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e-Research in the Social Sciences: The Possibilities and the Reality (A Review Article)

H. Russell Searight, R. Kirk Mauldin, Susan Ratwik, Richard Conboy and Barbara K. Searight
Department of Psychology, Lake Superior State University, 650 W. Easterday Ave,
Sault Sainte Marie, MI 49783, USA

Abstract: The purpose of this review is to examine the current status as well as benefits and barriers to online research in the social sciences. With the rapid development of internet technology in the past decade, there has been growing interest in the application of on-line technologies to social science research. While there are a number of on-line sites for survey completion and centralized data sets for studying psychological, health, political and sociological issues, collaborative on-line research communities have not developed at the same pace as these other innovations. The few exploratory studies of e-research collaboration conducted to date suggest that while there are potential benefits, there are a number of social, ethical and professional barriers to its development in the social sciences. A recent curricular innovation, in which undergraduate students from different institutions work collaboratively on an on-line research project, suggests that with specific training, a number of these obstacles can be overcome. However, at this point, there appears to be more potential for collaborative online research than is being realized. Issues such as trust, ownership, and quality assurance will need to be addressed before collaborative on-line research in social science becomes a common practice.

Key words: Collaborative research, internet, research methodology, social science research

INTRODUCTION

The research application of computer-based internet technologies is seen by many as revolutionizing both science and society. Jankowski (2009) notes that major paradigm shifts in the sciences often occur prior to or simultaneously with significant social change. The rise of experimental observation as the foundation for knowledge generation, evolutionary theory, and the acceptance of the wave-particle duality of light, were associated with major cognitive shifts in our conceptualization of the physical and natural worlds and our relationship to these domains (Jankowski, 2009). At present, the widespread use of computer technology for scientific communication, storage of large amounts of quantitative data, the rapid diffusion of scientific findings and the ability for scholars in multiple geographic locations to work on a large data set simultaneously may lead to another major paradigm shift (Jankowski, 2009). E-research and closely related terms, such as cyberinfrastructure and cyberscience, while involving the application of computer technology to the scientific enterprise differ in emphasis. E-research or e-science typically refers to applications of Grid architecture for accessing and analyzing large data sets from a geographic distance. Cyberinfrastructure places a greater emphasis on "distributed networks of computer, information, and communication technologies" (Jankowski, 2009). Social science e-research groups often include the study of e-social science, itself, and its implications for the form and content of newly generated knowledge (Lin *et al*., 2007).

The objective of this review is to describe the extent to which collaborative e-research is being conducted in the social sciences and its potential benefits as well as obstacles to its broad implementation. Because social science views the generation and dissemination of knowledge as an object of study influenced by social, political, and economic factors, this review will also address how a shift to online investigation influences issues of scientific authorship, research ethics, and the reliability and validity of measurement.

Observers have noted that e-research initially occurred in the natural and physical sciences with e-social science beginning several years later. National programs, such as those developed in the United Kingdom, began with support for e-research networks in the biological sciences which was eventually followed by a social science network. A similar lag of several years occurred in the U.S. (Fry and Schroeder, 2009).

Historically, the social sciences have a long tradition of developing legitimacy by emulating the natural and physical sciences (Searight and Merkel, 1991; Merkel and Searight, 1992). Typically, techniques developed and used in these "harder" sciences are initially applied by a small

Corresponding Author: H. Russell Searight, Department of Psychology, Lake Superior State University, 650 W. Easterday Ave, Sault Sainte Marie, MI 49783, USA

group of social scientists-early adopters-whose use of these methods are seen as an unconventional departure from the discipline's status quo (Kuhn, 1962). For example, personality psychology was dominated for many years by the qualitative descriptions and concepts of Freud, Jung and Adler. One of the first contemporary theorists to depart from the dynamic structural and drive models of the early psychodynamic theorists was Raymond B. Cattell who applied precise mathematical techniques, developed outside psychology, to describe personality as sets of quantifiable traits. Numerical values assigned to these traits could be inserted into an equation to predict specifc behavior such as success in selling (Engler, 2009).

While the time frame has been much more compressed than in personality psychology, a similar pathway has been described for the adoption of e-research techniques in the social sciences. The earliest forms of e-research collaboration were between computer science specialists and investigators in the biological and physical sciences. In the U.S., e-research was driven, in part by Grid Computing (Foster and Kesselman, 1999; Fraser *et al*., 2006). A potential advantage of Grid research is that systems or networks have been developed to permit research collaboration across geographic boundaries. "Shareware" has been developed for distributed analysis of large data sets similar to the programs from the virtual astrophysics laboratory (Lawrence, 2006).

Access to large data sets through on-line networks permits task and resource distribution which, in theory, should lead to more rapid and detailed data analysis (Schroeder and Fry, 2007). A number of areas of social science-particularly public health, public administration, and political science have large centralized data sets that can be accessed online. Similar to the "hard" sciences, early social science research collaboration was between scholars in these disciplines and computer scientists. A more recent development has been a focus on the social-political implications of on-line research communities, themselves, for the future of social science research. For example, the Oxford e-social science node has been focusing on issues such as the ethical, legal, and institutional issues surrounding e-infrastructures (Halfpenny *et al*., 2009).

LITRATURE REVIEW

Consensual knowledge in the social sciences: A challenge for e-Research: Hacking (1999) notes major distinctions between the social and natural sciences that have significant implications for e-research: "The classifications of the social sciences are interactive. The classifications and concepts of the natural sciences are not. In the social sciences there are conscious interactions between kind and person. There are no interactions of the same type in the natural sciences" (Hacking, 1999). In the natural sciences, direct observation and measurement are possible and consensually accepted. For example, the presence of a particular type of bacteria in a Gram stain is accepted knowledge if the observation tools are mechanically accurate. Similarly, the change in temperature of 10ºC is also directly measured and rarely open to debate about whether a 10º change can alternatively be constructed as a 5º change or a 20º change (Hacking, 1999).

By contrast, this level of precision is absent in the social sciences. The social sciences do not study naturally occurring categories such as distinctions between bird species, but create distinctions through the practices of observation and measurement (Hacking, 1999). Measurement and analysis are inextricably tied through operational definitions. These operations, such as how intelligence is measured or how members of the county report their political affiliation, cannot be taken at the same level of face value as a 10º change in temperature. In the case of intelligence, there are multiple ways that the construct can be operationalized including specific tests such as the Stanford-Binet test and Wechsler scales or by type as with Gardner's eight different forms of intelligence including spatial intelligence, kinesthetic intelligence and musical intelligence (Gardner, 2008). Each of these models reflects distinct operational definitions of intelligence. The ability to clearly and operationally define the topic under investigation and how it is being observed or measured is a key component of any type of collaborative social science research. Drawing upon Hacking (1999) and Wouters's work (2004), in describing "The Virtual Knowledge Studio for the Humanities and Social Sciences" in the Netherlands, it is noted that collaborative networks are likely to produce novel content and processes for studying social phenomena. While not being able to always foresee the form that these innovations will take, e-collaboration invariably leads to new "epistemic objects," and "novel technologically-embedded paradigms or scientific styles" (Wouters, 2004).

e-Research in the social sciences: A snapshot: For the current article, the authors performed literature searches in the journal databases of their respective disciplines. In reviewing a recent book (Jankowski, 2009) as well as recent articles in the area (Luzon, 2008), it was noted that that many of the references were from sources that were solely web-based. Because of this factor, searches were also conducted in several commercial websites with particular emphasis on Google and Google Scholar. The authors reviewed a number of websites, journals, books, and specific articles in their respective fields of expertise: psychology, sociology, public administration, political

science, and public health. While online applications in these disciplines were not difficult to locate, true distributed networks of online social science research collaboration were far less common. The examples below are by no means intended to be exhaustive, but are representative of e-research projects in the social sciences.

In psychology, there are several website creators that allow researchers to post automated questionnaires and surveys on topics such as the role of humor in relationships and personal strategies for stress management. Other sites included computer animated visual stimuli for studying perception. However, these were all essentially internet applications of paper surveys or experimental stimuli conducted by a specific investigator or a single university based laboratory. One on-line network of interest to psychologists is a psychiatric genetics project conducted by the Genetic Association Identification Network (GAIN). This collaborative-research project was developed to encourage investigators to share their data in exchange for extensive genotyping information. A specific GAIN project in the United States centered around compiling genetic data on bipolar disorder. One rule that has been employed in this network has been that the contributing scientists (those that contribute a specific data set) have nine months of exclusive publication rights after which the data can be accessed by other investigators including pharmaceutical companies (Meyer, 2009).

The Social Science Research Network (www.ssm.com) focuses on rapid dissemination of research reports-many of which are in political science and public administration. The network's site also includes "working papers" to which readers are encouraged to respond. According to the site, over 100,000 authors are represented. The site maintains a "most downloaded article" listing (featured in the New York Times as a "top ten list of social scientists") as a means of determining which authors have the most impact within a discipline.

The National Grid Service (NGS) in the United Kingdom is a data archive with over 5000 databases, and includes political information such as voting data for multiple EU countries. However, in reviewing ongoing projects, many are directed by teams of investigators at the same institution. The NGS also includes useful information for public health research such as nutritional habits and physical activity levels over multiple years. The University of Manchester, which is part of the NGS, is conducting research with the data base on childhood obesity (Canoy, 2009). The investigator listing of the obesity group indicates that they are all faculty at the University of Manchester.

Sociologists have been very active in studying the new types of social organization and norms associated with on-line networks-including collaborative e-research. These include cultural studies of "Second Life" and impression management on the web. While formal inter-institutional e-research networks are relatively rare, sociologists have formed some interesting collaborations. Members of the Oxford (England) Internet Institute have formed a research partnership with e-harmony, the online dating service (www.oii.ac.uk) to conduct large-scale surveys on issues such as online behaviors that would be considered acceptable in a potential romantic partner as well as the role that the Internet plays in married life. Additionally, the group is examining whether there are differences in the demographics and values of persons who develop romantic relationships online compared with face-to-face encounters.

Current status of e-Research collaboration: More questions than answers: Consistent with our informal survey, a number of investigators have noted that while computer technology has been readily applied to the social sciences, the anticipated increase in e-research collaboration has not (yet) materialized (Halfpenny *et al*., 2009). MyNetResearch, which was initially billed as a forum for developing research collaboration, while engendering conversations about the topic, demonstrates minimal evidence of use as a site for promoting investigator networks. Review of recent posts under the heading "Social and Behavioral Sciences" revealed posts primarily from junior researchers or Ph.D. candidates. Topics ranged from a request for ideas for a Ph.D. Thesis in Hindi to career advice ("Accepted an Assistant Professor job offer then received a better offer") to discussions of current social and political topics including a recent nominee for the U.S. Supreme Court, legalization of marijuana, and nuclear proliferation in North Korea. The idea of MyNetResearch being a "Facebook" style site for linking investigators into research networks has yet to be realized. These networks could serve a similar function as websites for musicians seeking collaborators ("heavy metal guitarist looking for drummer and bass player") ("qualitative sociologist seeking collaborators with background in statistical analysis and ethnographic methods "). However, as indicated above, if the postings are a guide, the website's testimonial, "MyNetResearch greatly expands the possibilities for research collaboration…." is narrowly accurate; possibilities have been expanded but have yet been translated into the reality of commonplace collaborative research networks. Commenting on the current status of e-research, Schroeder *et al*. (2007) concluded that collaborative systems are not yet well-developed and that sharing practices are still evolving.

There have been several qualitative interview studies that shed some light on the challenges posed by online research collaboration. In reviewing these studies as well as examining the descriptions of existing collaborative

social science networks, several consistent issues emerge that may account for the current state of affairs. These issues can be classified into two broad categories:

- The content of research and its dissemination and;
- The interpersonal dynamics of research teams.

The first category includes challenges to the foundational constructs of validity and reliability, research ethics, and the scientific publication system. The second category stems from examining communication, and group process issues that either have arisen or are likely to occur in collaborative e-research.

VIRTUAL PUBLICATION IN THE SOCIAL SCIENCES: NEW FORMS OF COLLABORATION, AUTHORSHIP, AND SCHOLARLY IMPACT

As Schroeder and Fry (2007) note, the future of collaborative e-research in the social sciences will be influenced by other forms of e-knowledge generation such as electronic publishing and open access journals. These new forms of academic communication have the potential to significantly change the foundation of social science by making authorship and publication a dynamic process involving multiple "authors" and editors. Open access publishing, in which journal articles are published on a web-based journal or a paper journal accompanied by an online version, has become more common in the social sciences. Our recent survey located 118 open access political science, 107 psychology and 76 open access sociology journals

Open access has been defined as follows: "…free availability…[of literature]…on the public Internet, permitting any users to read, download, copy, distribute print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the Internet itself" (Chan *et al*., 2002; Lucas and Willinsky, 2009).

Genuine open access publishing has promise for the social sciences by raising the possibility of new forms of written academic scholarship (Lucas and Willinsky, 2009). Papers may be "co-authored" both by the original author (s} as well as readers who append their responses to the paper. Many open access journals include a blog-type section for each article. This addition raises intriguing issues about authorship of a paper as well as the question of when a paper is genuinely complete. This is an interesting idea because it essentially adds authors to the manuscript and makes an article an evolving dialogue rather than a static addition to the literature. Researchers in the area can further critique the original authors' methodology and re-interpret the findings-almost as if the "Discussion and Implications" section of the paper becomes an evolving network of "co-authors." Open access software is now available making the transition from traditional journal writing to this new scholarly medium much easier.

These new forms of scholarly dissemination have raised questions about authors' and investigators' obligations to their academic audience. Many have argued that open access includes ready access to the data on which the study is based. Historically, investigators have had some obligation to make their data available to journal editors -a prerogative that has rarely been acted upon. If another scientist wanted to use the data set for secondary analysis, the original investigator's permission was required. However, unless conducted with government funding, the data were generally considered to belong to the investigator. Some open access publishers have challenged this view by requiring that authors permit access to data and even include links to data as part of the on-line article.

Web publication typically does not have the space and page limitations of hard copy journals. Additionally, some social science sites publish "working papers." While this trend could be used to elicit collegial feedback before formal submission of the finished product, there has been concern that these practices may diminish the role of editors and traditional peer review (Schroeder and Fry, 2007).

Open access publishing is already creating new forms of collaboration between authors and journal publishers. One of the concerns that has arisen with open access journals-particularly those that are formed outside traditional professional associations-- is that some of them require the author to pay a fee, often substantial, for an article to be published. There has been concern that depending upon authors to fund on-line journals may compromise the quality of scholarly articles. In a variation on the Sokol affair, in which a physicist, concerned about the lack of rigor in the humanities, submitted a nonsense article studded with many post-modern terms that was accepted for publication, a somewhat similar hoax was deliberately played on an open access journal to determine its rigor. In the recent open-access case, Davis (2009) submitted a computer-generated article using SciGen, a program that creates grammatically correct papers devoid of any meaningful content. The "article" included phrases such as: "In this section, we discuss existing research in red-black trees, vacuum tubes, and courseware." The study was accepted for publication even though the "author's" affiliation was listed as the Center for Research in Applied Phrenology (acronym "CRAP"). Davis (2009) indicates that the journal notified him that the study would proceed through the publication process as soon as he submitted a check for $800.00.

The Ethics of sharing data obtained from human subjects: In contrast to other disciplines such as meteorology, economics, or chemistry, social science data come directly or indirectly from human subjects. Numerous safeguards are put into place to protect subjects from harm or exploitation. Of relevance to investigators compiling on-line data banks and sharing data with members of an on-line research group, most consent documents used in university settings are institution-specific. The subject has typically given consent that the data associated with their participation would be used only by the investigator who originally obtained it. The open access data policy, while helpful for building networks of investigors in a subject of interest, makes personally sensitive data (e.g., sexual practices, drug use, illegal acts committed) available to a conceivably unlimited network of investigators. Moreover, with open access to journal articles and accompanying data, individuals accessing and using sensitive information would not necessarily have to be scholars in the field but could include journalists, businesses, or the lay public. Those of us in psychology and public health are particularly sensitive to misuse of our data in sensationalistic new stories. In addition, many of the surveys and other measures used in behavioral science research are not accessible to the general public because of concerns about misuse and subsequent emotional distress as well as preserving the instruments' validity. Finally, many of these sensitive research tools are proprietary-a concept that may disappear in a climate of open access scholarship.

Validity and reliability: New opportunities and unexpected challenges: Because of the necessity of operationalizing independent and dependent variables in the social sciences, reliability and validity are paramount. Collaboration from a distance can permit a level of reliability and generalizabilty (validity) that exceeds current standards (Fry and Schroeder, 2009). In analyzing human behavior patterns, such as hyperactivity in children, coding systems are employed by observers. A key issue in using coding is inter-rater reliability, the degree of agreement between different raters. When agreement is high, the accompanying behavioral dimension, (e.g., hyperactivity), is considered a valid construct. Using either live or recorded video data, e-collaborators at distributed sites can participate in these important psychometric studies-a process often made difficult by the limited availability of trained raters within a nearby area.

As suggested by the discussion of open access publishing, e-research has the potential for exposing the investigative process to greater scrutiny by more scientists than previously (Koko *et al*., 2000; Schroeder and Fry, 2007). Processes such as data coding and analysis, previously completed by the investigator in isolation, can now be examined and in many instances, data re-analyzed almost as soon as a research report appears. One of the more intriguing examples of research collaboration in social science has been the use and development of a technology permitting distributed observation of video data. Fraser *et al*. (2006) found that despite the fact that the geographically distributed investigators were all viewing the same video images, all of the viewers were not seen as being equal in their analysis. Off-site collaborators often did not have the same perspective on the video information as those who directly collected the data (Fraser *et al*., 2006). Since they did not have first-hand interaction with the participants or experience the setting in which the data was gathered, their analyses were erroneous or limited. The researcher who actually collected the data was seen as having the most valid perspective (Fraser *et al*., 2006).

Reliability and validity are also issues with archived text-based or quantitative data. If a databank is formed from the work of multiple investigators who gather the data independently and at different time periods, the resulting data pool may be questionable. For example, diagnostic terms differ in psychiatry as a function of the system used to define specific mental disorders. Attention Deficit/Hyperactivity Disorder (AD/HD) as defined today differs from how it was diagnosed in 1990 both in terms symptoms but also in the diagnostic label itself (previously, today's AD/HD was called Attention Deficit Disorder-with or without hyperactivity). Hence, differences in variable names and their meaning may make it difficult to combine data from sources used in a collaborative project (Meyer, 2009).

THE SOCIAL PSYCHOLOGY OF TASK GROUP COLLABORATION: IMPLICATIONS FOR E-RESEARCH TEAMS

Task group development: Forming, storming, norming, and performing: While limited, current research describing e-research teams suggests that the organizational and interpersonal challenges far outweigh technical problems. Lawrence (2006) noted that over 100 e-investigators spread among nine international sites in an on-line collaborative network of meteorologists and computer specialists was difficult to coordinate-members split into groups based upon their areas of expertise. However, the groups were not 'cleanly' divided with some members being in multiple groups simultaneously. While multiple types of communication were available to the team, they seemed to prefer project list-serves and e-mails. However, Lawrence noted that on-line meetings had much greater potential for misunderstanding than direct face-to-face encounters and concluded that most of the challenges to the project were not directly technology

dependent but, instead, were "…establishing priorities, creating development plans, handling disagreements, making decisions, and finding a comfortable pace of progress…" (Lawrence, 2006).

Social psychologists have explained the processes that arise in newly formed task groups (Worchel and Coutant, 2002; Tuckman, 1965). When a new group comes together to complete a task, a four phase sequence typically occurs: forming, storming, norming, and performing. During its early formation, members are focused on goals and tasks. However, members are initially individually- oriented and focused on self-interest rather than viewing the process as genuinely collaborative. Rather than asking others about their background and perspectives, more assertive individuals may verbalize that their goals are the group's goals. However, many group members focus on getting to know one another and address interpersonal dimensions before moving on to a task focus. As will be discussed below, e-research groups may have difficulty in this formative stage because the usual social information about members is greatly reduced. Qualitative studies of e-research collaboration have found that some members of collaborative teams are very sensitive to this omission: "No personality development and no relationship development happen on Access Grid. "...You really don't know the people who you are dealing with. So there is no progress over time…" (Lawrence, 2006). Luzon (2008) suggests that weblogs may be particularly helpful during these early phases for developing connections between researchers and fostering a group identity. As will be discussed further below, these first two phases may be more problematic or limited in on-line versus in-person exchanges.

During "storming," there is often a competitive atmosphere as members share ideas about how to address the task and each person's role in the process. During this phase, the task at hand becomes more clearly defined. If the team is to be successful, there must be some level of accommodating perspectives to a consensual definition of the task at hand. Early studies of collaborative e-research groups suggest that this phase may be different on-line than face-to-face. Kock (2006) found that while face-to-face research teams generated an average of 113 words per minute, the output fell to 6 words per minute when the team communicated on-line.

Either during "storming" or early in the "norming" phase, a leader or facilitator often emerges. In traditional groups, this role is often occupied by someone familiar with group process that is able to effectively connect with multiple members and model collaborative behavior. Even though online communities frequently value a non-hierarchical, horizontal structure, some type of central facilitator is important for organizing information and facilitating discussion of deadlines. A team that is "performing" is working as a unit. If differences emerge, there are acceptable methods for addressing dissent. Team members have implicit, agreed upon strategies for addressing unanticipated problems. At present, many collaborative e-research teams are composed of persons with long-term relationships that predate the current project so that these implicit strategies are in place:

> One reason I think by and large this project works very well is that…almost everybody in the project has known each other a long, long time. So they satisfy what I call the 'Principle of Least Surprise' which is: If I have a certain set of data, I can predict what the other person will do… (Lawrence, 2006).

In his original formulation of the group process model, Tuckman (1965) added a fifth stage, "adjourning". While Tuckman (1965) may have overstated the centrality of mourning the loss of the team, there is benefit from reflecting upon one's experience on both successful and unsuccessful task teams. This reflection, such as the observations shared by participants in the qualitative studies of e-research teams mentioned in this study, could provide valuable contributions for training modules in successful on-line collaboration.

Social loafing: Social loafing is well-known to anyone who has worked on a small group project with a deadline. This phenomenon refers to a"…reduction in effort by individuals when they work in groups as compared to when they work by themselves" (Weiten, 2010). Even when participants incorrectly believe that they are working in a group rather than alone, their output declines compared to when they believe they are working independently. The immediate cause of the diminished individual output in groups is that responsibility for task completion is diffused and identifiable individual contributions are much less apparent (Weiten, 2010). In terms of the four phases, loafers who chafe under their new responsibility for task completion during "norming' may try to re-direct the group back to "storming".

While Kock (2006) found that overall word production was considerably less in the on-line versus face-to-face condition, the total number of words per individual contribution was greater in the on-line condition. Qualitatively, the textual productions appeared to contain more information and knowledge and reflected a more reasoned product (Kock, 2006). One advantage of e-research using e-mails and other personally identifiable documentation is that social loafing is less likely to occur. While not directly applied to online research communities, investigations of task groups find that social loafing is less likely to occur when individual contributions are clearly recognized by other group members (Holgaard and Ingvaldsen, 2006). Kock's (2006)

research on e-business communication appears to at least partially support this view.

VIRTUAL RELATIONSHIPS ARE NOT THE EQUIVALENT OF FACE-TO - FACE ENCOUNTERS

On line communication: Potential loss of creativity and gain in objectivity: Qualitative studies suggest that on-line project communication, particularly when in the form of instant messaging, e-mails, or blogs, takes a more "finished" form compared with verbal content. Written e-mails are less likely to reflect the spontaneous thinking and generation of ideas occurring during face-to-face brainstorming in which free associations and unpolished ideas are shared. Investigators are less likely to "think out loud" in e-mail compared with conversational speech. "Thinking out of the box" is much more likely to occur when half-formed ideas can be shared and refined by others in direct, verbal, small group interaction. As noted earlier, the sheer number of words shared appears to be markedly less per unit time when communication occurs through e-mail or instant messaging rather than verbally.

Internet communication is generally considered to be more immediate and as occurring in "real time". However, in comparison to either a telephone or face-to-face conversation, any communication in the form of printed text can be set aside and addressed later. Setting an e-mail aside until later may be particularly helpful for negative or critical information such as requests for change in a manuscript or research design among collaborating investigators. If one party is offended or emotionally threatened by the request for change and this information is received in an e-mail or through a message center, the text can be printed out and set aside until the investigator can consider it and respond more objectively and less emotionally.

"Lean" on-line communication: Missing the message: In therapeutic communication theory, there is an important distinction between analogic and digital communication. Digital communication refers to the situation in which there is a direct relationship between the spoken word or written text and its referent (Watzlawick, 1993). For example, at a digital level, someone stating "I have a headache" is referring to having a pain in their head. On the other hand, the same content can be interpreted analogically or metaphorically. At an analogic level, the phrase may have multiple meanings-often conveying information about the relationship between the sender and recipient. For example, a woman is sitting watching television with her husband at 10 PM. She gets up from her seat and stretches while saying, "I really have a bad headache". While this phrase can be interpreted digitally as indicating a literal pain in her head, it is also possible that the sender is conveying that she does not wish to have sex that particular night or is angry with her spouse. At a slightly more abstract level, the woman may be communicating that she is in an emotionally distressing marriage ("This is a painful relationship").

While this example may seem to be a bit far afield from e- research collaboration, this distinction between digital and analog communication has very real implications. Because it is "leaner" (Kock, 2006), and has fewer non-verbal cues, online communication such as e-mail or blogs is digital and may not have the contextual range to convey important interpersonal information. On-line communication is usually through one channel -- written text. In contrast, verbal communication is far more nuanced with cues that direct the listener to the meaning of the words. Research indicates that while an e-mail sender believes they are clearly communicating that the content is "just kidding," recipients often don't receive or interpret the intended meaning (Kruger *et al*., 1999). Emphasis, the investment of the communicator in the message being conveyed, as well as subtle verbal communication indicating an opinion, are often conveyed non-verbally. It should be no surprise that many social psychologists assert that up to 90% of the meaning of oral communication is transmitted nonverbally (Fromkin and Rodman, 1983). For example, consider two researchers talking about one of their more senior collaborators on a research project. The senior member is seeking significant changes in the project-- a new and larger sample size or the addition of 10 more dependent variables. When the two colleagues are communicating about their senior colleague they verbalize," He wants a much bigger sample and has some new surveys that he'd like to include." The verbalization or written text alone does not convey an opinion of the proposed changes. However, the same spoken words prefaced by a deep sigh and accompanied by rolling of the eyes, a half smile, and shaking the head back and forth, convey the investigator's opinion of the request as misguided or needlessly excessive. Unless communication occurs with a very sensitive video camera, the meaning of this exchange is likely to be lost in e-collaboration.

The use of emoticons as an attempt to convey the feelings or true meaning behind the text message does provide some qualification of messages (Coakes and Willis, 2002). The uni- , bi, or tri-chotomous expression permitted by textual emoticons, when compared with face-to-face interaction, still greatly reduces the amount of contextual information conveyed. Additionally, while the smiling emoticon can be used to temper a harsh message, it may have the unintended effect of disqualifying a directive or recommendation. The first author has worked collaboratively with co-authors and editors in different areas of the country on chapters for

books as well as in continuing to update and edit a review in an online journal for practicing physicians. Even when receiving fairly specific and concrete editorial feedback from a reviewer, editor or colleague, the information is often open to mis-interpretation. For example, it is often difficult to determine whether the offered editorial recommendations are tentative suggestions or hard and fast requirements for subsequent publication. Again, when working collaboratively with colleagues through face-to-face contacts or by telephone, one can more readily process these issues and come to a resolution that benefits the end product while also maintaining respect for the relationship between collaborators.

The importance of trust: Sharing a project, including data that were challenging to gather and organize, can be anxiety-provoking, particularly if an investigator only knows their new collaborator through e-mails. While limited, there is some evidence that much e-collaboration is between members of the same academic institution who have a pre-existing history as research collaborators (Cummings and Kiesler, 2005; Genoni *et al*., 2009). In the Australian Network for Early European Research (NEER) e-collaboration, scholars who were in a academic positions for 20 years or more were more likely to be involved in active e-research projects (Genoni *et al*., 2009). Usually, these collaborations were continuations of projects in existence before e-research.

The conduct of science often has an important, informal political dimension (Latour and Woolgar, 1979). These underlying political issues, while critical, are unlikely to be put into writing because they can be traced back to the initiator. Concern about someone else taking credit for an investigator's work or taking a research idea that came up in a seemingly "collaborative" blog or list-serve (Luzon, 2008) is a significant concern:

> "I might say the biggest issue I think on collaborative data is the question of whether you trust other people so that you can be open to them with your ideas and getting credit for your hard work…" (Fraser *et al*., 2006)

Particularly when the on-line collaborator is unknown to the investigator holding the data, there may be genuine reservations about their ethical use of sensitive information:

> It's not just about managing who's got the data, but what they will do with it. My worst nightmare is that I get a call from a school or parent saying "I saw my little Johnny was on the telly about your project and I didn't give permission for it." (Fraser *et al*., 2006)

Because of these issues, it is unlikely that on-line communication will replace face-to-face meetings and "live" professional conferences. Even e- scholars will want to "meet the people behind the e-mails" (Genoni *et al*., 2009). Having a relationship with other trusted members of the e-team may also help new investigators become integrated:

> "…I think everyone that was brought into the project was sort of introduced as "…Okay, this person is brought in because they have this expertise or because we know-they've done something". [Italics in original] ...so I think people sort of came into it feeling special, in a sense, and then at the same time the other people were aware that, 'Hey, this person is here because of this.' That they're not just somebody that you grabbed-and I think that had something to do with it. A lot of these things are-The way they start out is the way they stay" (Lawrence, 2006).

FUTURE DIRECTIONS

While likely to be a necessary stage in its development, social scientists have questioned whether research is being "pushed" by existing computer technology rather than "pulled" (Fry and Schroder, 2007) by social science research questions. At present, there is concern that e-social science may be "more fashion than substance" (Fry and Schroeder, 2007).

In examining the United Kingdom's National Centre for e-Social Science, Halfpenny *et al*. (2009) note that the hoped-for collaborative interdisciplinary and cross-institutional network did not develop as expected and instead is currently a "piecemeal" arrangement. In attempting to explain this disappointing finding, the authors note the academic reward system is competitive and discourages collaboration: "The reality of individual competition over discovery claims, grants, promotion, and space in top-ranking journals is far removed from the ideal of openness and sharing of data and other resources promoted by the e-science vision" (Halfpenny *et al*., 2009).

Social scientists interested in furthering possibilities of e-research would benefit from study and implementation of collaborative on-line pedagogical models such as the CORAL project (Collaborative Online Research and Learning (CORAL, 2009). In this project, two student teams from two different universities are enrolled in two psychology classes. One of the groups is taking group dynamics while the other students are enrolled in the psychology of women. Students who had previously completed CORAL function as facilitators. The program combines didactic education with a collaborative research project carried out by the two classes. Through video conferencing and other types of online interaction, the groups develop project ideas, select (a) topic(s) and carry it out. Students have also been involved in examining the collaborative process, itself. In

addition to the completed research project, students are learning experiential lessons from this course in how small groups form, collaborate, and particularly how these processes occur online. Specific on line collaborative tasks included development of a web board, using a real time chat room, videoconferencing, implementing a file manager system as well as a centralized website and having a conjoint online calendar.

A particularly important factor in this regard is likely to be the knowledge and skill base involved in successful collaboration in general as well as in adapting these skills to an online community. While a topic of one of the courses, students directly experienced the four phases of forming a task group to carry out a shared project. The "norming and performing phases" were particularly challenging for these undergraduate students (CORAL, 2009). An observation that has import for faculty e-research collaboration is that for the groups to collaborate, a major shift in the members' approach to academic work was required. Specifically, the inter-individual competition for grades had to be subordinated to a collaborative orientation. As this study has suggested, the major challenges in developing e-research in the social sciences are not technological, but instead, are interpersonal.

Until issues of trust have been adequately addressed, e- research collaboration is unlikely to become more common than face-to-face collaborative work. Dependable relationships usually require some cultivation. In Quereshi *et al.*'s (2005) ethnography, one of the e-researchers articulated this clearly:

When I'm in a group participating on a project…we always make some time for a little social, informal communication to get to know each team member a little better. Most of the time, I did this by drinking a beer (or something else) with the whole group and talking about hobby's, the weather… All of this is very difficult to do, when one of your group members lives on the other side of the world. You may decide to go to a chat or gaming zone and do your social communication over there, but I don't think this is the same (Quereshi *et al*., 2005).

Some e-research teams have suggested that the network members have a second site on Facebook or other online social network for off-task socializing. Members may post photos, a brief biography, family information and a description of avocational interests. For future scholars, a guided online time-limited e- research experience similar to CORAL would provide invaluable training and education both in the technical aspects of online collaboration as well in the important interpersonal skills necessary to make these collaborations succeed.

CONCLUSION

On-line collaborative research in the social sciences is in an early stage characterized by pockets of innovation and productivity. However, these seeming new developments often take the form of pre-existing "bricks and mortar" collaborations that have migrated to the internet rather than the creation of new online partnerships. Ironically, many of the obstacles to scientific collaboration can often be explained by social psychology. Online communication does not include many of the contextual cues and nuances that are used to determine what the content of a message actually means. Additionally, while written documents such as e-mails and blogs establish individual ownership of ideas, these forms of communication often limit the synergy that occurs in face-to-face brainstorming. The ability to claim one's own intellectual contributions is particularly important in competitive research and academic environments. While moves towards making the data supporting research findings available to all investigators through centralized data banks may be seen as facilitating a collaborative and transparent research environment, this direction raises intriguing and potentially conflictual questions about who owns knowledge and its discovery. Additionally, while the quantity of accessible scholarly information in the social sciences has grown dramatically with the availability of websites and open access publishing, it is not yet clear whether there is or will be a corresponding improvement in the quality of social science research.

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