

AN EMPIRICAL INVESTIGATION OF THE EPISTEMOLOGICAL ASSUMPTIONS UNDERLYING TWO ISD APPROACHES

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Abstract

A situated information systems design (ISD) methodology for supporting routine work is being iteratively developed and refined. Driven from a different theory of action from conventional ISD methodologies we have reason to believe that the new methodology assumes a different epistemological stance. As pointed out by Hirschheim (1995) there has been very little examination of epistemological assumptions implicit in ISD methodologies. Consequently, in this paper we address the differences in epistemological assumptions of the conventional ISD approaches (such as Structured System and Analysis Design Methodologies) and the situated ISD approach by constructing a simulated field situation to allow a conventionally-trained IS analyst to analyse the same case as had been previously analysed by applying the situated ISD methodology. We find that while the conventional approach focuses on articulated knowledge and observes the system under study with a detached stance, the situated approach includes tacit knowledge and recognises the importance of the environment. This is achieved through immersion in the system such that the situated analyst attempts to take the subject position of an actor in the system, while also maintaining some analytical distance.

Keywords: systems analysis and design, methodologies, epistemology, information systems theory

1 INTRODUCTION

In several previous publications (Johnston and Milton 2002; Johnston et al. 2005) we have argued that conventional approaches to information systems design are implicitly informed by the widely-held view that human purposeful action proceeds by deliberation on a mental model of the world of action. Consequently, these approaches privilege support for the more deliberative aspects of human activity in work systems such as planning, decision making and simulation. However, activity at the operational level in many work environments is largely routine and poorly supported by such information systems designs. Recent work in the cognitive sciences under the rubrics of situated action theory (Suchman 1987; Agre 1997) and ecological psychology (Reed 1996) suggests that routine action is largely non-deliberative and makes crucial use of structures in the action environment for attainment of goals.

In response to this we are engaged in a long term funded research project to develop a new information systems analysis and design methodology for application in work domains where operational activity is largely routine, which is explicitly informed by these situational theories of human action. The project (Johnston et al. 2005) uses a participatory case-study approach in which the methodology is iteratively applied and developed in real companies with routine system problems. Unfortunately, space does not permit full elaboration here. However, in broad terms our 'situated systems methodology' involves analysing routine work practices in terms of action-centred constructs (actions, situations, activities, environmental structures, affordances) to identify their core goals, activities and environmental constraints. This analysis allows reorganisation of these work practices in restructured environments so that system goals are achieved more effectively and efficiently using

lighter-weight information system support.

In parallel to the iterative development program, we are interested in demonstrating empirically that the methodology is indeed paradigmatically different from conventional systems analysis and design methods such as Structured Systems Analysis and Design Methodologies - SSADM (Johnston et al. 2005). This paper reports on the analysis of an investigation we have conducted to this end. We conducted a single case experiment in which we asked an experienced systems analyst, trained in conventional methods, to perform a systems analysis and high-level design proposal for a real company that we had earlier studied in the first iteration of our methodology development program (Johnston et al. 2005). In that case study, one of us (VW) had applied the situated systems methodology to propose a solution for the company and had thus played the role of a "situated systems analyst" while simultaneously researching the methodology. Because it was not possible to gain further access to the original case company, we created an off-site simulation of the company with which the "traditional systems analyst" could interact.

We can thus not only compare the two solutions produced but also study the processes by which they were obtained to make a more explicit comparison of the philosophical commitments which drive the two analysis and design approaches. In this paper we deal specifically with the epistemological issues that arise when our methodology is applied in practice rather than the conventional approach. Rather than deduce the epistemological position from what we already know about the philosophical underpinnings of the situated systems approach, we are taking the route of using an empirical investigation of the epistemology-in-use through a comparative application of the two methodologies. To complete this project, we will also use the data collected to examine how the underpinning ontology and action-theory manifest themselves in practical application of the methodology.

The paper contributes to theory because, as pointed out by Hirschheim et al (1995), within IS there has been little analysis of the epistemological assumptions behind different IS analysis and design methodologies. This paper should be of interest to those concerned with the philosophy of information systems analysis and the competing claims of various ISD methodologies.

2 RESEARCH METHOD

2.1 Case study

Our starting point is a case study undertaken as part of the methodology development project (Johnston et al. 2005). The case involved Cabling Communications Pty Ltd (pseudonym), a company which manages the activities of 40 technicians involved in installing residential telecommunications equipment and six technicians involved in disconnecting such equipment. The company employed a team of four full-time job dispatchers, two part-time dispatchers and two part-time warehouse staff. Cabling Communications had an outsourcing contract with a larger telecommunications provider, Telco, and subcontracted the work it received to a team of technicians working as independent contractors. Cabling managed the installation of 100-150 telecommunications products each day, and the disconnection of a similar number. Cabling's Management were interested in a redesigned system that would result in improved efficiency and effectiveness as well as cost savings to Cabling, in particular a system that, although designed specifically to suit the current activities of Cabling, could be applied to any future workforce management activities that Cabling might undertake.

Cabling Communication was selected as a case study site for the development of the situated systems analysis and design methodology (Johnston et al. 2005). We conducted a situated systems analysis of the work practices in the case study site and developed a proposal for improvement, based on the existing version of the situated systems methodology. At the same time, our research purpose was to test the existing instantiation of the situated systems methodology and use the case study findings to further develop it. In other words, as well as proposing an improved system, we were involved in theory testing and theory development.

Because of its focus on supporting routine work, development and refinement of our situated methodology required that the researcher be embedded in the work system. To achieve this, a mixture of research techniques was used over a period of 12 weeks (Johnston et al. 2005). The researcher first trained and worked as a dispatcher. In addition, semi-structured interviews were also conducted with dispatchers, technicians and warehouse staff and their work was directly observed; for example, the researcher followed technicians in the field and asked questions about their activities as they worked. Because the researcher applied the methodology as part of this participatory case study we could use this as an example of the phenomenon of undertaking of a situated systems analysis through which to identify the epistemological assumptions implicit in the conduct of this type of analysis.

2.2 Single case experiment

One year after conducting the case study, an experienced conventionally trained systems analyst was asked to conduct a second systems analysis and high-level design proposal for the same business problem. This analyst did not have direct access to Cabling and so in order to have this analyst study the same system as the project situated researcher had (the organisation of Cabling had changed over the year), a single case experiment was set up whereby the situated researcher acted as a proxy for Cabling. The conventional analyst was given a context diagram of Cabling showing the different actors involved (manager, dispatchers, router, technicians, warehouse staff). From this, the conventional analyst devised a schedule of interviews. He was also provided with all of the available company documentation of the computer system. Because of the situated researcher's deep immersion in Cabling's practices, it was possible for her to role-play Cabling system personnel in requirements gathering interviews and provide the conventional analyst with the information he sought in order to conduct the analysis and high-level design. The conventional analyst was initially not told the research purpose of his work, other than it was to provide an analysis of Cabling systems and a proposal for improved design.

2.3 Analysing the case study and the single case experiment

We had two analyses of the same business problem. One was conducted by a situated systems researcher applying the situated systems methodology. The other was conducted by a conventionally trained and experienced systems analysis conducting analysis and design according to the conventional tradition. (The method used by the conventional analyst conformed with the tradition of SSADM).

The data about these two phenomena that we have for analysis are the actual system analysis records in the form of notes, drawings, formal representations, and the final design documents. We also have accounts of the process undertaken, in the case of the situated systems analysis through field notes and introspection, and for the conventional systems analysis through recordings of the interaction with simulated users and interviews with the analyst after the design phase. These data were used to elucidate the epistemological commitments underlying the analyses and design.

2.4 Limitations of the design of this investigation

We are well aware of the limitations of the design of this investigation. Firstly, because a system design practice based on the situated methodology does not yet exist, the researcher involved in both applying and developing the methodology is only a surrogate for a professional analyst trained and experienced in using the final methodology. Secondly, there were severe restrictions on how the conventional analyst could actually collect the data. We did ask the conventional analyst to describe how, ideally, he would have gone about the study and to comment of the extent to which the design felt artificial. Thus, both our 'situated' and 'conventional' systems analyses are simulated and once removed from actual practice. In addition, both the researcher and the conventional analyst brought

their own epistemological assumptions to the research. Moreover, we have just one instance of each so generalization cannot be statistical. Against these limitations, since each analyst engaged in an extended interaction with a real-life scenario from analysis to design, we have a strong basis for analytical generalization as well as high external validity.

3 IDENTIFYING EPISTEMOLOGICAL APPROACHES

In broad terms, epistemology refers to the nature of knowledge. Three questions (or very similar versions of these questions) are commonly used to investigate an epistemological approach (for example, Chua 1986; Hirschheim et al. 1995; Denzin and Lincoln 2000). These are: What can be known? What is the relationship between the knower and the known? and How do we find things out? Although this first question is often regarded as an ontological question, it is closely entwined with epistemological issues. Similarly, although the third question addresses methodological issues, these are informed by the epistemological position.

Although there has been a longstanding debate within IS over the epistemological merits of positivism and interpretivism, this debate has now died down (Mingers 2004) and we have no interest in rekindling the fire. As Klein and Myers (1999) acknowledge, in contrast to Burrell and Morgan's (1979) characterisation, there are a range of philosophical positions associated with interpretivist research. We would say that the epistemological position of situated systems theory is interpretivist in that we view human action as meaningful and we discover this meaning rather than negotiate or construct it (Schwandt 2000). However, this understanding of interpretivist is different from that of Orlikowski and Baroudi (1991) who describe it as a position where the researcher refrains from imposing a particular view of the world on the data and is interested in understanding how meanings are negotiated in everyday life. Likewise, our position is quite different from Klein and Myers' declared hermeneutic approach, which also sees meaning as mutually negotiated and which they also describe as interpretivist.

Given these difficulties with terms, we see no point in trying to characterise the two ISD approaches in terms of declared epistemological positions. Rather, in this paper we will compare the epistemological positions of the two approaches in terms of the three questions listed at the beginning of this section.

4 COMPARING EPISTEMOLOGICAL APPROACHES

4.1 What can be known?

Implicit in the approaches of the conventional analyst and the situated analyst are very different ideas about what can be known. Fundamental to the situated theory of action are the ideas that knowledge is embedded in action and that action is situated in the environment. Implicit in the approach of the conventional analyst was the position that what can be known is that which can be articulated and ultimately represented in the system. This is illustrated as follows.

In order to analyse the system, the conventional analyst used knowledge articulated in responses to interview questions or manifest in documentation of the existing computer system. He said that ideally, he would have conducted the interviews in the actual work environments. When questioned closely it became apparent that he was superficially interested in the environment of the system, for example the attitudes towards change and computers. Visiting the actual work environments would not have changed his analysis, only his ideas about implementation. His analysis would have remained in terms of functions, processes and data stores.

The situated theory of action draws from Heidegger's understanding of knowledge as a way of being in the world, rather than a reflective representation (Guignon 1983). Because of its focus on routine action, the situated analyst is required by the methodology to try to get to tacit knowledge, which is implicit in action which occurs in the environment. Hence, the situated analyst tried to become

immersed in the environment of the actors through participant observation. Whereas the conventional analyst was superficially interested in the environment of the system for implementation reasons, understanding the environment of the actor was fundamental to the approach of the situated analyst. Her analysis, guided by the methodology, explicitly included an understanding of the physical, cultural and organisational aspects of the environment as well as actors' tacit knowledge. It appears that the conventional analyst sees work in some sense as abstracted from real environments, as are the representations that make up the computer system.

4.2 What is the relationship between the knower and the known?

The situated analyst and the conventional analyst adopted very different relationships with the 'known', that is, with the system under study. Whereas the conventional analyst would typically be characterised as a detached observer, the situated analyst became a participant observer and actually worked as a despatcher at the case study site.

But was the conventional analyst really detached and objective? Sociology of Scientific Knowledge, Feminist and Postmodern studies all critique the idea of pure objectivity as a myth. As has long been maintained by theorists of standpoint epistemologies, ways of knowing and being are shaped by the individual's standpoint or position in the world. In this study, although it may have appeared superficially that the conventional analyst had an objective relationship to the system under study, he was forthcoming about how his previous experience with systems coloured his interpretations. We submit that the position of both the conventional analyst and situated analyst is one of 'embodied objectivity' (Haraway 1991), that is, a view from 'somewhere'. In the case of the conventional analyst, that 'somewhere' included the previous experiences that the analyst brought to his work.

The case of the researcher acting as 'situated analyst' was more complex. In addition to the researcher's previous experiences, through participant observation (which was dictated by the methodology), the situated analyst experienced the subject position of an actor in the system. This meant that the nature of the situated analyst's engagement with the study was vastly different from that of the conventional analyst. As Nandhakumar and Jones (2002) point out, participant observation is seldom discussed in mainstream IS journals and the difference between the participant observer and the detached observer has been traditionally conceptualized as a dichotomy between insiders and outsiders (Walsham 1995). More recently, as described in Labaree (2002), anthropologists have variously conceived of a continuum existing between insiders and outsiders (Galibert 2004), of both occurring at once, and of a continual moving back and forth between insider and outsider status. It appears that the situated analyst was like the sociologist of everyday life who Hitzler and Keller refer to as being 'permanently in the dilemma of being at the same time co-actor, observer and reporter' (1989:100). This relationship affected how the situated analyst understood both the problem and the solution. As Labaree puts it, "the participant observer cannot be immunized from their respondents, acting like a detached recording instrument that merely synthesizes the data and disseminates the findings." (2002:113) Working with the despatchers meant that the situated analyst understood what was frustrating about their work and felt some type of moral obligation to ensure that the proposed solution made the routine aspects of their work easier rather than more complex.

The interpretation of both the situated analyst and the conventional analyst was also coloured by their values and beliefs (Lincoln and Guba 2000). As expected, the conventional analyst privileged management as the priority for system support. His first interview was with the manager, and he was most interested in improving things from a manager's perspective. His formulation of the problem was that it didn't support management enough and hence his solution was based upon automating some of the existing processes and improving information to management, including more precise measurement of KPIs. This solution involved an unreasonable increase in workload. The conventional analyst also added Human Resource Management and Payroll as functions to the system, even though these had not been identified as a problem by anyone to whom he spoke.

In contrast, the situated analyst privileged the facilitation of routine action over the provision of

information to management. Informed by the situated theory of action (Johnston et al. 2005), she believed that more of what happens in organisations is routine rather than not routine. As a result, the situated analysts' formulation of the problem, and hence the solution, was based around improving communications between dispatchers and technicians. By contrast, the conventional analyst did not look at things in terms of action and so did not think that it was important to improve communications between dispatchers and technicians.

When discussing epistemological positions, the word 'critical' is used to indicate both an assumption that knowledge is inscribed with particular power relations, and a political motivation of transforming these power relations in favour of the dominated (Ngwenyama 1991). While not necessarily having the same political agenda as a critical analyst, the solution proposed by the situated analyst was empowering for the dispatchers. This was not a coincidence in that, while certainly not dictating a particular political stance, the methodology encourages the situated analyst to focus on activity. The situated analyst considered that the dispatchers are the ones who know most about the system as they are the ones involved in the operational activity. As has been described by Johnston et al (2005), the most effective systems are those that support operational activity effectively. Obviously, these systems need to be sold to the manager. However, systems designed only according to management's expressed needs and without operational considerations in mind are likely to backfire (Mumford 1983). This is why the researcher worked as a dispatcher rather than as the manager.

4.3 How do we find things out?

The following discussion shows that the situated analyst and the conventional analyst had quite different approaches to gaining knowledge about the system, identifying opportunities for improvement and finding an appropriate solution.

According to the situated action view in forming the methodology, actors engaged in routine action do not make use of explicit models of the work world; their knowledge of what they do is tacit. In Polanyi's familiar words, they 'know more than they can tell'. This means that the analyst must engage with user's work practices closely rather than just rely on interviews and documentation. As discussed, the situated analyst used participant observation which allowed her to experience the subject position of an actor in the system. Being immersed in the system also enabled her to collect 'unprompted data', (Galibert 2004) those data which are constructed by and for the actors. The conventional analyst relied mainly on 'prompted data', those which are constructed by and for the observer; in this case responses to interview questions and documentation about the computer system.

At an abstract level, the conventional analyst tried to find things out by dividing what was happening into functions. Goles and Hirschheim (2000:252) characterise this as a search for Humean causal relationships based on reductionism, 'where the whole is further and further reduced into its constituent parts'. The approach of the situated analyst was perhaps more holistic than this, maintaining greater recognition, at an abstract level, of the relationship between the parts. The conventional analyst combined transcripts from interviews and documentation to construct high-level data flow diagrams that were detached from the context. In contrast, the situated analyst wanted at all times to maintain the relationship between activities and the particular circumstances in which they occurred.

In order to identify opportunities for improvement, the situated analyst used the situated systems methodology to evaluate the work practices against stated and tacit goals and constraints. Any identified opportunities for improvement were grounded in the data. In contrast, it appeared that the conventional analyst had an a priori concept of what a system should be like (e.g. it should include Payroll and HRM functions) and that he identified problems by reference to this ideal type.

Although both analysts made use of abstraction, for the situated analyst, the abstraction was like a prop to enable identification of opportunities for improvement. The solution was grounded in the particularities of the workplace and made use of environmental structures so that goals were achieved

more effectively and efficiently. In contrast, the conventional analyst appeared to expect the abstraction (logical system) to conform to an ideal type. In this sense, once he had defined the logical problem, he considered that he had the solution; design was just an implementation detail.

4.4 Summary of the epistemological position of the Situated Systems Methodology

Discussions in IS about research philosophies have often drawn from anthropology (Walsham 1995). In broad terms, the preceding analysis indicates that the epistemological position taken by the situated analyst is comparable to that outlined by Galibert (2004) in the context of anthropology, (although the situated analyst deliberately changes the system under study and focuses on everyday working life rather than everyday life). Galibert distinguishes between a factual anthropology which focuses on states of existence and an actor-observer anthropology or an 'anthropology of action' which focuses on everyday life as an activity, retains the context of field data and acknowledges its particularity. Galibert describes this anthropology of action as coming 'from below' and being both participant and detached, both inside and outside the subject of study. It is inside in that it is 'built up in the time and space of its object and is... within the expressive forms of the interpersonal relations expressed in local sociality' (2004:462) It is outside as a result of the analytical distance that it takes. This description of actor-observer anthropology resonates with what we discovered to be the epistemological position implicit in the situated systems methodology.

5 CONCLUSION

The paper reports on a novel empirically-based investigation that allowed us to compare the epistemological commitments of our own developing situated systems methodology with those of the conventional approach by examining reasonably realistic instances of their application to the same real-world problem. We have analysed the epistemology-in-action of the two analysts as reflected in their collection of data and its subsequent analysis under the three headings: What can be known? What is the relationship between the knower and the known? and How do we find things out? See Table 1.

| | What can be known | Relationship between knower and known | How we find things out |
|------------------------------|--|---|---|
| Conventional approach | Articulated knowledge | Analytical distance | Detached observation, comparison to ideal types |
| Situated approach | Both articulated knowledge and tacit knowledge Influence of the environment | Analyst takes subject position of an actor in the system, while also having analytical distance | Immersion in the system |

Table 1: Comparison of the epistemological positions implied by the 2 approaches

The work is significant because there has been little previous work comparing epistemological commitments of alternative ISD methodologies *as they are played out in actual application*. We will next use the data to compare the ontological and action theoretic commitments of the methodologies. In terms of our own long term project to iteratively develop and refine a practical methodology for designing information systems that effectively support routine action, it gives us an independent check that the methodology does actually differ paradigmatically from the existing tradition.

Acknowledgements: We wish to thank the management and staff of Cabling for kindly making their time and facilities available for the case study. This project is supported by Australian Research Council Discovery Grant DP0451524.

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