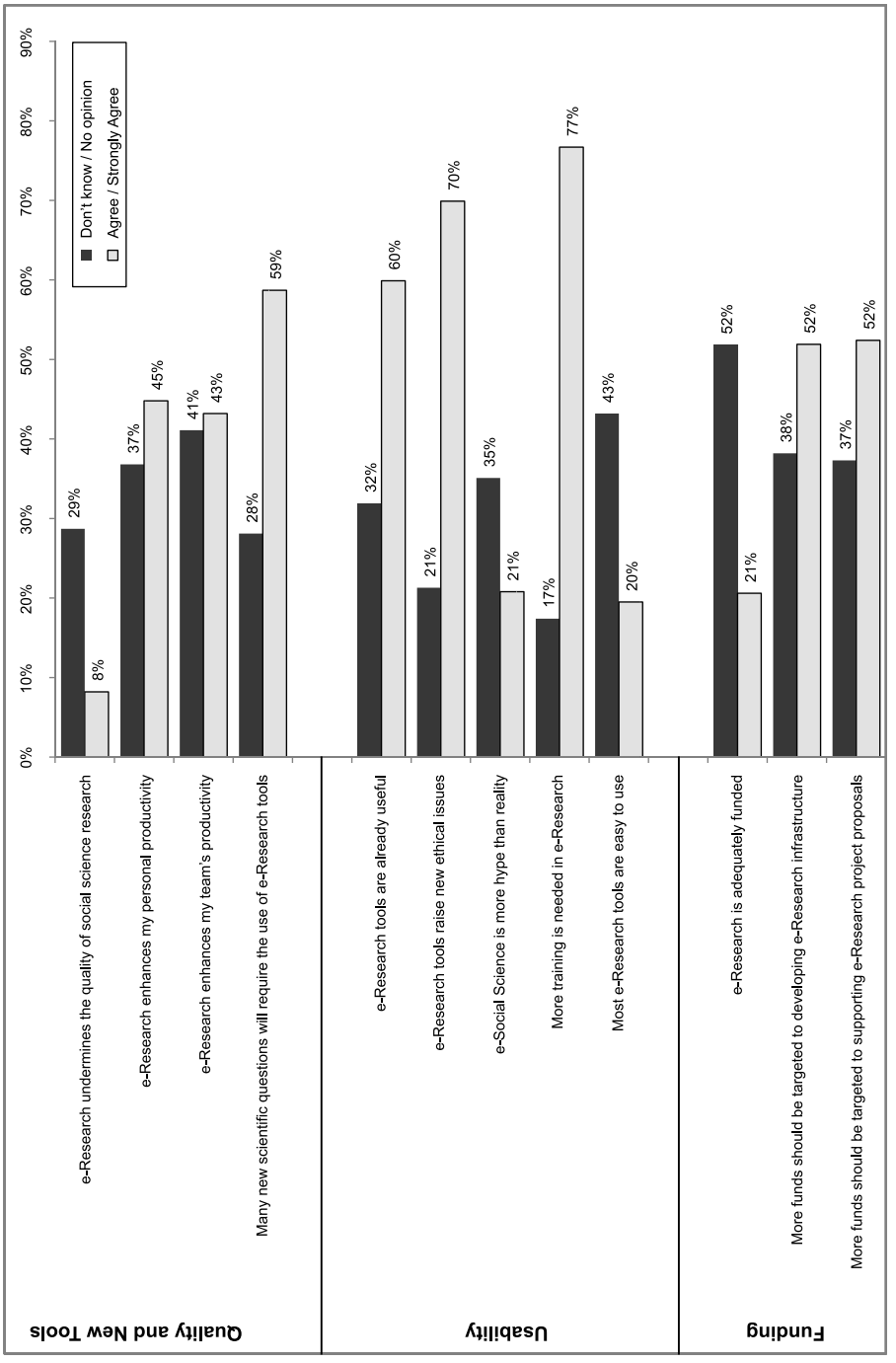

Figure 1. Attitudes towards e-Research (n=526).

Indices of Key Variables

Based on these responses, we constructed three indices. An index of support for e-Research was developed as an additive index, consisting of the number of positive responses to the statements (shown in Figure 1) about e-Research, but excluding the questions on adequacy of funding and whether e-Research raises new ethical issues. These two measures were excluded from the support index because of the potential for opponents of e-Research to indicate that it is 'adequately funded', and that it does not raise new ethical issues. A respondent could think that e-Research raises new ethical issues without either supporting or not supporting e-Research in general. The number of positive responses was then collapsed into three categories: high support (8–10 positive responses), medium support (4–7 positive responses) and low support (0–3 positive responses).

An 'uncertainty index' was also developed as an additive measure, defined by the number of 'don't know' responses to questions specifically about e-Research (Figure 1). The number of uncertain responses was then collapsed into three categories: high uncertainty (6–12 uncertain responses), medium uncertainty (2–5 uncertain responses), and low uncertainty (0–1 uncertain responses).

Finally, we developed a scale for proximity that was constructed by creating an additive index, where respondents were given one point if they had registered to be on the NCeSS listserv; one point was added if they participated in an Access Grid meeting, and two points if they helped organize one, since the Access Grid is one e-Research tool. We also asked: 'A number of social and computer scientists are involved in developing advanced Internet and Grid technologies to support social science research. This is sometimes called "e-Social Science". Are you aware of developments in this field?' One point was added to their score if they said they had 'followed' e-Social Science 'closely', and two were added if they said 'yes, I am personally involved in such developments'. This yielded a scale from 0 to 5, which was then grouped into three categories, based on their level of proximity: distant (0 points), marginal (1–2 points), and proximate (3–5 points).

Factors Shaping Attitudes Toward e-Research

Using these indices and other measures discussed below, we then asked whether attitudes are being shaped by disciplinary and methodological approaches, defining a politics of e-Research, by cohorts, or by proximity to e-Research, as suggested by the certainty trough, which was discussed above.

A Politics of Methods?

To develop a summary indicator of research approaches, we used SPSS to conduct a cluster analysis on a set of items that spanned methods (qualitative or quantitative research), skill sets (coder or user),[20] and collaborative styles (sole researcher or one of a team). Using this method, four types of researchers emerged from the data, as indicated by the bold factors highlighted in Table 3:

1. Lone Researchers, who are often the sole investigator, often or always coding or designing applications, and employing a mix of quantitative and qualitative techniques;

2. Team Players, who usually work as members of a team, develop and use e-Research, and use a mix of quantitative and qualitative methods;
3. Quals, who are primarily users of e-Research, and identify themselves as qualitative researchers, most often as a sole investigator; and
4. Quants, who usually work as members of a team, often coding or designing their own applications, and relying more on quantitative than qualitative research.

Among our respondents, the cluster analysis identified nearly a third (29%) of the respondents as Quals, followed by Team Players (26%), Lone Researchers (23%), and finally, the Quants (12%).

Using these categories of research approaches, it is clear that disciplinary and methodological practices do not have a strong relationship with who uses and who does not use advanced ICTs in the research process. For example, interest in e-Research across our sample was relatively similar across a range of methods. For instance, 59% of both qualitative researchers and survey researchers were 'interested' or 'very interested' in e-Research. The methodological and collaborative approaches of researchers help to illuminate patterns of e-Research practice, but they do not account for differences in attitudes towards the diffusion of e-Research across the sciences and humanities. For example, Figure 2 shows that one of the only significant links between types of researchers and attitudes was that Quals were somewhat less likely to believe that 'new scientific questions will require the use of e-Research tools' (49% of Quals believed this was the case, compared to 60–65% of the Quants, Team Players, and Lone Researchers).

Table 3. Factor analysis of approaches to research (n=526)

		Empirical clusters			
		Lone Researcher	**Team Player**	**Quals**	**Quants**
Involvement with methods development	User of research methods	0.47	0.34	**0.74**	0.18
	Both a user and developer	0.45	**0.66**	0.22	**0.55**
	Methodologist, developing or studying methods	0.08	0.00	0.03	0.27
Types of methods	Quantitative	0.19	0.07	0.09	**0.57**
	Mix of quantitative and qualitative	**0.66**	**0.86**	0.18	0.04
	Qualitative	0.15	0.07	**0.72**	0.39
Application coding	Never or rarely code or design applications myself	0.00	0.83	**1.00**	0.05
	Often or always code or design applications myself	**1.00**	0.17	0.00	**0.95**
Team orientation	Sole investigator on all/most projects	**0.45**	0.06	**0.53**	0.00
	Sole investigator on half of projects	**0.42**	0.07	0.23	0.00
	One of a team on most/all projects	0.13	**0.87**	0.23	**1.00**
	Percentage of sample in each cluster	**23.0%**	**26.2%**	**29.1%**	**12.0%**

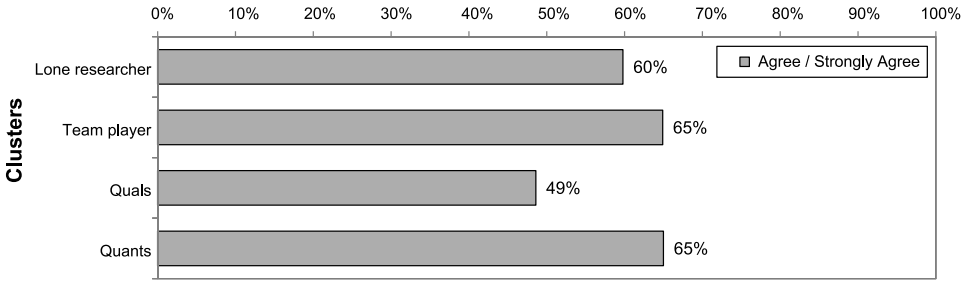

Figure 2. Approaches to research and the impact of e-Research: percentage of respondents agreeing or strongly agreeing with statement 'Many new scientific questions will require the use of e-Research tools' (n=526).

Ages and Cohorts of e-Researchers

We have highlighted the degree to which the sample is skewed toward respondents with degrees earned after 2001. The relative prominence of those with recent degrees suggests that a cohort of early researchers (regardless of age) might have more interest in e-Research. It is the case that more recent graduates are more interested and supportive of e-Research, but the relationship is more complex than initially presumed. First, as the next analytical section will show, interest in e-Research is more consistently associated with proximity, which is more common among the more recent graduates. In this case, cohorts may then have a more indirect effect by being associated with proximity to e-Research tools. In addition, age and training co-vary, making the independent effect of each factor more problematic.

When we examined the age of respondents and the date they earned their highest degree, neither age nor the year of degree showed any significant independent effect on their support for e-Research, as measured by the support index described above. There was, however, a significant effect of the year of degree within one particular age group, the 36–45 year old group. Within that age group, earning a degree more recently (since 2001) was correlated with increased support for e-Research over those earning their degrees prior to 2001.

While this effect is not conclusive, it suggests a possible pattern related to this cohort that would be interesting to follow up in future studies. One speculation is that this group of scholars in early middle-age are transitional in the sense that research technologies changed dramatically during their formative years as researchers. Researchers older than 45 were generally trained in an era without the personal computer or the Internet as core infrastructures for their research, as they only became widely used after they had started their academic careers.[21] Researchers younger than 35 had personal computers and the Internet available to them at relatively young ages, particularly by the time they reached university education.

The generation in-between, however, straddled the pre-Internet and Internet eras. For those who went straight through college and graduate school in their 20s, much of their university training with technology would have pre-dated the Internet, although it would have generally relied on computing resources such as word processing and statistics packages. For those in this age group who completed their higher education after 2001 when they were in their 30s, their final post-graduate

Table 4. Support and uncertainty by proximity (n=526)

		Proximity			
		Distant	**Marginal**	**Proximate**	**Total**
Support	High support	23.1	**44.4**	**44.1**	33.3
	Moderate support	29.4	36.4	32.4	32.2
	Low support	**47.5**	19.2	23.5	34.6
Uncertainty	Certain	23.1	48.3	**66.2**	37.8
	Marginal	28.2	32.9	23.5	29.0
	Uncertain	**48.7**	18.8	10.3	33.2

training would have come once academic computing and Internet-based resources had become ubiquitous. Within this group only, the year of their highest degree has an effect on their index of support, and a more recent degree relates to a higher support index score. In the other age groups, the year of degree makes no difference.

Thus, our data tentatively suggest that for these transitional researchers, having earned a final degree later in life than their generational counterparts who earned a degree earlier in their careers appears to correlate with greater support for e-Research. These data are suggestive, but not conclusive. For example, explaining this correlation would require additional exploration into the differences between faster and slower degree earners in this group of researchers.

Proximity

We looked at the relationship between proximity to e-Research, as measured by the index discussed above, and levels of support for and uncertainty about e-Research. Proximity is associated with support for e-Research as well as with levels of uncertainty, providing support for a variant of the certainty trough, that is, the notion of an experience technology. As Table 4 shows, those most distant from e-Research are most likely to express the lowest level of support, while marginal and close proximity are related to higher levels of support. Thus, we are able to conclude that there is a tendency for those more proximate to be more supportive (Table 4). There is little difference in these data between the marginal and proximate categories with regard to levels of support, which may indicate that a major challenge for those wishing to extend the influence of e-Research lies in reducing the disengagement of those most distant from e-Research. Since the marginally close researchers already express similar levels of support to the most proximate researchers, it is possible that existing efforts will continue to draw both groups into support for e-Research practices at a similar rate. More distant researchers, however, may require additional effort and new approaches if they are to become more engaged in the e-Research domain.

Proximity is related also to greater certainty about e-Social Science. Those most distant from e-Research are most likely to be uncertain (49%), while those most proximate are the most certain (66%) about its implications and use (Table 4). Likewise, uncertainty is associated with being disengaged from e-Social Science. Both opponents and promoters of e-Research are more likely to have a higher level of certainty than are either self-identified spectators or the disengaged (Table 5).

Table 5. Uncertainty and perspectives on e-Social Science (n=526)

		Perspective				
		Opponents	**Spectators**	**Promoters**	**Disengaged**	**Total**
Proportion of sample[a]		7.6	43.2	33.3	9.9	
Uncertainty	Certain	**40.5**	19.7	**68.1**	8.7	37.9
	Marginal	27.0	33.7	23.5	30.4	29.1
	Uncertain	32.4	**46.6**	8.4	**60.9**	33.0

Note: [a] The total is less than 100% as 6% of the respondents did not answer the question relating to their perspective on e-Social Science.

Summary and Conclusion

This article reports on an exploratory project, based on a self-selected set of respondents to a web-based survey, rather than a random probability sample. Nevertheless, the findings are indicative of characteristics that define interest in e-Research among the social science and related research communities.

Given the response to this survey, interest in e-Social Science seems to be greatest among more recent graduates, suggesting that the more recently educated cohorts of researchers may be the most likely to be open to new technologies and practices.

Within this context, we sought to determine whether methodological practices or proximity to e-Social Science shaped attitudes toward e-Research, as suggested by conceptions of a certainty trough and an experience technology. The findings suggest that methodological practices may be over-estimated, since researchers from a wide range of disciplinary and methodological perspectives were interested in e-Social Science. However, proximity mattered. Those most proximate and engaged in e-Research were both more supportive of e-Social Science and more certain in their beliefs. However, rather than support a certainty trough, the pattern of findings lent support to e-Research as an 'experience technology' in line with other research on trust in the Internet in everyday life.[22]

However, more systematic research should be conducted to confirm the findings of this exploratory project. A follow-up study, repeating this survey with a more robust systematic probability sample, could help establish a population baseline and then track changes in attitudes towards and uses of e-Research in subsequent years. This pilot study of apparent patterns in 2008 has provided a valuable basis for that work. Within the proposed systematic probability sample, it would be important to include particular fields of interest, such as social scientists, across different national contexts.[23]

e-Research initiatives have been launched around the world, but little is known about their visibility and uptake by researchers across the disciplines. This web-based survey suggests that a significant group of researchers are aware of e-Research initiatives, enabling us to identify some evidence of where adoption is likely to occur, and the factors related to support for these initiatives. Early adoption and interest in e-Research practices represent a wide range of methodological traditions, but those most interested in e-Research tend to be among a cohort of more recent graduates of doctoral programmes. Also, while there is a generally positive orientation towards the potential of e-Research among those interested in its

development, many remain spectators or disengaged from new e-Research practices, and, therefore, relatively uncertain of its value to the social sciences. Greater certainty and support of e-Research is driven largely by proximity to e-Research.

These findings could help shape initiatives aimed at supporting the diffusion of e-Social Sciences, and e-Research, more generally. More exposure to e-Research initiatives, based on these findings, is likely to reduce uncertainty and increase levels of support, beyond any increased resistance that greater awareness might kindle. Training programmes, hands-on experience, demonstrator projects and more accessible information about e-Social Science, and e-Research, particularly targeted to post-graduates and young researchers, could be effective. Doctoral and early career training might be the most promising targets for efforts to engage more social scientists in e-Research.

Notes and References

1. This work is based on the e-Infrastructure Project of the National Centre for e-Social Science (NCeSS) conducted by the Oxford e-Social Science (OeSS) node at the University of Oxford, supported by a grant from the UK's Economic and Social Research Council (RES-149-25-1022). We thank all the members of the NCeSS Strategy Board, who collectively reacted to early versions of the questionnaire, and advised us on ways to refine the study. Rob Procter and Peter Halfpenny of NCeSS, and Ralph Schroeder and Marina Jirotka of OeSS were more directly involved in supporting the design and conduct of this study. Monica Gerber and Ellen Helsper provided invaluable assistance and feedback with our data analysis. We thank these colleagues.
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18. The final survey instrument and more detailed results of the survey are available online at: http://www.oii.ox.ac.uk/microsites/oess/survey/.
19. For simplicity, responses disagreeing or strongly disagreeing with each statement have been excluded, although they can be calculated by subtracting the other two percentages from 100%. The proportion of disagreement was quite low in most cases.
20. The categories 'coder' and 'user' are based on self-report. Although there are certainly differences between serious software engineers who generate computer code and a casual author of scripts to perform tasks, this basic division appears to distinguish between those who generate new methods for interacting with their data and those for whom the computer programmes are more of a black-boxed technology.
21. Of course, there are exceptions to this, particularly within fields and disciplines that relied on computation prior to the advent of desktop computing.
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