RESEARCH METHODS IN INFORMATION SYSTEMS
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9 RESEARCH METHODS IN INFORMATION SYSTEMS: USING ACTION RESEARCH

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Abstract

A major difficulty for researchers has been to understand the choice and applicability of Information Systems Methodologies in practice for small organizations. This work is based on the construction of a new methodology based on current methodologies as a comparative exercise. To understand this methodology as a whole and the original methodologies, a hermeneutic approach was utilized. Action research was used in seven cases with experienced and naive analysts. One of the tentative conclusions from this research was that information systems evolution for small organizations construed as an inquiring system comprises the information systems methodology, the problem situation and the intentions and assumptions of the analyst.

Introduction

As Information Systems has evolved into a discipline there have been increasing tensions between theory and practice (for example, Checkland 1983 and Hirschheim 1983 have demonstrated the tensions in O.R.). Tension has also emerged between "scientific" and "sociological" approaches to research (Jackson 1977).

This paper presents a framework for research into real life Information Systems analysis and design and presents a report on our work at the University of East Anglia under the following headings:

(1) The area of concern
(2) The multi-view methodology
(3) Research paradigms in information systems
(4) The choice of action research as an aid to developing the multi-view methodology
(5) Practical strategy in the development of the multi-view methodology
(6) General theory lessons
(7) Explanation of the variety in the cases
(8) Tentative conclusions from the action research
(9) Further developments and use of the research

The Area of Concern

The main area of concern is the current confusion in systems analysis and design because of the emergence over the past few years of a number of new methodologies or approaches. One attempt to relieve this confusion has been in the area of methodological comparison. Perhaps the most thorough example of this was the CRIS exercise (CRIS 1982, 1983). Iit must be said that this suffered from three limitations. The first was that it relied on voluntary contributions from the proponents of methodologies. This tended to weight the sample towards the academic and led to some glaring omissions, particularly Ethics and the NCC approaches in the UK. The second lay in the specification of the task, which started from a problem statement and thus pre-empted that part of a methodology concerned with problem analysis. The third was in the lack of an organizational perspective, e.g., political, social factors.

Another attempt to compare methodologies was based on the original work of Couger and Knapp (1974) to classify tools and techniques as the "bottom-up" approach in comparing methodologies (Colter 1983; Couger et al. 1982).

In our attempt (Wood-Harper and Fitzgerald 1982), initial ideas were based on comparing six approaches appropriate to systems development with respect to the objectives of the methodology, paradigms and models. Each methodology will contain several models. Ethics (Mumford 1982) contains the "socio-technical" model and the "cybernetic" model. This initial comparison by Wood-Harper and Fitzgerald was to postulate the "dominant" model of each methodology.

To add to the comparisons of methodologies, Klein (1983) made an important point, i.e., "How can we be neutral in using tools and techniques unless we are in a problem solving situation?" We believe that he was arguing that the context of the problem situation is important for the comparison of methodologies.

A similar point was put by Checkland (1983) at Argyris's (1983) interactive seminar in Minnesota: "What is the situation?" The important point he was making was that we cannot judge any action unless we understand the "cultural" situation.

Our view on comparing methodologies is similar to Klein and Checkland and we feel that it must be seen in the context that the analyst and the user cannot be removed from the problem domain. This view is reflected in our subsequent work.

The Multi-view Methodology

Arising from the taxonomy of Information Systems Methodologies (Wood-Harper and Fitzgerald 1982), a framework was constructed from the comparison of methodologies. The systems analysis consisted of the following five areas:

- Analyze Human Activity Systems
- Model Information
- Analyze/Design Socio-technical Systems
- Design Human Computer Interface
- Design Technical Sub-system

It is possible to select the most suitable approaches to each of the five areas and then integrated the results of each into an analysis and design methodology. This methodology was called "Multi-view." The scope of the methodology is roughly bounded as Structured Systems Analysis (De Marco 1980) or Logical Systems analysis. This Analysis and Design (Jeffrey and Lawrence 1984) does not include physical design.

Construction of Methodology

Multi-view was not established overnight, nor is it complete. Available tools and techniques, insights drawn from other methodologies as well as more formal insights have been put together and then developed and amended in the light of experience. This process will continue.

The field of Information System Methodology is composite because it is made up of views seen from different perspectives. Each view selects its own relevant facts in relation to its own values. As Vickers (1970) says:

> Each view needs to be described from its viewpoint, sometimes in its own language—just as a sociologist, a rioter, a bystander, and a policeman need to give the different accounts of the "same" riot....But the differences between them are due not only to ignorance and error but to a difference in viewpoint which, by making different facts and values relevant causes...the resulting accounts to be neither conflicting nor cumulative but complementary.

We agree with Vickers' exposition except that sometimes the views could be conflicting. These views quoted above were originally perceived as through a "sieve" through which appreciation about the organization and its information needs are drawn. These five stages must be integrated to achieve an effective solution.

The Model for the Five Stages

The five models contained in the methodology are as follows:

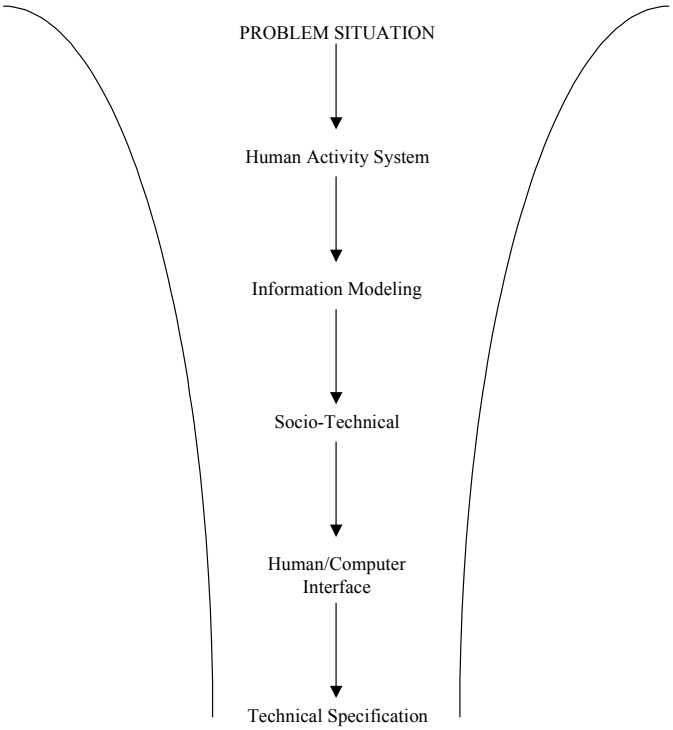


Figure 1. The Model for the Five Stages

- The Human Activity System analysis is based on Checkland, particularly "Rich Picture and Root Definition" (Client, Actor, Transformation, World-view, Owner, and Environment—Smyth and Checkland 1976).
- Information modeling is based on the semantic nature of data. It charts entities, attributes, and relationships (Rock-Evans 1981) and the functions on that data.
- Socio-technical design is based on the analysis of Internal Organization, People, Technology and Tasks. This leads to the explanation of the various socio-technical alternatives (Mumford and Weir 1979; Mumford 1983; Trist 1981). This model will delineate the tasks between people and computers.
- Human/Computer Interface model is based on insight gained in the airline industry in the early 1970s (British Airways 1972) and refined by Blackman (1975). The model is conversational.
- The technical sub-system model is based on Waters' extensive consultancy and research experience from the early days of DP in the UK at Lyons. Waters (1979) suggested the interaction of sub-systems which must be present, concentrating on the technical specification of a computer system. He detailed several sub-systems consisting of: application, information retrieval, database, and maintenance, recovery, control, monitoring, and Human/Computer Interface systems.

Waters included Human/Computer Interface as part of the Technical Subsystem, but our version has conceptualized the Human/Computer Interface as a distinct area in view of extensive new research efforts.

Research into the Methodology

An action research program was set up (Wood-Harper 1982; Wood-Harper and Flynn 1983) to deal with a variety of cases, using the Multi-view methodology to interpret and reinterpret the "theory" of the five models framework. Our intention was to determine the extent to which Multi-view, in practice, helps the analyst and the users to achieve an effective solution of problems particular to small organizations. Our research position is important—Mason and Mitroff (1981) in commenting upon the Harvard Case approach make a useful critique on Christensen et al. (1978). The Harvard Case approach can be seen as:

- Each organization is "unique"
- It cannot be ordered into a neat *a priori* classification
- Empiricism is based on "in-depth" personal judgments of a "problem solver" with regard to a particular situation
- It is subjective

Mitroff (in above) comments:

> What makes something scientific is not the absence of variability but rather on our collective ability to study why the results vary. There is nothing inherent in the Case approach per se to prevent us from studying how and why different analysts reach different "action" plans.

Although Mitroff's comments emphasize the Harvard Case, this is appropriate for other case work. In our case work, we tried always to comment on the "theory" and explain it more fully, whilst also being prepared to adjust that theory if the need arose. The following section maps out the research paradigms appropriate to information systems.

Research Paradigms in Information Systems

Information Systems is a multi-perspective discipline and should have a pluralism of research methods. Antill (1984) drew a broad picture of research methods and assumptions and showed the relevance of each of these to Information Systems. Different research paradigms were developed in different disciplines—physical science, history, astronomy, sociology, etc. We see the Information Systems field as embodying a mixture of scientific, technical, organizational, societal and psychological aspects. Therefore the researcher has to understand the appropriate paradigm to the particular work being undertaken and to interpret the results accordingly. Jenkins (1984), at this conference, maps out the research methods for Ph.D. students in Information Systems in the U.S.A.

Our methodology and its stages can be best seen with a social science viewpoint on research. Morgan and Smircich (1980) give a useful typology for Organization Theory

on the approaches in Social Science and give examples of research methods in organizations. They define a paradigm for research consisting of core ontological assumptions of reality, the assumptions of human nature, the epistemological stance, the type of knowledge to be produced and favored metaphors.

Paradigms of Assumptions in the Stages of the Multi-view Methodology

In understanding the multi-perspective nature of Information Systems and, particularly, Information Systems Methodology, it is important to relate the typology for organization theory to the different approaches used within Information Systems.

The assumptions underlying the conceptual models in the areas of the multi-view methodology based on the original "candidate" methodologies is in Wood-Harper and Fitzgerald (1982) and can be related to the assumptions on which the research methods in Table 1 are based. We place the methodological assumptions as follows:

(a) The assumptions in the Human Activity area are based on Checkland's methodology and can be placed in columns 1 and 2. Particularly, Checkland classifies his methodology as an exploration of pure subjectivism.
(b) The assumptions underlying the Information Modeling area based on Data Analysis can be placed in columns 5 and 6.
(c) The assumptions underlying the area of Technical Design based in the Traditional (NCC) Systems Analysis methodology can be placed in columns 5 and 6.
(d) The assumptions underlying the socio-technical area based on the socio-technical options by Mumford (1982a, 1982b) can be placed in columns 3 and 4.
(e) As discussed above the stages were used as a basis of the Multi-view Methodology. The assumptions underlying the Multi-view Methodology can be placed in columns 2 and 3 and are discussed in more detail in the following section.

Paradigm of Assumptions on the Multi-view Methodology

The question can be asked, "What paradigm is appropriate in acquiring knowledge of the multi-view methodology?" Our research interest is not only the methodology in itself as CRIS, but also the understanding in action. If we look at the table, the research methods spectrum spans from the phenomenological insight to the construction of a positivistic science. The different parts of the methodology address different assumptions from reality as a concrete structure to the projection of human imagination. We believe that our assumptions must balance and synthesize these views.

Dilthey gives an analysis of World View under three headings and this can be thought of as a paradigm:

1. **Naturalism** – the view that man relies on his senses to understand nature and subsequently adopts a goal of manipulating nature for his/her own ends. This is the goal of positivistic science.
2. **Subjective Idealism** – in which the actor projects moral ideas that will transcend the given reality of the situation. This is the goal of phenomenology.

Table 1. Morgan Table
(Adapted)

	Subjective approaches to Social Science			Objective approaches to Social Science		
	1	2	3	4	5	6
Core Ontological Assumptions	Reality as a projection of human imagination	Reality as a social construction	Reality as a realm of symbolic discourse	Reality as contextual field of information	Reality as a concrete process	Reality as a concrete structure
Assumption about Human Nature	Man as a pure spiritual, conscious being	Man as a social constructor, symbol creator	Man as an actor the symbol user	Man as an information processor	Man as an adaptor	Man as a responder
Basic Epistemological Stance	To obtain phenomenological insight, revelation	To understand how social reality is created	To understand problems and patterns of symbolic discourse	To map contexts	To study systems process change	To construct a positivist science
Some Favored Metaphors	Transcendental	Language game understanding text	Theater culture	Cybernetic	Organism	Machine
Examples of Research Methods	Exploration of pure subjective	Hermeneutics	Symbolic analysis	Contextual analysis of *Gestalten*	Historical analysis	Lab experiments surveys

3. **Objective Idealism** – this is the view whereby the world is regarded as not being manipulated scientifically nor is it dominated by the assertion of moral will. This is the goal of hermeneutics.

Our theory of multi-view needed a philosophy which would integrate the range of perceptions in our framework. We therefore used the hermeneutic method. This hermeneutic understanding of the above is amplified by Checkland (1981) as follows:

- It consists of the theory, art or skill of interpreting, and understanding of the product of human consciousness.
- The subject matter of the human sciences have coincided with the external facts, but also in conjunction with expressions of the human mind which becomes cultural.
- There emerges a number of conflicts by a process of objectification.
- The hermeneutic analysis aids the process which allows the preliminary concepts of the subject matter to emerge, and is then used to conduct an examination of what the parts reveal. This in turn clarifies the concept of the whole which must be perceived so that all the parts can be related to it.

Relating back to the table, we can see our four assumptions as follows:

(1) Ontological – an information system methodology is a framework or designed abstract system to postulate rules for the effective analysis and design process. Therefore the methodology has to be interpreted by the "problem solver" in the problem situation.

(2) Epistemological – the method used is dependent on the problem situation, the owners and the problem solvers. To understand the "how" and "why" of the methodology as it is used in practice, it is necessary to understand and develop the methodology. Knowledge produced from this research will not lead to scientific laws but the situation and understanding of rules that can be transferred to similar problem situations and contexts.

(3) Assumptions About Human Nature – the assumptions here are that the actors construct their social reality in the human activity system and the socio-technical system and the interpretation of rules in that situation.

(4) The favored metaphor is the interpretation of text. A methodology can be seen only within the historical development of the methodology and "read" and understood over time by action and reflection.

Our work is very similar to the Scandinavian view (Hansson 1982; Kall 1982).

Our research therefore attempts to understand how system analysis and design is interpreted through objective idealism. We believe that to understand this process it can only be thought of in terms of action research in situation enrichment for the multi-view methodology as a whole and the models of "the parts" of the methodology.

The Choice of Action Research as an Aid To Develop Multi-view Methodology

The problem context under consideration here is the analysis and design prior to the implementation of small computer-based information systems. The particular topic within that area is the development of a suitable methodology enabling the analysis and logical

design to be done cost-effectively within the very heavy constraints imposed by the unavoidable shortage of expert systems analysts of small systems.

Within Social Sciences, Clark (1972) postulates five methods of research:

- Pure Basic (concerned with a theoretical problem)
- Basic Objective (taking a general practiced problem)
- Evaluation (assessing some aspect of performance)
- Applied (trying to solve a problem by applying the appropriate knowledge)
- Action Research ("one strategy of influencing the stock of knowledge of the sponsoring enterprise and also of the scientists")

Our research consists of trying out the methodology on practical cases which will, in turn, provide feedback for theory building. What does this mean in practice, and what implications does the practice have on theory development? Since in our context each situation is, by definition, "unique," it is impossible to set up controlled experiments. Thus, if real insight is to be gained from real life situations, we believe there is no other alternative than to use some form of Action Research.

Action research stems from the behavioral sciences based on the principle that the researcher is within the field of that research and becomes a partner in the action and process of change.

The source of action research originates from Kurt Lewin, who says that complex real social events cannot be studied in laboratory conditions. Pointing out that we need an action "frame of reference," Silverman (1970) says, "society is concerned with action rather than with observing behavior. Action arises out of meanings."

It follows that an explanation of human actors must take account of the meanings whilst remaining aware of their actions. Land (1983) states:

> If you're going to do research in this area, which method of research is valid? We're concerned with a multi-dimensional world in which it is very difficult to analyze cause and effect....some people call it action research....develop techniques, methods and methodologies and thus we go into the world and try them out...find a host who is willing to use these and we try to see as best as possible how things will work out....It is difficult to say what effect is due to the methodology or to some personal or environmental factors.

The one large body of Action Research cases which most resembles the work being undertaken at the University of East Anglia (UEA) is that carried out under the supervision of Peter Checkland at Lancaster's Department of Systems. The similarity between UEA and Lancaster was that graduate student "problem solvers" are trained in a particular methodology and are then sent out to live organizations to analyze their problems, recommend solutions, and evaluate the usefulness of such solutions as were implemented (or the factors which caused such solutions to be rejected) and to participate in Action Research. Our Action Research learning cycle is shown in Figure 2 from Anderton and Checkland (1977) and HUMOR Group SYSLAB (1982).

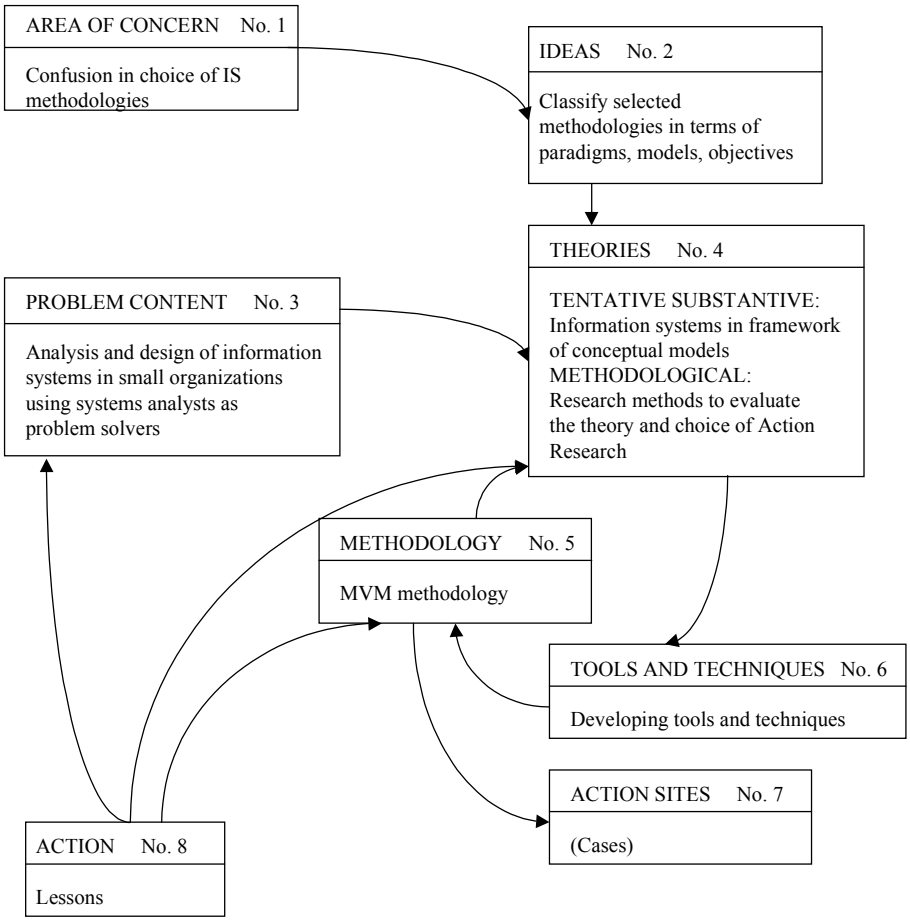


Figure 2. Learning Cycle of Action Research

Stage 1 – commences the recognition of the confusion in the choice of Information Systems Methodologies.

Stage 2 – one of the ideas generated to alleviate this confusion, by evaluating current methodologies in the UK with case material, could be by classification. This classification consisted of paradigms, objectives of use, and the conceptual models (how the methodology conceptualizes its "world").

Stage 3 – frames the problem context as the analysis and design of information systems in small organizations (Bolton Report 1979) by using systems analysts (the "systems analyst" within the problem domain).

Stage 4 – suggests two theories: substantive and methodological. The first was to postulate a tentative framework consisting of the five models (as shown in an earlier subsection of this paper). Each part of this framework will bring its substantive theory. For example, Human Activity Systems theory will be

taken as the theoretical basis on the intellectual construct laid by the Lancaster School. The second was how to investigate the methodological theory by research methods. We chose the action research method by case (Research Paradigms and Action Research as shown in an earlier section).

Stage 5 – this is the Multi-view Methodology constructed from the five model framework and based on the objectives of use of the original methodologies. The sequence of this methodology goes through the analysis of Human Activity Systems, the Information Model, analysis and design of the Socio-technical Options, design of the Human/Machine Interface to the design of the technical specification.

Stage 6 – tools and techniques are developed within the methodology including refinement of techniques when available.

Stage 7 – Action Sites with seven cases. The first three were in a professional institute, two were in a computer/consultancy company, one in a freight company, and one in a polytechnic distance learning unit.

Stage 8 – Each case is written up and lessons learned in the theoretical and the methodological sense under these headings in order to build case experience:

–	Problem Situation Initial Terms of Reference....	+ =	The political+organizational climate the personal problems, personalities and roles.
–	Problem solvers Problem solving Team	+ =	The analysts(and their experience) participation and non-participation of users in the problem solving process, management process in the problem solving team.
–	Action	=	Results of the work, the attitudes and satisfaction of the problem owner.
–	Methodology Product	=	Documentation of the methodology work products
–	Methodology Theory	=	The stages of methodology, model cycles + iterations.
–	Substantive Theory....	=	What is this work, what can we say about the five views for Information Systems in small organizations?

Practical Research Strategy in the Development of the Multi-view Methodology

Two strands of research provide valuable comparison. Both strands are engaged in virtually the same activity although normally on different cases.

Experienced Analysts

These analysts are engaged directly in Action Research. That is to say that they are actively involved in theory building. This is part of an on-going program of paid consultancy using full-time and part-time consultants. The commercial and contractual nature of the work is an essential part of this strand of research as this type of pressure is one of the main driving forces viz the need to provide adequate Systems Analysis, Design and Implementation (SADI) support at an acceptable price.

Naive Analysts

The other strand of the drive to provide adequate SADI is the desire to support the naive analysts. These are undergraduates used in the research. They work in project teams on final year assignments. They have had basic grounding in computing and accounts and are trained in the Multi-view Methodology. The project teams tackle the same problem situations (Wood-Harper and Flynn 1983; Antill and Wood-Harper 1984).

General Theory Lessons

The research team and both strands above were engaged in theory development. An IS methodology is based on complex substantive and methodological theory which can only be developed over time. It is not susceptible to "make or break" testing in the short term.

Information Systems Methodology Theory

The first patterns are now emerging from the individual case lessons on methodological theory. Iteration of the main phases from our experience was expected, but the results were more dramatic. In the professional examination system, the Man/Machine Interface would be a low priority in the rational order of the methodology. The examination system used the Institute's examination centers (of another Institute) in the UK. In order to permit the use of these centers, they had to approve part of the output of the system at the time when the investigation had just started. Again on this case, at the problem perception stage, it became apparent that the "treasurer" would approve the hardware if, and only if, the micro-computer he had in his office was chosen!

In another case, the polytechnic distance learning unit hardware had to be purchased against the "logic" of the sequence of the phases of the methodology. Educational establishments in the UK have the end of their financial year in April. For the polytechnic, the "hardware" had to be purchased before April otherwise the budget was lost. Churchman (1982) points out that there is a dialectic between "idealism" and "realism." In our work, "the ideal" is the sequence of the methodology as prescribed, but "the reality" is reiteration and the mixture of phases.

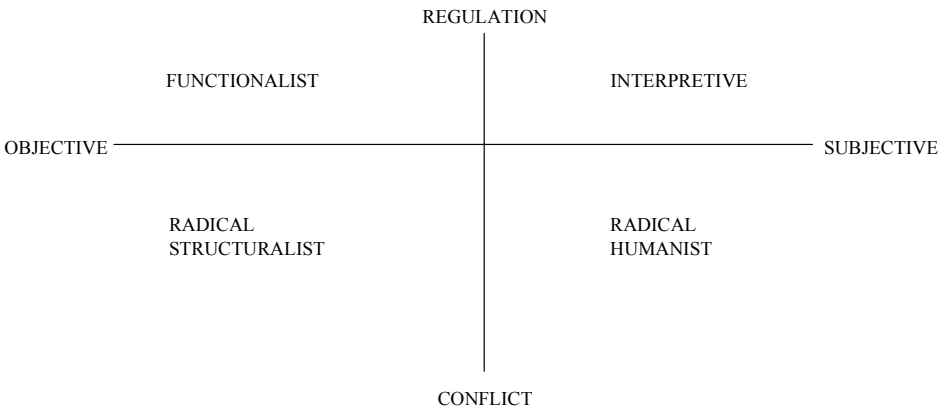
Substantive Theory

Our cases were used to reflect the theory and in particular the interaction between the analyst, the methodology and the problem situation (Wood-Harper and Episkopou 1982). These could be thought of as an Inquiring System (Churchman 1971) and as a Human Activity System for Systems Development in small organizations. The general patterns from lessons acquired on each case can be seen within their perspective by reflecting theories on chances and problems of field experiments (Nissen 1982).

Nissen makes two points. The first is that we cannot formulate general laws about situations and people (and methodologies) but if, on the other hand, we formulate *a priori* theoretical frames of reference, the researchers will be able to express the part of what they learn in relation to it. His second point (and the most significant, made also in Checkland 1983) is that the contributions to theoretical knowledge must reflect the fact that we need: "open theories based on Weber's 'Ideal Types,' and in cases real people close the theory in action." We feel that this methodology is an "ideal type," applied subjectively in each case by the analysts through the interpretation of the problem situation.

Explanation of the Variety in the Cases

It is necessary to explain the variety of interpretations possible in each case, particularly in the human activity stage above, by examining alternative underlying assumptions. Burrel and Morgan (1979) have formulated a framework of two dimensions: the first based on the assumptions about the nature of social science from Subjective to Objective; the second on the assumptions which a theory makes about the nature of social reality, from conflict to regulation. If we construct these dimensions, we have the resulting diagram:



The individual cases in our research strands as above have demonstrated how different paradigms interpret the Human Activity Stage. This concept was formulated by how this concept was viewed through the above paradigms.[1] The following table details this concept through the four paradigms.

Table 2. Human Activity Stage

FUNCTIONALIST	INTERPRETIVE
The Human Activity System does not have to rely upon impartial observers for its existence. Its sub-system and interactions function accordingly, again dependent of outside manipulation. The reason for investigating these systems is to grasp a better understanding of their functions. The humans within the system do not present extra problems in so far as do other components. Thus there exists the possibility of dual function, i.e., prediction and control of the system. We can see this exemplified in a conglomeration of bureaucratic routines, all operating in an efficient, reliable, impersonal manner. The first paradigm also provides the occasion for experimenting with new and different structures.	It is necessary to understand subjectively the intentions of the humans who construct the systems if one is to have a clear idea of how and why such systems operate. Obviously the analysis will recognize its dependence upon the *a priori* notion of free choice and free will inherent in people's actions. – Only through in depth participation and intimate involvement can detailed information about it be obtained. – The paradigm is helpful in areas that concern the subjective, emotional aspects of relationships. Thus it can be seen that these different aspects can facilitate prediction and control of the system because it allows the participants to conduct their activities in a less erratic and more constructive manner.
RADICAL STRUCTURALIST	**RADICAL HUMANIST**
They appear to have a hard existence external to the observer. Research into the system is for the ultimate reason of considering radical changes. The object is to underline the fact that such systems are occasionally unstable and do have contradictory/ conflicting elements between its different groups. The purpose of the study is to aim at an end result which will furnish the emancipation of people in our present-day socio-economic structures.	Similar to the Interpretive paradigm, the Human Activity Systems are seen as the constructions of humans, and as such can be viewed as external as well as subjective. Participation in such systems must be a priority if an understanding of the systems is to be grasped fully. It follows that participation implies a valuable part in the process of changing existing customs. The emphasis on participation is to enable a rapport and understanding with the status quo—which is generally considered to be a constraint upon human developments. As a consequence, it is hoped that this will help the process of emancipation on all levels—socio-economic structures, psychological barriers.

[1]Adapted from M. C. Jackson, University of Hull, consultancy work on "Systems and Systems Methodologies" (unpublished) for the Open University.

Our understanding of the above paradigms helps us to evaluate the interpretations based on our theories and the problem situation, plus the terms of reference. Most of our cases tend to use the functional paradigm for Information Systems except in two instances. The first was the computer/consultancy company, where the authors of this paper acted as consultants (one of the authors being the company chairman). There were major changes in the company based on the study. Within this study, the interpretive paradigm was exclusively used. The second instance was the Information System for course management for distance learning financed by the UK government and physically placed at a polytechnic. This was an unexplored field situation within our framework, not having a complete Human Activity System. Actors in the problem participating fully in the design included the radical manager of the unit and his staff (who were all seconded polytechnic staff) who wanted to change the education system. They felt that existing education systems had to change to emancipate people by their teaching material, assessment, and themselves! We therefore see the methodology in this case as being based on the substantive theories lying in the radical humanist paradigm. This variety demonstrates that the domain of Information Systems methodology can be partly explained by the interaction between the problem situation, the analyst and the method as an inquiring system. This context will constrain or liberate the inquiry through one of the four paradigms.

Tentative Conclusions from the Action Research

This work was based on an idea which attempted to classify methodologies into Objectives, Models and Paradigms. An "ideal" methodology was set up, based on this classification and used in action research, with the aim of understanding more comprehensively the methodology, the problem situation, the terms of reference, and the analyst as an inquiring system.

We are now beginning to understand more clearly the hermeneutic understanding of an Information System Methodology in practice in small organizations. The work has shown three main patterns emerging from the cases:

- A methodology cannot be separated from the problem situation and the analyst's intention and beliefs.
- The sequence or logic of a methodology is ideal, but the realism of the organizational climate will force a constant dialectic.
- Paradigms—the assumptions underpinning our theories on methodologies and action will be conditioned by the initial terms of reference, the problem situation and the analyst.

Further Developments and Use of the Research

We can broaden our conclusions of our research by looking at the diagram below of the multi-view framework. Cammann (1981) comments that a program of research should:

- Integrate with the field with which it is concerned.
- Identify its objectives of use.

We will comment upon these aspects in greater detail.

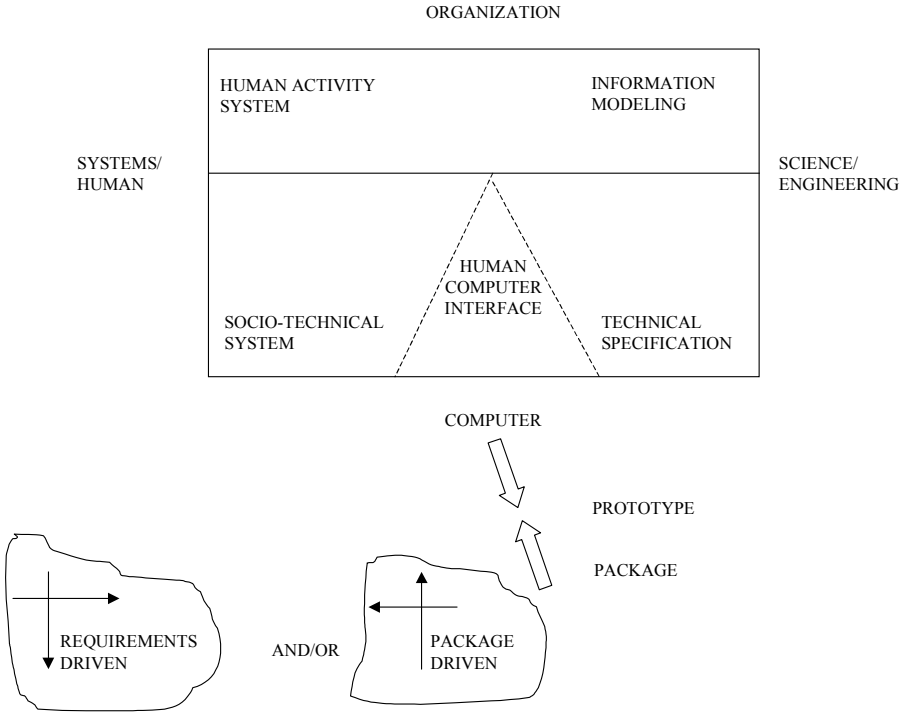


Figure 3. Representation of the Multi-view Methodology

Integration with the Field

The representation of the multi-view methodology in Figure 3 can be related to the current research. Mumford (1982a, 1982b) can be seen as the main development of Ethics on the left half of the diagram. CRIS obviously lies within the right hand side, although Flynn, Episkopou and Wood-Harper (1983) comment that only four in the original submissions deals with the Human/Computer Interface design. ISAC seems to cover most of the phases, although it is difficult to define exactly its theoretical base as above compared to Ethics and CRIS, although it has enough variety and is very successful in identifying change. Prototyping is one of the most significant ideas for Information Systems within the science paradigm.

We now are using protoyping as a strategy to implement the bottom right-hand box as the technical specification and man/machine interface (Wood-Harper 1983 for "ideal" case study; Wood-Harper 1984; Wood-Harper, Moore and Parker 1984;Dearnley and Mayhew 1983a, 1983b). Martin (1984) on Information Engineering can also be seen on the right hand segment. The map shows packages in which more research is needed. It is however a valid point because small businesses may need the use of these packages to tighten their information requirements. As Pfeffer (1981) states in one of his four laws of Organization Research:

> The law of Unresoluable Ignorance: How can organization theory make valid contributions in successful organization analysis when they ignore the unsuccessful failures?

In our context, we need to research the vast majority of small businesses who do not apparently need, as yet, information requirements within our "formal" sense.

Objectives of Use

A research program should formulate its Objectives of Use. One of our objectives is to help small organizations and the means by which this can be achieved is twofold. The first is by direct teaching of end-users. This has started on an EEC funded course for a developing country—1983-84—and we hope to start a course for local businessmen in London and in Norwich. Secondly, the research has a much wider impact because of the publication of a book which is specifically written for the end user. The contents will be adopted by the ITEC centers (Antill and Wood-Harper 1984b). Cammann says:

> Since different potential consumers of research results are likely to have different interests, to assimilate information differently and to employ different standards for judging results,; researchers need to know their audience and adapt their themes, methods and reports accordingly.

The representation in Figure 3 shows the overview of the content of the book and the course, where the multi-view diagram is shown and demonstrated in using packages and prototyping in systems analysis for the end-user. We hope that some of our results from our research will be useful to external "naive" analysts. There are more lessons to be learned by us. The process of the learning cycle continues!

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