

L. Stapleton, (1999). 'Information Systems Development as Interlocking Spirals of Sensemaking', in Zupancic, J., Wojtkowski, W., Wojtkowski, W.G., Wrycza, S., (eds.), *Evolution and Challenges in Systems Development*, Kluwer Academic/Plenum Publishers: New York.

Information Systems Development (ISD) in Complex Settings as Interlocking Spirals of Sense-making

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1. ABSTRACT

This paper assesses a research framework against the findings of a field research study. The framework employs the metaphor of a triple spiral as a means by which Weick's sense-making concepts can be applied to ISD activities. The study examines the experiences of members of a large manufacturing organisation in a multinational company. Study participants included project teams members, consultants and senior management. This research is ongoing and other organisations are being engaged in the study. Results suggest that the framework is applicable to the ISD activity and could be used to encourage broad-based research in ISD i.e. research that brings together and understands the relationship between the IS as a social artefact and its complex organisational context. The results support the notion that the framework aids the understanding and management of change at micro- and macro- levels within organisations.

2. INTRODUCTION

This section provides a brief outline of the philosophical underpinnings of the study. Any philosophical basis implies a set of accepted assumptions. This study shifts the philosophical basis of ISD away from functional rationalism. Functional rationalism, Naturalism and Interpretivism in ISD and related literature are discussed and a Sense-making perspective is presented. The emphasis shift from functional rationalism to sense-making implies shifts in the assumptions underlying ISD and therefore imply emphasis shifts along each of the four dimensions of ISD. These emphasis shifts are presented in the 4P Framework in section 3.

This section outlines three philosophical positions found in literature regarding ISD: Functional Rationalism (Positivism), Naturalism and Interpretivism. Sensemaking is then proposed in the second section in the context of these philosophical positions, indicating how sense-making includes an interpretivist perspective but also emphasises action and response.

2.1. Functional Rationalism, Naturalism and Interpretivism in ISD Research and Practise

Functional Rationalism is a term coined in the literature to describe positivist influences in much ISD theory and practise (Bickerton & Siddiqi (1993)). Most ISD methodologies are based upon functionally rationalist premises. These premises have dominated ISD research and practise, a fact which is well documented elsewhere (Myers (1995), Klein & Hirschheim (1991), Galliers (1993)). Alternative philosophical positions have been proposed including Naturalism in ethnographic techniques (Suchman (1987), Bentley et.al.(1992)) and Interpretivism (Boland (1985), Myers (1995)).

Naturalism usually involves 'detached' observers. The observers build descriptions of the activities of the target group and, through various de-briefing methods, outline suggestions for technological (or other) support that might make the group more effective. Naturalism was originally a reaction against positivism within the social sciences. However, results from naturalist approaches have been mixed. Leading social researchers suggest that the notion of 'detached observers' is fundamentally flawed. An observer will, by definition, affect the behaviour of a target group. This and other objections have lead to a major re-evaluation of naturalist assumptions (Hammersley & Atkinson (1983), Hammersley (1990)). Within the IS community one reaction has been to jettison the assumption of a detached observer and, instead, directly engage organisations and subsequently examine the affects of this engagement. This is inspired by action research approaches (Avison & Wood-Harper(1990), Checkland (1981)).

Interpretivism focuses on the idea that reality is socially constructed inter-subjectively i.e. on the basis of the sharing of subjective realities amongst participants in a social group. This has lead to research based on phenomenology and hermeneutics, which focus on dialog and the inter-subjective construction of 'narratives' (Boland (1985)). This perspective is inspired by the work of Wittgenstein, Husserl and Schutz amongst others and has spawned a focus on attempting to define ways in which people use language to help them interpret reality ('language games'). This implies that the IS developer must gain practical experience of the 'language games' of the user in order to understand the interpretations that users have of the world, and therefore the subjective meanings and interpretations that they have of ISD, software specifications and the CBIS itself (Bickerton & Siddiqi (1993)). Recently philosophers and social theorists have criticised assumptions underlying interpretivism arguing that by overly focussing on the creation and interpretation of narratives interpretivists de-emphasise action (Ihde (1993), Weick (1995)).

2.2. Sense-making

Sense-making literally means the making of sense. People 'structure the unknown' (Waterman (1990) p. 41) and researchers interested in sense-making concern themselves with how and why people create these constructions and what the affects of these

structures are. Sense-making is viewed from many different perspectives in the literature. It has been seen as means by which cognitive maps of individual experiences are produced (Ring & Rands (1988)), as a way by which people organise stimuli so as to enable them to comprehend, explain, understand and predict (Starbuck & Milliken (1988) p. 51). It must be noted that sense-making and interpreting are not the same. Interpretation has been defined as deriving an ‘*acceptable and approximating translation*’ (Mailloux (1990)): *acceptable* meaning that it has some stature in the community and *approximating* meaning that one attempts to capture some intention etc. that is presumed to exist in some objective way. *Translation* is an activity such as historicizing or producing allegories that gives shape to the approximation. However, sense-making is more than interpretation. It involves creation as well as discovery and authoring as well as interpreting. Interpretivism has been described as being passive (Weick (1995)). Ihde believes interpretation and re-interpretation imply construction->de-construction->re-construction cycles. Such cycles are far from passive but emphasise invention and re-invention. Action and interpretation must go together. This is where sense-making enters the fray. ‘*Sense-making highlights the action, activity and creating that lays down the tracers that are interpreted and reinterpreted*’ (Weick (1995) p. 13). What has been lacking in interpretivist theory has been a focus on action. Ihde (1993) further argues that interpretivism over-emphasises the world as narrative. The world is not merely a text to be interpreted. It is a space within which we find and invent ourselves, discover possibilities and engage in experience. Sense-making induces a focus on process.

3. THE ‘4P’ FRAMEWORK

The framework proposed in this study is based upon the concept of sense-making. It introduces an *explicator*: someone who facilitates the sense-making process and thus enables adaptation to change and organisational learning as a fundamental part of complex ISD. Explication is the key process by which inter-subjective meanings are discovered. It involves reflection and evaluation of current systems and the search for future possibilities. The explicator is positioned between two worlds: the complex world of the manager and the technical world of the developer (Yadav (1983)). Explication is a philosophical term used here to refer to the process of revealing the nature of something without explicitly defining every element (ODP (1994)). It refers to the exploration and determination of meaning. In this study explicators are those who facilitate explication in the organisation.

[INSERT DIAGRAM 1 HERE]

Diagram 1 outlines one view of the framework. The framework has four dimensions: *Perspective*, *Process*, *Product* and *Power*. The study treats these four ‘P’s as important dimensions of ISD that must be considered by those involved in the development project. Each ‘P’ is a triple spiral involving explication. The exact nature of explication depends upon the dimension involved i.e. explicating the product of a project has different concerns than explication in the context of the politics that surround the project. The triple, interlocking spiral symbolises the interaction of various sense-making processes. One spiral represents sense-making activities that proceed within the ‘world’ of the user community, another spiral represents sense-making that exists within the ‘world’ of the development staff and another spiral represents sense-making that occurs in the ‘world’ of the explicator. The world of the explicator lies between the technical world of software development and the business world of the users.

The spiral metaphor is used to convey the idea that sense-making in the context of ISD implies both convergence towards solutions (and re-solutions) and divergence towards new ways of using information effectively. The *interlocking* of spirals represents the way that people involved in each spiral must interact with those engaged in other spirals of sense-making in order to make-sense of organisational realities. The dimensions and their constituent spirals are interwoven with each other into complex patterns of organisational behaviour (Stapleton (1998c)). The interlocking spirals thus represent the inter-subjective nature of ISD activities (Boland (1985), Boland & Day (1989)). For example, if change occurs in the business, each of the three spirals must interact for all the relevant parties to come to some sense of what the change means and what the appropriate responses are in the context of the IS. Converging upon solutions in this way implies a cyclic process during which the questions we are trying to answer are progressively reviewed and understood. Sense-making theorists argue that when the question is adequately understood then the required solutions should be obvious (Weick (1995)).

3.1. The Four Dimensions of the 4P Framework and Associated Emphasis Shifts

Sense-making spirals imply emphasis shifts along the four dimensions of ISD. These emphasis shifts are examined in the field research, providing the organising framework for the questionnaire used in the interviews. 'Emphasis shifts' implies, for example, that there is a prominent perspective in IS methodologies, which needs to be reviewed and shifted towards another *perspective*. Similarly *process*, *product* and *power* have associated emphasis shifts studied here. This section discusses each dimension of the framework in turn. Within this discussion, an emphasis shift is proposed which is examined in the study.

[INSERT DIAGRAM 2 HERE]

3.2. Perspective

This dimension refers to the viewpoints inherent in the literature, education and practise associated with ISD. Many writers have emphasised the positivist, functionally rationalistic perspective endemic in the discipline (Siddiqi (1994), Klien & Hircheim (1989), Boland (1985), Wood & Wood-Harper (1993), Myers (1995)). A growing consensus has emerged that because an IS is a social artefact technical/functional perspectives alone are invalid. Diagram 2 shows how a sense-making perspective emphasises question definition rather than decision making. A sense-making perspective requires the participants in ISD to focus upon understanding the questions underlying some stimulus or 'cue'. Weick (1995) argues that if these questions are understood their resolution is usually obvious. Cues arise in the user community as people come to understand the implications of a systems design or as they work with a prototype or fully implemented CBIS. Cues are initially poorly understood intuitive triggers. Explicators facilitate the sense-making process by helping the organisation to define the questions that are raised by the cues. Questions and solutions are fed through the triple spirals (and therefore through the development spiral i.e. the 'technical' perspective in ISD) by the inter-subjective interaction of the explicators, users and developers.

A major difficulty with positivistic perspectives is that they overlook the inherent ambiguities of organisational life (March (1978) & (1987)). On the other hand, sense-making locates people in a complex, ambiguous space within which they discover meanings and appropriate responses. March argues that ambiguity must be understood in its own terms, rather than trying to rationalise it into clear, coherent statements that eliminate ambiguity. Requirements determination is the area of ISD that often has most ambiguity and complexity associated with it because it attempts to reconcile two different world views (Yadav (1983)). However, Requirements Engineering continually cries out for clarity and coherence <\$F for example see the IEEE standard definition of a 'requirement' (IEEE (1983), Byrne (1994)> *Clarity* and *Ambiguity* are proposed here as opposite perspectives.

3.2.1. Emphasis Shift 1: Clarity => Ambiguity

Sense making implies that organisational space is chaotic, inherently ambiguous and must be made sense of in an ongoing process (Louis (1980)). ISD activity comprises many conflicting and nebulous issues. This perspective questions methodological approaches to ISD and offers a compliment to the notion of 'method' (Ciborra (1997)). The study examines this emphasis shift in an attempt to test the polarity of *clarity* and *ambiguity* and shed light on the applicability in ISD of notions of ambiguity as expounded by March. There is a myriad of ambiguities that could be examined in such a study. The focus here is on *Ambiguities of Preference and Meaning*. These are extremely important in organisational decision making and, by implication, in ISD (March (1987)). In deference to IEEE standard 830 (IEEE (1983)) most ISD methods demand clear, concise and coherent statements of requirements. However, if the world is inherently ambiguous it would seem that this demand is not only inappropriate but will lead to serious problems for both developers and users. A sense-making process is needed. A subset of these ambiguities is '*Ambiguity of Expectation*'. Mathiesen (1993) shows how different users have alternative expectations of what is meant by an 'information system' in the context of an ISD project. This ambiguity is rarely explicitly addressed in ISAD methodologies.

3.3. Process

'Process' refers to the means by which ISD proceeds. Metaphorically, this study uses spirals as an image of directed sense-making in ISD. Most methodologies advocate a linear path, flowing from one phase to the next until the end destination is reached (Senn (1989), Solvberg & Kung (1993) <\$F DOD (1985) & (1988) demand that US defence projects adhere to a linear path. Problems associated with linear transformations are abundant. For example, see Avison et. al. (1992) p.135, Moreton (1995) p. 160)). Even prototyping, often promoted as an evolutionary, cyclic, approach, is usually only revisited in one or two iterations, with engineers frowning upon more iterations (Davis (1993) pp. 341-5). ISD is far from a tidy, neat process. Rather the ISD activity is ambiguous, complex and involves the formation of 'contexts' within which people engage in cyclic learning processes (Ciborra & Lanzara (1994)). Spiral imagery reflects this complexity, emphasising a cyclic process of discovery and re-discovery, and the creation and re-creation of social realities. It emphasises the fact that IS developers can only achieve an understanding of information requirements by means of evolutionary techniques (Khazanchi & Yadav (1995)). In this section linear and spiral processes are seen as bi-polar opposites, and a shift in emphasis from linear to spiral processes is examined.

3.3.1. Emphasis Shift 2: Linear => Spiral

Kendall & Kendall (1993) describe ISD as a 'journey'. This journey is often represented in methodologies as linear with definite beginning and end points. For example, structured methods typically start with an 'opportunity analysis' phase and end with 'implementation' and 'warranty' phases. Sense-making spirals emphasise a journey with an ambiguous beginning and without a definite end destination. We will deal with the 'ends' of ISD in the next section. However at this point it is important to note that the spiral takes us in two directions simultaneously: *inwards*, converging upon an understanding and, therefore, a resolution of a question and *outwards*, diverging in a search for new meanings, new ways of 'seeing' and new possibilities. This emphasis shift transforms the linear tunnel into a journey of discovery during which we take stock of where we are at certain points and adapt to the 'environment' as it changes. Most methodologies overlook divergent thinking but heavily emphasise aspects of convergent thinking. For example, methodologies generally promote deriving decisions and agreement (to requirements, specifications etc.) as against an ongoing search for new, more effective ways of using information.

3.4. Product

'Product' refers to the outcome of ISD i.e. what the process produces. Many authors agree that the IS is a social system, part of a dynamic social process (Klein & Hirscheim (1989)). Torvinen & Korteinen (1997) argue that '*the ISD activity should be seen as a development of activity and not only as a development of software products*'. Therefore one expects that the outcome of an ISD process would, itself, be a process. This process gives rise to more processes as the spiral revolves. Sensemaking spirals reflect this notion by emphasising the ongoing resolution and engagement of ISD participants with a changing world. On the other hand most methodologies see the IS as a technological artefact comprising functions with definite, crisp edges. This is true of both structured methodologies and object oriented methodologies (Graham (1991)). Thus, the methods focus our attention upon a subset of the IS (the technical subset). The emphasis shift proposed here is from product to process, from ends to means. A (re-) development process is the outcome of ISD because it enables sense-making. What is redeveloped is a social, rather than technical, 'artefact'.

3.4.1. Emphasis Shift 3: Product => Process

Emphasis Shift 2 focuses upon ISD as a journey. Emphasis shift 3 reflects upon the 'destination' or outcome of ISD. Traditionally, ISD is seen as a means by which a CBIS is delivered to the organisation. Thus, the CBIS as a technical artefact is the outcome of the project. Spiralling sense-making suggests that the outcome of any ISD process must involve the provision or enhancement of the sense-making process itself. Thus, the development process never really ends. Diagram 2 shows how cues are made sense of through inter-subjective dialogue and solved and re-solved in the *Product* triple spiral. Explication facilitates this dialogue. Indeed, the IS itself enables sense-making.

3.4.1.1. Products or Processes?

This emphasis shift suggests that the product of ISD must itself be a process by which the 'world' can be explicated i.e. by which the organisation can make sense of changes in the world and their affects upon the information system. This implies that the two dimensions 'Process' and 'Product' are, in fact, the same. However *Process* and *Product* have been treated separately in this framework because all projects (whether social or technical) have purpose and are directed towards some goal, regardless of how ambiguous, mis-understood and dynamic that goal is. A development process must spend time converging upon implementable solutions. These solutions (and re-solutions) must focus upon the process itself and embody changes to the process by which the organisation can converge upon new solutions in the future.

3.5. Power

The impact of politics upon the ISD process is well documented (Markus (1984)). However, few methodologies focus attention upon the realities of influence and politics during ISD. Neither does ISD methodology literature provide much insight into how developers might address these issues. Often, ISD projects end up as battle zones where the development process itself becomes a weapon in the stockpile of armaments (Kendall & Kendall (1993) & (1994)). Lynn Markus warns IS developers that politics is ignored at their peril, and yet so often the IS discipline sees itself in some way 'above' politics as if this issue is irrelevant. This leads to contention between those engaged in the development process (Hirscheim & Newman (1989)). Yadav (1983) suggests that contention between IS personnel and user communities is driven by the methodologies themselves because they are focussed on the technological world of IS staff rather than on the more complex managerial world of the users. Researchers have proposed a need to move away from contention and find ways of building trust and the true involvement of users. This is seen as a shift of emphasis from contention to collaboration. Explicators are facilitators and arbitrators in the making sense of political processes.

3.5.1. Emphasis Shift 4: Contention => Collaboration

Explication provides a means by which participants in ISD can make sense of political realities. The framework proposes explication to facilitate collaboration and negotiation. Political realities are addressed explicitly as part of the development process and everyone is given a 'voice'. This idea draws on work by phenomenologists who show the importance of building trust and empathy in organisations in order to nurture openness in reflection and dialogue (Boland (1985)). This is especially important in situations requiring major change and adaptability i.e. where basic assumptions are being challenged and reviewed.

4. RESEARCH METHOD

A large organisation was approached and asked to participate in the study. Given the exploratory nature of the study, and the fact that it required very 'rich' data about how people viewed the world around them, it was obvious that a qualitative approach would be required. The field research method was adopted using questionnaire-based semi-structured interviews to gather data. Field research was preferred to case studies because it was felt that full and complete access to all documentation and participants in project development could be a problem. The questionnaire ensured that the same issues were addressed in each interview, although questioning was quite open and participants were encouraged to explore all aspects of ISD they felt related to the issue under discussion. Participants included project leaders, user representatives on IS projects, senior IS managers, users and consultants involved in project development. Interviewees were encouraged to discuss their experiences openly and in confidence. Tape recordings of the sessions were not used because it was felt that this would intimidate the interviewees. Many, but not all, participants were interviewed both in groups and individually. The group sessions were used to encourage discussion of issues amongst the various participants whilst the individual interviews were used to provide a setting within which participants could discuss issues privately. Interviews generally took place over a number of sessions and sessions lasted between one & two hours.

Of course the author cannot be sure that this empirical research is reasonably representative of ISD generally and further studies are being carried out to ascertain the more general applicability of the conclusions drawn up herein. However, it has been said elsewhere and is re-iterated here that most research approaches applied to ISD (including case studies, postal surveys etc.) are doubtful in this respect (Moynihan & Taylor (1996)).

5. OUTLINE AND INTERPRETATION OF RESULTS

5.1. Perspective

5.1.1. Clarity => Ambiguity

In the framework ambiguity is seen as opposite to the traditional premise of a primarily homogeneous, lucid world in which meanings are shared. The empirical evidence gathered supports the contention that during ISD user interpretations, expectations and organisation are fundamentally highly ambiguous. Participants in the study saw this as a major reason why the ISAD process be used to develop a system which evolves as a statement of requirements, rather than as a response to stated requirements. The IS was a *statement of requirements* rather a *response to requirements*. People continually revisited the IS in order to help establish their current preferences, needs and appropriate actions in response to the changing world within they were situated. This is particularly true in the maintenance phase (post-implementation). A number of interviewees explained that no two users shared the same interpretations of historical events, of what the organisation required or what the system should deliver (*Ambiguity of expectations*). All participants in the study stated that ambiguity was very pervasive in their experiences of ISD.

However, further analysis revealed that this bi-polar emphasis is overly simplistic. The organisation required some point from which to start making sense of the ambiguous and complex world of IS requirements and preferences. An emphasis on clarity in deriving requirements enabled reflection. 'Clear' statements (which usually existed in the form of a CBIS prototype) were not so important in their content, as they were important in their ability to set an agenda for making sense of the more complex social realities in which people found themselves. The positioning of the system (and the strategic business concepts it embodied) in the operational life of the organisation was a change management and learning process (Stapleton (1998b)). It provided a launching pad for sense-making and also provided a statement of 'where we are at', a record of previous sense-making activity. Thus, positivistic and rationalistic statements (system specifications, prototypes etc.) enabled people to make sense of subjective and complex realities. However, these statements were not themselves 'true' statements of those social realities. This suggests that *clarity* and *ambiguity* are not necessarily the opposite ends of a bi-polar emphasis. Rather they are both necessary perspectives of a sense-making process.

For example, in one case the ISD project had arisen as a result of strategic business concepts that were to be introduced in the firm. However, senior managers explained that implementing these concepts at an operational level was a perceived problem. Managers felt that if the organisation became engaged in dialog at the various management levels prior to actually delivering anything at an operational level the organisation may never implement the strategic concepts. As one senior manager put it '*we would be talking forever about it, without actually getting anything done.*' In order to overcome this perceived problem a software package was identified which embodied the key strategic concepts, thus ensuring that the organisation became engaged in the required discovery and enactment process i.e. find means by which the concepts could be operationalised by the business. Thus, the main objective of the ISD project was not to satisfy user requirements at an operational level but to enact major change so that high level business concepts would be reified in work practises. The IS was to be an agent of change, and a means for discovering what change meant (Stapleton (1998b)). IS functionality provided the agenda around which these discussions could take place.

5.2. Process

5.2.1. Linear => Spiral

The study examined this in some detail. However, for reasons of brevity this section focuses on the management of change during the ISD process. During the development process the general approach to handling change was as follows:

1. If a change requirement was identified, ask if it can be satisfied by modifying work practises etc.

2. If not then change the software (reluctantly!)

This approach is adopted across the organisation on most ISD projects. Importantly, it meant that changes to the package were strictly controlled and generally resisted. This smacked of technological determinism and so was explored with the interviewees to understand why they took this stance. Rather than the software package driving ISAD I suggested that user requirements should drive the process. However, further discussions with interviewees exposed the naivety of my line of questioning. Several participants told the story of a previous project that had taken the approach I had suggested i.e. respond to all change requests and modify the system accordingly. The results of this approach were

1. A project that had an enormous budget and time overrun
2. A system that had to be completely re-engineered.
3. A system that was almost the same as the system it was meant to replace.

There was much evidence to show that extensive user involvement could create a lot of problems. The 4P Framework did not take this possibility into account. The ultimate objective of the IS project was to introduce change into the organisation. However, because participants used existing systems as a frame of reference for the new system it was extremely difficult for them to see what the new system embodied in terms of new business concepts. The new system had new business concepts 'built' into it at a functional level. However, users requested that the new system be modified so that, effectively, the new concepts were programmed out. The project group obliged and the project was an initial failure and had to be re-worked. Interviewees spoke of the organisation being completely taken aback when the new system was unveiled and looked so like the previous system.

3.4.1.2. Capturing Cues

A requirements log was used to manage requirements. The log provided a means of recording cues from the users for change. The log entry (which was never longer than a single line) was unimportant. Interviewees explained this was because the '*actual requirement*' would be discovered during discussions that would take place between the explicator and the user when the log entry was explored. The MIS organisation recognised that the log entries were simply requests for help and 90% of requests were satisfied without changes to software. The requirements log recorded cues for sense-making and the explicator in MIS spent most of his time helping users (and MIS) to make sense of the cue, ultimately defining the need and the fix. Cues often arose as a response to change in operational activities. The explicator acted in a type of consultant/facilitator role not dissimilar to Weick's 'conceptual therapist' (Weick (1982)). This view of requirements determination and satisfaction is diametrically opposed to the linear views usually adopted in ISAD methodologies. MIS managers interviewed directly linked the fact that their organisation now spent more time in explication mode and less time writing code to an increase in users' satisfaction with the MIS group. This is currently the major IS activity in the maintenance of the implemented business system.

3.4.1.3. Spirals

Explication moved in two directions at once during ISD. Explicators attempted to come up with resolutions for questions raised by cues as found in the requirements log, but at the same time had to encourage the exploration for new possibilities and ideas in response to change. As participants attempted to overcome various problems associated with their approach to ISD (usually arising from the method they had adopted in capturing requirements) the study revealed that they moved further and further away from a linear process and more and more towards a spiralling process. This spiralling ISD process was a social process that was constantly revisited and re-invented. This is discussed further in the next section.

5.3. Product

5.3.1. Product => Process

Participants in the study found it very difficult to pinpoint when the project began i.e. when the initial requirements determination process started. Two senior managers stated that they could not remember that far back: '*you are asking us to go back into the eighties, that's a long time ago*'. Furthermore, when asked to pinpoint when work stopped on a system (as opposed to the project being 'implemented') participants described a systems maintenance mode which continued into the present and involved the satisfaction of '*user requirements*' (although often without modification to the CBIS). Participants agreed that there was an ongoing change-management process characterised by sense-making processes as described earlier. Thus, we can see that the 'end destination' of ISAD was an ongoing process of re-invention and re-discovery, with modifications to the CBIS being only a small part of this activity. Results showed that about 10% of maintenance requirements required CBIS coding. Responses to change requests were usually changes in work practises or IS use.

Research results suggests that major projects originate from a confluence of strategic objectives with an aggregation of high numbers of low-level changes, which appeared in the requirements log. Projects studied were born out of a largely intuitive sense that something was needed (either because of aggregation of lower level needs in the same organisational/functional area or a sense of the need for strategic change). This intuitive sense was converted into more formal statements of requirements that were transformed as the project proceeded. What the needs and appropriate actions were was unknown at the outset (other than in broad strategic terms). Strategic statements were constraining influences helping to define the scope within which the project must focus.

An intuitive sense of a need creates a cue for sense-making. The intuitive nature of the cue explained why the content of a requirements log entry (i.e. the recorded cue) was unimportant. As one respondent explained *'we knew that they (the requestor) didn't really understand what was required. That's why entries were restricted to a single line. It was only when we got together with the users that we worked out what was actually needed or what the problem was. Often this bore no resemblance to the original entry. Usually it had nothing to do with modifying code'*.

Cues were 'captured' and a discovery process entered into in order to understand the question raised by the cue and thereby determine and enact an appropriate response. This suggests that the notion of 'capturing requirements' is somewhat incorrect. People made sense of the requirements (i.e. what they felt they needed or preferred) as they engaged in a process of making sense of the cues. This was evidenced in the process of 'requirements satisfaction' outlined above. In the associated dialogue between explicators and users defining questions and determining solutions were not separate discussions. Furthermore, interviewees explained how MIS had moved away from obtaining 'user agreement' or 'sign off' on decisions regarding requirements satisfaction. The experience of IS staff interviewed was that focussing upon agreeing decisions simply created conflict and tensions between users and MIS. It took time for users and IS to understand what was needed, and during this time other changes can come into play affecting the perceived requirements. Agreeing decisions simply forced users into 'buying off' on something they did not fully understand and IS staff into implementing code users did not really want. It is interesting to note that in 'decision mode' most change requests were satisfied by code changes. MIS managers stated that there was a direct correlation between the fact that they now produce much less code (focussing more upon user support) with the much higher level of user satisfaction with the IS group.

The target organisation used a continuously circulating process by which change was managed. It continued beyond the formal 'implementation' of the IS. At an individual level the requirements log is used to capture sense-making cues and resolve change. At an organisational level projects are used to provide the sense-making agenda. The project itself can be seen as a means by which an ongoing process is initiated, or perhaps more accurately, redirected and re-invented. In terms of project outcome, there were two critical factors, which determined the success of a project in the organisation studied

1. The derivation of an ongoing dynamic of discovery and re-discovery of meanings
2. The derivation of a system which provides the means for 1

However, note that these outcomes were not explicitly designed. They came about as a response to massive difficulties encountered during the development process. The sense-making processes were put in place after much pain and anguish. This finding supports the framework proposal. It suggests that the most important outcome of a project is not technical but social. The ISD activity was not 'successful' until the primary focus shifted away from developing a technical product and towards establishing a means by which the organisation could make sense of change in the context of using information effectively.

5.4. Power

In order to outline the results of the study along this dimension a general discussion of power in the target organisation is appropriate before examining the particular emphasis shift proposed within this context.

In the organisation studied power was very centralised. Decisions about which requirements were satisfied often depended upon the level of access the requestor had to the power brokers. Interviewees described how elevating a requirement through the management structure was a primary means by which a requirement could be satisfied. Two senior IS managers explained how this also acted as a filter i.e. if the requirement was not that important people would not go to the trouble of elevating the request. MIS management provided resistance to software changes but if the change was important enough it would get enacted. However, this approach forced the users to make sense of change in terms their own work-lives before referring to CBIS reprogramming.

Explicators facilitated this and were seen by MIS managers as key in the management of politics. Their location in organisational space enabled explicators to see potential problems ahead and forewarn various groups. Often, these problems were both functional (possible major project required) and political (the implications of current work upon lines of influence in the organisation). Managers explained how, in this way, the explicator acted as an *'early warning system'* on the information systems front. This role seemed to be more important than his role as an arbitrator. This was possibly because power was so centralised. Interviewees in MIS felt that their ability to respond quickly to requests from power brokers or those socially proximal to power brokers was vital for the success of their function.

5.4.1. Contention => Collaboration

Interviews revealed that explicators in the target organisation shared key attributes that uniquely equipped them for their work. These were *communications skills, business knowledge and the ability to build trust amongst users* (referred to as *'organisational skills'* by interviewees). Only a small number of people within MIS fulfilled these criteria. Interviewees described how these people are relied on heavily by the MIS function. The skills of these people take a long time to develop (typically three years) and *'not everyone made the grade'*. Interviewees identified it as the major area in which IS graduates lacked skills.

The importance of building and maintaining trust and credibility was emphasised by participants. The credibility issue was particularly important in the context of the power-brokers and those who had access to power-brokers. Not satisfying the latter's requests could be dangerous and 'could undo months of hard [MIS] work' i.e. they could turn the power-broker against MIS. Thus the emphasis shift from contention to collaboration was quite significant in the success or failure of user support. MIS invest much time in developing 'good relations' with user communities.

In the final analysis the issue of change was seen to be more important by interviewees, especially interviewees higher up the management structure. One manager explained 'at the end of the day it doesn't matter whether or not the users like the system, or whether they are satisfied with the project outcome. What matters is what the [power brokers] want. They wanted change, not satisfied users'.

6. CONCLUSION

6.1. The Spirals Metaphor

6.1.1. Strengths of Spirals Metaphors

Interlocking spirals imply joint discovery and resolution by organisational members of shared understandings and meanings. The spiral image emphasises the unravelling of ambiguities and provides for an ongoing journey of discovery and re-resolution. It seems to be more powerful than the cycles/circular metaphor (common in interpretivism) because it implies convergence towards appropriate 'solutions' simultaneously with divergence towards new and more effective modes of behaviour. When applied to ISD the spiral implies sense-making and the important part role MIS groups can play in enabling an organisation make sense of what it does, why it does what it does and how it can respond to change at various levels.

6.1.2. Weaknesses of the Spirals Metaphor

All metaphors present a way of seeing and, by implication, ways of not seeing. The study suggests a number of weaknesses of the spirals metaphor which may prove difficult to overcome. Firstly, the spiral is still a line. It does not strongly emphasise jumps in thinking from A to M. Rather, the spiral implies a movement from A to B to C and on to M. This opposes the concept of divergent thinking as outlined in March (1971) where 'jumps' from A to M may be required for the discovery of new possibilities. Secondly, the spiral is 2 dimensional. A more appropriate metaphor is the interlocking helix. However, not only is this very difficult to represent it is also limited in that it is only three dimensional, emphasising only vertical and horizontal movements in the sense-making process. The reality seems to be a multi-dimensional spiralling process through complex organisational networks and hierarchies of links and connections.

6.2. Strengths & Weaknesses of the Framework

Two metaphorical weaknesses of the framework are that it does not reflect a multi-dimensional space and it de-emphasises the importance of rationalism as a starting point for discussions. The view that 'technical' is synonymous with a positivist obsessions is naïve. This naivety causes inconsistencies in the framework, inconsistencies that arise because of inappropriate polarisations. In reality, people are pragmatic and often explicitly or implicitly recognise and address the problems of complexity and ambiguity. This is an important finding given the current debate with the IS discipline between interpretivists on the one hand and positivists on the other.

6.3. Final remarks

The study confirms that both ISD and its outcome are social processes. The logical structure provided by the IS is not necessarily a hindrance to sense-making. What is important is that participants explicitly or implicitly recognise the importance of sense-making and the realities of complexity and ambiguity. If this principle is not recognised the process of discovery and enactment can become inverted. The metaphor of an exploratory journey is critical in a successful project. If divergence is not emphasised alongside convergence then the organisation will tend to recreate the past. Interlocking spirals is a useful metaphor in that it opens new avenues of thought as regards ISAD. Sense-making is also a highly informative notion by which ISD activities can be understood. Sense-making concepts suggest that the technical/business divide is not always as appropriate as originally thought. Often, the broad functionality of the system can be a statement of where the organisation wants to go and impinges upon core rigidities engaging the organisation in a change process (Leonard-Barton (1992), Stapleton (1998b)). To suggest a complete isolation of technical and business worlds may be inappropriate in successful IS support activities.

It is also notable that the education of graduates in the IS discipline lacks an emphasis on the two very important areas: *communications & organisational skills*. This was not a central focus of the study but came across as a strong message in work on the *Power* dimension. It confirms assertions of other researchers that the IS discipline needs to review educational curricula, particularly in the area of systems analysis and design (Myers (1995)).

Whilst it must be emphasised that this paper presents the results of exploratory work designed to ascertain the general applicability of the 4P Framework, the results are encouraging. The 4P Framework seems to be insightful whilst requiring some changes which must in turn be empirically tested. Like any qualitative study, other researchers must make sense of the results in their own contexts and confirm or otherwise the interpretations presented here for themselves. Further work is undoubtedly needed (and is underway) to establish the extent to which the conclusions drawn up in this paper are more generally applicable.

7. ACKNOWLEDGEMENTS

The author wishes to gratefully acknowledge the financial support of Forbairt (The Irish Science and Technology Research Agency) for the RAISE project by which this research is supported. The author also wishes to thank Professor Ciaran Murphy of University College Cork for his continued help and guidance in this work. Finally, the author wishes to thank the anonymous reviewers whose comments were a great help in producing the final draft.

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Diagram 1. Framework Dimensions & Emphasis Shifts

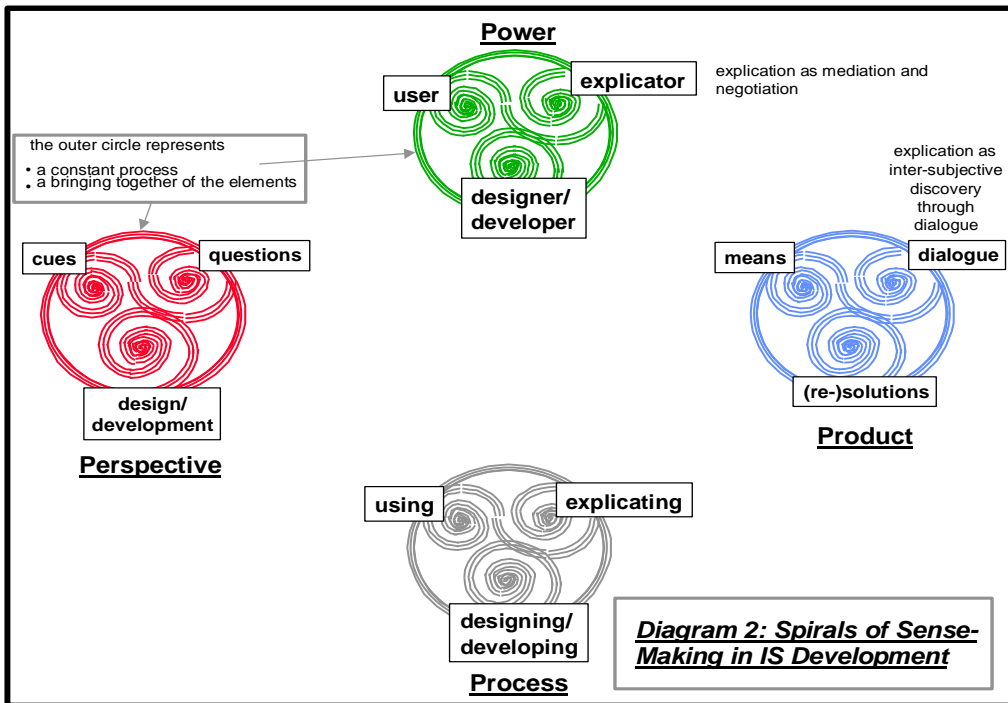


Diagram 2: Dimensions of Sense-Making and Associated Emphasis Shifts

Dimension	Emphasis Shift
Perspective	Clarity => Ambiguity
Process	Linear => Spirals
Product	Product => Process
Power	Contention => Collaboration