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Analysis by Long Walk: Some Approaches to the Synthesis of Multiple Sources of Evidence

Steve Sawyer
School of Information Sciences and Technology
The Pennsylvania State University
513 Rider I Building
University Park, PA 16801
(814) 865-4450
(814) 865-5604
sawyer@ist.psu.edu

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Introduction

Through this chapter I make two contributions. First, I provide both conceptual guidance and practical advice for information systems (IS) scholars who are involved in multi-method research, with a particular focus on conducting multi-method analysis. Second, and as a means to achieve the first contribution, I detail some of the principal components of multi-method research. Multi-method research is based on the premise that analysis of separate and dissimilar data sets drawn on the same phenomena will provide a richer picture of the events and/or issues than will any single method. While valued by many IS scholars multi-method-based research to study the roles of information and communication technologies (ICT) in social organization is under-explored as a set of coherent techniques. In response I put forth a set of observations that arise from my own multi-method research experiences (see Guinan, Coopriider and Sawyer, 1997; Sawyer, Farber and Spillers, 1997; Sawyer, 2000b, Crowston, Sawyer and Wigand, 2001).

For this chapter multi-method means a combination of data collection approaches, such as survey collection and field work, drawn on the same phenomena (Sawyer, 2000b, Brewer and Hunter, 1989). By analysis I mean the process of discerning findings from data. As context for this discussion I draw on my ongoing research into organizational computing infrastructure changes and enterprise resource package (ERP) installations (see Sawyer, forthcoming, Sawyer, 2000a, 2000b, Sawyer and Gibbons, 2000, Sawyer and Southwick, 1996, Sawyer and Southwick, 1997). My discussion on multi-method research reflects the idiosyncratic blend of concepts, personal preferences and contextual circumstances through which an interpretive researcher sees the world. However, many of the issues I raise may be equally viable for IS scholars with different epistemologies than mine.

A multi-method approach to research on the uses of ICTs involves several data collection techniques

organized to provide multiple but dissimilar data sets regarding the same phenomena. By dissimilar I mean that they include different forms of data. For example, using participant observation and laboratory experiments is one way to conduct multi-method research (see Sproull and Kiesler, 1991). The observational data is typically textual and open ended, relatively unstructured and context dependent. Data derived from the experiments is typically de-contextualized, numerical and highly structured.

Multi-method research is typically done by drawing on a set of data collection methods that accommodate each other's limitations (Jick, 1979; Gable, 1994; Gallivan, 1997). For example, Sproull and Kiesler (1991) used the observational data to provide insight into the context and the experimental data to provide insight into observed behaviors. Further, both the conceptual bases and data collection techniques help to shape the phenomena of interest. So, there are many ways to conduct multi-method research (Brewer and Hunter, 1989). Here I focus on “multi-method fieldwork:” blending fieldwork with surveys as this is what I most often do in my research. My conceptual bases are rooted in social theory (see Sica, 1998) and this combination of methods and theory leads me towards different questions than would someone who draws on psychology and combines fieldwork with experiments (see Sproull and Kiesler, 1991).

Fieldwork includes participant observation, interviewing, and collecting archival records – characteristics of both intensive and prolonged involvement with the social units being studied. (Jackson, 1987). Surveys involve data collection instruments (often self-administered) to collect responses to *a priori* formalized questions on pre-determined topics from a valid sample of members of identified social categories.

Surveys are a mainstay of the quasi-experimental field research tradition on which most IS research is based; survey-based studies comprise more than 49% of research done on the use of ICT in organizations (Orlikowski and Baroudi, 1991). Explicit multi-method studies represent about 3% of the same research

base (Gallivan, 1997).

A multi-method fieldwork approach implies that surveys are used in a manner that differs from the more common quasi-experimental field research use. In the latter, survey data are extracted from the field and quantified. Non-survey data are used to support or enrich findings from survey data. A multi-method approach sees the two forms of data collection as co-equals. That is, each data collection method must both stand on its own (independence) and also be combine-able (interdependence) (Kaplan and Duchon, 1988; Gallivan, 1997; Jick, 1979; Brewer and Hunter, 1989). I discuss these concepts in more detail in section three.

This process of combining multiple data sets is often called triangulation (see Jick, 1979). Triangulation is the analytic act of identifying similar findings from different data sets. Essentially, this suggests seeing the same “research event” from different perspectives. This strict definition of triangulation reflects a positivistic perspective that there is a single truth to be observed (Falconer and Mackay, 1999a, 1999b, 2000). Such a strict definition also implies that a common research perspective is embodied in a triangulating analysis (Jones, 1999; Falconer and Mackay, 1999a). In this chapter I do not seek to engage directly in the emerging debate about either the viability of the commonly held view of triangulation or the more broadly philosophical debates on paradigmatic pluralism (see Jones, 1999). Instead of focusing on triangulation’s meaning(s), later in this chapter I discuss the analysis of combined data sets in terms of both comparison and for contrast.

On a more pragmatic level there are few common conventions, and even fewer analytic techniques, to describe the process of the analysis of combined data sets (one exception is the positivist’s multi-

trait/multi-method matrix described by Campbell and Stanley, 1966) (Gable, 1994; Howe and Eisenhardt, 1990; Williams, 1986; Jick, 1979). This often limits the value of this type of research to the broader community because describing the methods used in doing such a multi-data set analysis is both important for establishing credibility and space-consuming (Seidler, 1973; Lincoln, 1995; Sutton and Staw, 1995). The need to write extensively about non-standard methods typically comes at the cost of reducing the space devoted to discussing findings.

Both fieldwork and the more common survey-based approaches have strong ideological bases. A multi-method approach that combines surveys with fieldwork seeks to integrate (or at least bridge) these perspectives. For example, Langley (1999) argues that “synthetic” methods -- where various forms of data are linked together in emergent analyses, represents a n under-explored area of methodological development. The result of such a linkage is a new method, not just an aggregation of existing techniques (Brewer and Hunter, 1989, p. 17). For example, in Sawyer (2000b) I contrast the multi-method research done by Kaplan and Duchon (1988) and Guinan, Coopriider and Sawyer, (1997). By making this contrast, I illustrate the various ways these studies draw on the strengths of the combination of data collection methods (Jick, 1979; Gallivan, 1997).

The chapter continues in four sections. In the first section I provide an overview of Mid-Sized University’s (MSU) computing infrastructure change as the context for the discussion of conducting multi-method research. Section two contains a discussion of the elements that underlie a multi-method research effort. In section three I present a set of issues that arise in the conduct of multi-method analysis and in the final section I highlight some unresolved aspects of multi-method approaches to research on ICTs uses.

An Example: MSU's Computing Infrastructure Change

The context for our discussion of multi-method analysis is an ongoing study of the computing changes at one organization. Since early 1992 MSU has been engaged in installing both a client/server-based computing infrastructure and an enterprise resource package suite (ERP) to replace their mainframe computing infrastructure and proprietary, stand-alone administrative information systems. The research goal has been to identify how changes to MSU's computing infrastructure are manifested in the technical, social, and administrative structures of the organization.

The MSU is a private, research-oriented university which enjoys high name recognition, nationally and internationally. The MSU's administrative and organizational structures are representative of typical U.S. universities of nearly 18,000 students and 4,000 employees. However, by 1993, three environmental factors constraining MSU's computing infrastructure created a situation demanding senior management's attention. These were: (1) an increasing workload required of MSU's mainframe systems, (2) a restrictive reliance on MSU's outdated legacy systems, and (3) an increasingly unmanageable tangle of administrative and academic computing networks, characterized by overlapping links and disparate technologies.

These issues regarding computing are typical of most academic computing systems (Alpert, 1985; El-Khawis, 1995; McClure and Lopata, 1996) and many mid-sized and large organizations. Facing this scenario, MSU's CIO made the decision to revamp the computing infrastructure to take advantage of new client/server technology and purchased software (the ERP and some additional software packages).

The MSU case is similar to many other organizations who are changing their computing infrastructure and installing ERP software. By ERP I mean an integrated suite of software modules that partially automate

an organizations key processes (such as manufacturing, accounting, marketing, HR, payroll, etc). Relying on an ERP is typically a major change to an organization's operations (Davenport, 2000). Since these systems are vendor provided, they are not fully customized for any user. Thus, acquiring an ERP system requires extensive tailoring of both the package's functions and the organization's work practices (Sawyer, forthcoming).

The MSU research was designed as a longitudinal, multi-method effort spanning individual and organizational levels of analysis. At the individual level, the focus is on how the ERP systems, and the consequent work changes, are being interpreted. At the organizational level, the focus of research has been directed toward understanding how these systems affect the web of computing already in place at MSU. The research approach has also been designed to allow us to focus on the potentially differing perspectives towards ERP among individual users, technologists, and vendors. Five people have participated in data collection at various points while one has been part of the project from its inception.

Data collection activities encompass participation with, and observations of, committees formed to work on specific aspects of the ERP initiative; interviews with managers and workers (both IS and line); document/records collection and surveys. The field work aspects includes extensive observation, interviewing and archival record collection. Survey data includes two sets of employee assessments (focused on training and quality of work life). These survey's data were provided to the research staff. Interviews varied by level of structure, with most being semi-structured and open-ended. The field notes record data collected from unobtrusive observations, from participation in committees and meetings, and from informal social interactions. There are two types of field notes for each observation, interview, or interaction. The first type is a chronology of events and actions; the second is a more free-flowing

account of perceptions, stories, and anecdotes. The chronology serves as a record of observations. The account serves as a record of the observer's perceptions.

Survey data were gathered by the human resource department and were designed to provide insight into changes in the job classification structure, to plan for IT-focused training, and to gauge employee readiness for the computing changes. The two surveys contain 40 questions (plus some demographic requests) with most of them using either five point Likert scales or yes/no responses. The survey data were not collected in support of an explicit predictive model.

Elements of a Multi Method Research Approach

Like many forms of research, multi-method approaches are guided by a number of factors such as validity and generalizability. Factors common to most research approaches are well- documented in other work and not discussed here (see, for example, Brinberg and McGrath, 1984; Creswell, 1994; Danzin, 1970). Of more interest for this chapter are the factors specific to multi-method research such as: the roles of theory, method independence, insulation, data interdependence, analytic integration, and data comparability versus contrast (Brewer and Hunter, 1989). In the rest of this section I outline these factors and explain how the MSU research was designed with these in mind. The factors are listed and defined in Table 1.

<insert Table 1 near here>

The Roles of Theory

Central to most research is the development and/or testing of theory (Blalock, 1971; Popper, 1968; Weick,

1995). Contributions to theory can be seen along a continuum from development to testing (Sutton and Staw, 1995; Glaser and Strauss, 1967; Yin, 1989; Blalock, 1971; Bagozzi, 1979; Hoyle, 1995). However, theory development and/or testing is often not done well in organizational research, a subset of which is research on organizational computing infrastructures (Sutton and Staw, 1995; Weick, 1995; Merton, 1967). For example, Grunow (1995) reports on the methodological and theoretic approaches to 303 papers concerning organizational research. He found that 78% of these papers did not align theory to their research questions and 82% of the papers did not contribute meaningful results to theory development. As Sutton and Staw (1995, p. 371) state: "... references, data, variables, diagrams and hypotheses are not theory."

Even if Sutton and Staw (1995) are correct and Grunow's (1995) analysis is accurate, some form of theoretical rationale still forms the basis of the analysis and discussion sections of most scholarly papers on ICT uses in organizations. One benefit, and a primary differentiator, of multi-method research is multiple data sets. This suggests two roles for theory. First, theory can be a source of guidance on how to develop multiple data sets by helping the researcher focus on the types of data needed. Second, theory is also the means for uniting the various data collection approaches because it provides common concepts that help to structure the data collection efforts. While some authors protest against using formal theory (see Van Maanen, 1995a; 1995b), theory serves as a stabilizing force for multi-method-based research. A theory-based approach helps sort through the blur of reality, providing a way to characterize observation and interpretation (Weizenbaum, 1976). Vaughan (1992) calls this "theory elaboration" and Weick (1995, p. 385) calls it "theorizing." Hence, multi-method research approaches imply the use of *a priori* theories, though the actual linkages among these theories may not emerge until data collection/analysis.

For example three *a priori* theories form the interpretive frame of the MSU research. Structuration theory provides a way to relate social structures and physical structures (such as the ICTs being used) through the ongoing actions of the social actors (Giddens, 1984; and Turner, 1987; Orlikowski, 1992; and Robey, 1991; DeSanctis and Poole, 1994; Koppel, 1994). This perspective provides a lens for viewing organizational and departmental action. Work design provides a perspective extending from individual through the departmental level. This perspective focuses on work as a set of tasks that are related to group and social norms (Hackman,1977; Hackman and Oldham 1980; Nadler, 1963; Adler, 1986; Kelley, 1990). Punctuated equilibrium relates both across time (Gersick, 1988; 1989; 1991; Miller and Friesen, 1980; Tushman and Romanelli, 1985; Romanelli and Tushman, 1994).

These theories were selected because they: overlap at various levels of analysis, explicitly incorporate the temporal nature of the study, and together provide a means to structure data collection. This set of theories also provides a means to organize analysis of the survey data. The difficulty with relying on *post-hoc* theory is that there may be little linkage among the data sets and the study becomes less of multi-method and more of a series of studies on a common topic (Gallivan, 1997). In essence, this is the conceptual contention made by Falconer and MacKay (1999b). Kaplan and Duchon (1988) also highlight the pragmatics of trying to merge dissimilar data into a coherent set by using a form of grounded theory, pointing out how difficult it is to redirect the analysis effort in light of unexpected findings.

Independence

One value in using multiple collection methods is that they draw data from the same group of people. However, these people interact with the researcher(s) in several ways over the course of data collection (as participants in interviews, as subjects of observation and as respondents to surveys). This means that

the survey effort is also related to the interview effort in that they are typically done by the same researcher(s). Hence, multi-method researchers must consider how their *total* presence will affect subjects.

To address independence the MSU research was planned in multiple phases and focused at multiple levels. This allows for data collection to be separated by level of analysis and provides for some control over selection of participants. Further, this phased approach allowed multiple researchers to have distinct roles in each phase. For example, I worked closely with several groups and was the only person to interact with senior IS and organizational leaders. Other researchers were given specific projects and/or groups of people to follow or interview. In this way we reduced the confusion over having multiple researchers, reduced potential conflicts of interest over the purpose of the research, mitigated concerns that the research staff would be seen as reporters for senior leadership, provided for some “territorial” clarity and minimized confusion for the people at MSU. However, one limitation of this approach is that we had virtually no overlap in respondents/participants among the research team.

Insulation

Inherent to multi-method fieldwork is the disturbance caused by the (multiple) presence(s) of the researcher(s). Approaches to reducing this disturbance lie on a continuum from unobtrusive observation to direct participation (i.e., action research) (Argyris, Putnam & Smith, 1985). The surveyor leaves behind the anticipated and unintended effects that the questions in her instrument instigate. The fieldworker is an interpreter and contributor to both the events seen and roles played during her time in the field. Thus, the roles of the multi-method researcher remains a research decision open to interpretation.

The MSU research plan incorporates three ways to insulate data collection efforts. First, the various levels of the organization are used as insulation. Each member of the research team is focused on particular aspects. And, while the formal and informal social networks of any organization suggest that there will be some awareness, using organizational level as a means of insulation is both easy (as levels exist) and flexible (Since researchers can have different roles at different levels). For instance, one researcher at MSU became aligned with certain user groups. And, even though they later worked to follow a particular sub-project of the implementation, they maintained ties to the user group representatives included in that project. Second, the MSU research spaces data collection across time to provide an insulating effect. After a prolonged interaction with the IT unit (see Sawyer and Southwick, 1997), we returned on occasion to conduct follow-up interviews. Third, using unobtrusive and non-invasive data collection (such as archival record collection) helps to insulate one data sets' effects on another. At MSU we have been included on a number of electronic mailing lists and listservs where our presence, while not hidden (as we make sure that other members are aware of our presence) is not invasive.

Interdependence

Balanced against the independence and insulation issues is the desire to create linkages between the various data sets. In the MSU study we stressed the value of interdependence over insulation. Following from this decision we approached linking data sets three ways. The most obvious way, as laid out above, is creating links via theory. This is why I've advocated that there must be some form of *a priori* theory that helps to structure the collection of data. A second means to create interdependence is to focus on overlapping concepts. Often these emerge from the interim analysis. For example, issues of time (an aspect of the *a priori* theory) led to interim analyses where the concept of temporal differences among

various work groups involved in the implementation of the ERP arose. This led us to searching for discussions of temporal differences in other data sets (see Sawyer and Southwick, 1997).

A third form of linkage is to focus on events. This form of linking uses a particular event as a means to organize the data. In our analysis of the events related to one of the MSU sub-unit's installation of a client/server computing-based system we structured the analysis around different data sets by focusing on what was said, done, or related to particular aspects of the implementation process (see Sawyer and Gibbons, 2000). We have also begun to discuss analysis based on highlighting the connections among different sets driven by particular people or groups – a form of social network analysis.

Integration

Analyzing multiple data sets that are focused on a common phenomena often leads to paradoxical results. That is, data drawn from different data sets may lead to contradictory findings (Sawyer, 2000b). These contradictions represent the potential for new learning or for exposing methodological flaws (Robey, 1995). Developing such findings suggests the value of interim analyses to help define differences among data sets (Miles, 1979).

The need for ongoing analysis and the intense energy that field work demands that the multi-method researcher must be both close and distant to the data. To make sense of mixed forms of field data, ongoing analysis is critical and deeply reflective analysis is demanded. Prescriptive analytic techniques -- available in more traditional experimental and quasi-experimental data analysis (e.g., Pedhauzer and Schmelkin, 1991) are not as well developed for qualitative analysis (e.g., Miles and Huberman, 1994). In fact, that is one of the points that gives rise to this paper. Still, there is some guidance. For example,

using explanatory matrices – where issues form one axis, sources form the other, and supporting data fill the intersecting cells – is one flexible technique (Miles and Huberman, 1994). Another technique is to build evidence chains, where an issue is stated and then the supporting evidence is laid out. Both of these imply immersion in the data sets to develop ways to categorize the corpus of data and to extract the relevant segments. This guidance gives rise to additional operational issues which we take up in the next section.

Is Analysis Comparison or Contrast?

This aspect of multi-method research focuses attention on the way analysis is conducted. One approach is to focus on identifying the overlaps between sets. As discussed, above, this is the approach which best aligns with attempts to triangulate findings across multiple data sets (Jick, 1979; Jones, 1999). A contrast approach to analysis implies that the multiple data sets allow the researcher to highlight and explore incongruities and paradoxes that arise. Influenced by Robey's (1995) conceptualizing the value of exploring paradox, in the MSU study we have instead used contrast as the orienting approach (see Sawyer and Southwick, 1997).

Relationship to Process and Variance Models

A multi-method fieldwork approach to research draws on data collected using techniques that often are tied to dissimilar epistemologies (Jones, 1999; Falconer and McKay, 1999a, 1999b, 2000). For example, most survey approaches to data collection are focused on developing factors or structures that explain or predict outcomes, and these are typically factor or variance models. Fieldwork data sets often imply a process or sequence theory (Abbott, 1995) Mohr (1982) argued that process and variance theories drew on different epistemological assumptions and should not be mixed. Within the IS literature, both Markus

and Robey (1988) and more recently Jones (1999) have also argued for this delineation.

Shaw and Jarvenpaa (1997) go on to present a typology for combining process and variance approaches that has 18 forms, 16 of which are hybrid combinations. Each of these approaches allows for multi-method research. However, in each approach the means to incorporate process and variance leads to different issues. My intent in this paper is to focus on analysis of multiple and dissimilar data sets, not to engage in the ongoing debates on process and variance models (see instead Mohr, 1982, Markus and Robey, 1988, Abbott, 1995, Langley, 1999, Weick, 1999). However, it is important to realize that developing multi-method research is likely to also mean confronting some epistemological choices and explicitly deciding on how to accommodate both process and variance models .

MULTI-METHOD ANALYSIS ISSUES

In this section I reflect on my efforts to conduct multi-method analysis, touching on some of the mechanical and philosophical issues along the way. My focus on multi-method analyses suggests that I draw on both fieldwork analysis and survey analysis. However, I do not spend our time on these topics. The literature and guidance on analyzing survey data is both extensive and well known (e.g., Miller, 1991; Pedhauzer and Schmelkin, 1991). The literature and guidance on fieldwork and other intensive and/or qualitative research approaches has a growing body of literature and the companion chapters of this book contribute to this corpus (see also Miles and Huberman, 1994). My focus is on how to combine and/or move between multiple and dissimilar data sets drawn on the same phenomena. – a form of synthesis. I would also note that most social scientists have done some form of this synthesis (such as using some pilot interviews to help structure a survey or archival data to assist in setting up an experiment). My

orientation is towards the use of synthesis to allow me to move among data sets. The rest of this section contains a discussion of issues that arise in the analysis of multiple data sets.

Explanatory matrices provide a means to synthesize dissimilar data sets

In the process of coordinating and tracking data collection the research team members have used vignettes and stories to help develop a shared understanding of what we are learning (e.g., Miles, 1979; 1990). The research design means that each of the research team members develops insights driven by their field work, use of survey data, and perspectives into the MSU transition. Through this planned – but informal – interim analysis effort, several themes emerged. These themes are used to help frame a return to the field notes and organize data to support or refute their value. This framing was done using explanatory event matrices (Miles and Huberman, 1994; Miles, 1990). In an explanatory event matrix the themes form one axis (typically the rows) and the sources of evidence form the other axis. The cells made from this matrix contain pointers back to the source of evidence relative to the theme (or concept) to which it relates (see Appendix 1 for more about explanatory matrices).

Two points follow from this use of explanatory event matrices. First, using these matrices creates evidence chains, an important element of any rigorous method. The chain of evidence allows other scholars to understand (if not replicate) the thinking that is embodied in the matrix. Second, explanatory event matrices are not tied to a particular method of analysis – it juxtaposes themes and evidence. This means that themes drawn from different data sets can be set within the same matrix.

Non-overlapping findings lead to richer insights

Kaplan and Duchon (1988) highlight that discrepancies between their field work and the survey data were

instrumental both in nearly derailing the project and served as the source of the greatest insight. This contrasts with proponents of multi-method analysis who suggest that multiple data sets allow the researcher to draw the same conclusion by drawing on analyses the same phenomena from multiple perspectives (Jick, 1979). Focusing on where the themes and findings that emerge from analysis do not overlap has led to greater insight in my own research. For example, the findings of my dissertation (which primarily focused on analyzing survey data) suggested that software development teams did not benefit much from using an electronic meeting support (EMS) system (Sawyer, 1995). However, after more detailed examination of the 16 months of fieldwork data (and additional field work and surveys) I was able to discern distinct differences in EMS use based on various software development team social practices (Sawyer, Farber and Spillers, 1997).

In the MSU study survey data suggested that most respondents were comfortable with the impending computing change. However, one of the most consistent observations was that the majority of the people who were to be affected by the ERP installation had high levels of uncertainty and were quite unsure of the changes to come. This difference highlights the value of the contra-indicating observation as an important signal for additional attention. These differences also highlight the value of multiple data sets – I have been able to draw on observations, conduct interviews and re-read documents to help re-examine evidence about how MSU's people are preparing themselves for ERP-enabled change.

Integrating across multiple data sets is time-consuming

While the use of explanatory event matrices allows some juxtaposition of data sets, I find it difficult to be immersed in more than one set of data at a time. Given the large number of non-overlapping themes and findings in the different data sets, switching data sets means also switching from one set of findings and

themes to another. Without some unified means to conceptualize these data sets, the range of findings and themes quickly overwhelms me. Kaplan and Duchon (1988) intimate this in their discussions of how the project team, with each member tied to a particular data sets' findings, had trouble understanding the findings and themes that arose from analysis of other data sets. In the context of the MSU data set, it was easy to dismiss the findings that arose from the survey data analysis. Given the investment in the fieldwork and the lack of involvement in designing and collecting the survey data, it was difficult to invest the time to understand this data set.

Moving between data sets is time-consuming: a personal "switching" cost. The Guinan, Coopriider and Sawyer (1997) paper reflects this in that we did not overtly include the findings that emerged from our field work, reporting instead a series of models derived from the survey data. However, these models were informed, and the analysis guided by, the field work. Thus, we minimized switching costs by privileging the survey data over the fieldwork data. I did this, again, in Sawyer and Guinan (1998): highlighting survey data findings but relying on (unreported) field work data to shape this analysis. In doing this I minimized the cost of switching data sets and perhaps also reduced the value of the potential insight. Gallivan (1997) notes that many multi-method studies are reported as distinct pieces. Moreover, I have taken the same path in my current study on MSU's computing infrastructure: focusing each paper on the themes that arise from a particular perspective and in doing so muting the other perspectives.

Privileging one perspective on the data

Implied in the discussion of switching between data sets is the importance of knowing one's data. Multi-method research means there are two (or more) sets of data drawn using different ontological and methodological approaches. This demands great intellectual flexibility (or perhaps naivete) for the

researchers (Jones, 1999). In many cases, multi-method research approaches rely on multiple researchers, each tied to a particular method (as in Kaplan and Duchon, 1988). Other times, the research team members overtly privilege one perspective over the other (in order to reduce the difficulty of knowing deeply and the cost of switching between). In the MSU study, the six-plus years of study have added the additional complexity of data volume. With such a large corpus of evidence it becomes difficult to organize and present the data in a way that allows one to comprehend the data set. In this way my experience with the MSU multi-method study mirrors some of the experiences Schultze (2000) writes on in her ethnography of information workers. Thus, difficulties in understanding large data sets are not particular to multi-method studies. However, the need to know dissimilar data sets further complicates the processes of understanding this data.

Using interim theories

The best way I have found to explore the data has been to nurture emerging hypotheses – to check out my intuition by returning to the data sets, pitting emerging theorizing against current data. Miles (1979) writes of this approach as interim analyses: carrying the results of a particular interim effort forward into future analyses. And, earlier, I wrote of explicitly incorporating this into the research method through the research team meetings. In the presence of multiple and dissimilar data sets, I've found this approach to be quite valuable. Coupled with using explanatory event matrices, this allows me to explore an emerging theory across several data sets (and in building the matrix I also develop my evidence chain as a record). In the cases where there are multiple researchers, this approach provides a basis for comparison and contrast. As an example, early in the MSU case we did a short study of a self-contained component to the larger project (See Sawyer and Gibbons, 2000). During the data collection, we (the two co-authors) developed different theories of how the installation of the new parking services computing system

evolved. Both of us built matrices supporting our pet theories and then were able to negotiate through these to the point that the final analysis (represented as a case study) emerged.

Creating linkages between data sets: Taking the long walk

Relative to any mono-method analysis, multi-method data analysis takes added time to learn multiple and dissimilar data sets, to be able to switch between them, to identify and analyze the outliers, and to work through the myriad pet (or interim) theories that arise from within various data sets. This time is set against most scholars personal agendas and perceptions of time. Such deep and consuming reflection must be set against the realities of academic work/ reward structures (for granting, tenure and promotion), the topical movement that is a pertinent factor in contemporary studies of ICT use, and the current (journal-article-oriented) structures of IS scholarship.

Beyond the contextual observation, one under-explored issue relative to the synthesis of multiple data sets is data reduction – the process of abstracting themes from the evidence and then testing and modifying these themes across multiple data sets. In the absence of automated approaches (such as the use of factor analytic techniques in statistical analyses) to combine data sets, I have found reflection the best means. This reflection is often done via long walks which I have used to sort out a blur of facts and make some sense from so much. As biographies of many scientists (such as Einstein, Watson and Crick, Paling) have suggested, deep reflection is a common aspect of much research². In essence, the long walk becomes a data reduction technique. Perhaps the most discomfoting aspect of this observation is that a reliance on individual skill is not replicable. This suggests that synthesis may be idiosyncratic. This observation implies that the process of making the linkage is less important than is the ability to represent the link. In essence, this shifts the attention from method to finding. And, while this seems reasonable it

also suggests the difficulty in developing a reasonable basis for how best to make these linkages.

DOING MULTI-METHOD RESEARCH: SOME CONCLUSIONS

One of the more persistent challenges in multi-method analysis is documenting the analysis of multiple data sets. This is one of the reasons I have repeatedly suggested developing explanatory event matrices. In practice, the matrix is often a simple table, with the cells containing pointers back to the proper sources. Less than one-half of the MSU field work is digital (much of it is pen and paper), so these matrices become shorthand structures for recall. I date them and often have multiple versions clipped together. Combined with reflective comments in the field notes (as suggested by Bogdan, 1972 and discussed above) this is my best way.

One common response to my plaint, above, is to use some form of computer-aided analysis software (such as NUD*IST or ATLAS-TI). However, I have found that they serve mainly to help maintain the structure of relations (embodied in my series of matrices with pointers). And, to use them it often requires either digitizing all the data or maintaining both a paper structure and a digital structure (in the software). Thus, I've moved away from using such tools. To me the difficult work is developing the structures and themes, not keeping track of them.

It also seems that most multi-method studies are based on teams of multiple researchers. Typically, each researcher had a particular method expertise (and perspective). For example, in the MSU study, one researcher has led the effort, working with various collaborators within the research framework. In this way each research team member has a pre-defined role. It may be that a multi-method approach demands multiple researchers, that the different data collection approaches are tied to the particular

researchers, and the integration across multiple data sets is, in practice, a negotiated arrangement among the research team. Certainly this is the way multiple methods were used by Kaplan and Duchon (1988).

Moreover, in each of the examples in this paper, one data set (or at least one type of data) dominates the analysis. In effect, this is the way most survey-based research is done, the survey data set is dominant and all fieldwork (interviews, etc.) are explicitly or implicitly subjugated (Brewer and Hunter, 1989).

The MSU approach reflect this, but the dominating data set is the corpus of field notes, making this more like a fieldwork study than I had ever anticipated. While sensible, privileging data sets suggests that any multi-method research approach evolves into a tiered research effort.

Conceptually, though, multi-method analysis is based on the premise that separate and dissimilar data sets drawn on the same phenomena will provide a richer picture of that event or issue than will a mono-method analysis. My experiences suggest that, while valued by social science and IS scholars (see Jick, 1979, Brewer and Hunter, 1989, and Gallivan, 1997), multi-method research is still an under-developed approach. Still, even given its current level of ambiguity, multi-method approaches provide a robust frame from which we can work on developing better insights into, and more useful theories of, the inter-related roles of ICT's uses and the formal and informal social organizations into which they are embedded.

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Table 1: Six Issues with Multi-Method Data Collection

Role of theory	Used to guide the study and establish relationships between multiple data sets
Independence	The effect of one data collection methods to another.
Insulation	Exposing subjects to effects of multiple waves of data collection.
Interdependence	Providing for intentional links between data.
Integration	Combined analysis of multiple data sets.
Comparability v. Contrast	Analysis highlights differences caused by different type of data and can lead to incongruities in analysis.

Appendix 1: Explanatory Matrices

In an explanatory event matrix the themes form one axis and the sources of evidence form the other axis (Miles and Huberman, 1994; Miles, 1990). The cells formed by this matrix contain pointers back to the source of evidence relative to the theme (or concept) to which it relates. As an example here is (an abridged) part of an explanatory matrix used in Sawyer (2000b).

Themes\Evidence	Mgr1 Interview1	Mgr2 Interview1	Mgr2 Interview2	Meeting1 Observation	PM Plan N
Specific Implementation Characteristics	<i>Note: This group of characteristics reflect issues with implementation. Evidence supporting each of the four characteristics are drawn from a range of sources.</i>				
Multiple stakeholders	See lines 4-10.	See lines 55-57, 61-64, 102-105.	See lines 45, 49, 76-81.	See the diagram and field notes, p2 & 4.	See sections on stakeholders and steering committee.
Multi-level	See lines 53-75.	See lines 83-92, 115-132, 134.	See my comments To this interview.		
Multiple effects	See lines 111-138.	See lines 151-157. See the two memos MGR2 provided w/ this interview.		See field notes pp 7-9.	See risk management section (and updates).
User schedules				See field notes pp. 10	See plan v. updates.

Notes:

1. See OECD, (1998), *The Software Sector: A Statistical Profile for Selected OECD Countries*, Committee for Information, Computer and Communications Policy, Directorate for Science, Technology and Industry, Organization for Economic Co-operation and Development, Report DSTI/ICCP/AH(97)4/REV1 at <http://www.oecd.org/dsti/sti/it/infosoc/stats/software.htm> (Sep. 20, 1999).

2. I invoke these scholars' names to point out their use of reflection and to highlight the value which they place on reflection. In essence, I appeal to higher authority! A naive reader might think I am setting my work near theirs and this is not so.