Multi-metaphor method: organizational metaphors in information systems development

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Abstract. *Conventional methods have been criticized for their positivist philosophy and for either ignoring the organizational context of information systems development (ISD) or using only a simplistic, machine-based conceptual model of organizations. We have developed an approach to enable systems developers to use a richer view of organizations and a more interpretive approach. Multi-Metaphor Method (MMM) supports developers via a range of metaphors as cognitive structuring devices to understand an organization so that developers can learn to move between different ways of 'reading' the social context in which ISD occurs. We explain the rationale and theoretical underpinnings of MMM and then discuss our action research to investigate the viability and relevance of MMM during ISD practice. We show how the developers' use of organizational metaphors via MMM did not just enable rich conceptualizations of the client organizations but also influenced the ISD process and final product. We review the learning outcomes and discuss the implications for systems development practice of our research.*

Keywords: information systems development, methodologies, action research, metaphors, cognitive psychology, Multi-Metaphor Method (MMM)

INTRODUCTION

The action research reported here arose from the concern: how can we enable information systems (IS) developers to use a richer model of organizations than found in both conventional methods and the newer agile and Web methods, and to move towards an interpretive approach for understanding people and their organizations? We sought an approach to be used in parallel with developers' existing methods (to avoid the need for extensive retraining), quick and flexible to use (to be compatible with agile and Web methods) and grounded in previous academic research (to give a strong theoretical underpinning).

Our approach is a new method based on *metaphors* for organizations: Multi-Metaphor Method (MMM). It can be used alongside an existing information systems development (ISD) method as a flexible complement to it, and it utilizes humans' innate cognitive ability to think via analogy and metaphor as a 'short cut' to richer conceptual views of organizations than the machine-view of most ISD methods. Its theoretical foundation has three strands: the organizational analysis literature on using metaphors to understand and interpret organizations (particularly Morgan's [1986] seminal work *Images of Organization*), the cognitive psychology literature on *how* we think via analogy and metaphor, and previous IS research into the use of metaphors.

In the following sections, we explain the motivation for our research and the theoretical underpinnings of MMM. We have investigated the use of MMM in ISD via interpretive action research, two cycles of which we discuss in this paper. Finally, we reflect upon the learning outcomes from the research and discuss the implications for systems development practice.

MOTIVATION FOR THE RESEARCH

Historically, most ISD methods have been predicated on a 'hard', technical/engineering perspective concentrating on technical change and not appreciating ISD's organizational context, nor seeing ISD as a negotiated process of socio-technical change (Lyytinen, 1985; Baskerville *et al*., 1992). It is suggested that this is because many systems developers are primarily interested in the fast-changing technology and see the organizational context of an IS as, at best, of secondary importance (Kling, 1993; Walsham, 1993; Checkland & Holwell, 1998). As a consequence, they assume that a technical system can be studied and developed separately from the organization and its historical and social context as a 'discrete entity' (Kling, 1987; 1992). However, it is argued that the lack of consideration of the social and behavioural dimensions is the cause of failure of many information systems (Hirschheim & Boland, 1985; Kling, 1987, 1992; 1993; Walsham, 1993; Checkland & Holwell, 1998).

Where conventional ISD methods do address the organizational context, they are criticized for their limited conceptual model of an organization. It is treated as if it were a routinized, efficient, information-processing machine that can be designed and controlled in a rational way to achieve predetermined goals (Hirschheim & Klein, 1989; Dahlbom & Mathiassen, 1993; Walsham, 1993). However, as Checkland & Holwell (1998, p. 79) write, 'If human beings were automata, then the conventional rational model would be adequate, but we need a model which incorporates the sheer cussedness and irrationality of human beings as well as their readiness to conform'.

Conventional approaches are also criticized for being based on 'positivism' – the philosophical paradigm underlying the scientific method. This assumes that a physical and social world exists independently of humans. It can be measured and modelled by a neutral, objective observer and its behaviour can be predicted (via 'cause' and 'effect') – it (too) is like a machine. In conventional ISD methods, the systems developer is similarly a detached observer, acting as a technical expert who elicits or 'captures' requirements from cooperative users, represents

them in models and then constructs a computer-based system that automates the models (Hirschheim & Klein, 1989; Dahlbom & Mathiassen, 1993; Hirschheim *et al*., 1995). The requirements specification 'should contain all the true requirements and nothing but the true requirements' (McMenamin & Palmer, 1984, p. 77). However, as Walsham (1993), a proponent of interpretive approaches in IS, writes (p. 29), 'the concept of a 'complete and correct set of requirements' . . . sweeps away the multiple perspectives and ambiguities of organizational life and hides them under the carpet of the mechanistic metaphor'. A positivist stance might be appropriate for the technical aspects of computer systems such as measuring speed of performance and efficiency of (computer) memory use. However, it is ill-suited to the social world of humans where computer systems are developed and used.

An interpretive stance, on the other hand, assumes that our world can only be accessed through social constructions such as language and shared meanings and understanding. An organization '. . . does not exist as an independent entity but is part of sense making by a group of people engaged in dialogue' (Checkland & Holwell, 1998, p. 40). Interpretive systems development approaches (see, for example, Checkland, 1981; Winograd & Flores, 1986; Mumford, 1995) recognize that people, including developers, construct their own social reality and support dialogue about different perceptions of 'reality' in order to develop information systems that are appropriate for a particular social context. However, interpretive systems development approaches have not, so far, been widely adopted in industry.

Recently, alternative, lightweight or 'agile' ISD methods have emerged, such as Adaptive Software Development (Highsmith, 2000), eXtreme Programming (XP) (Beck, 2000) and Naked Objects (Pawson & Matthews, 2002). These are less cumbersome and prescriptive about the ISD process than conventional methods but still pay little attention to the organizational context of ISD. For example, aspirations such as 'the code is the documentation', while probably developer friendly, do not reflect the wider context in which systems are developed, for which documentation is critical.

With the creation of the internet and the World Wide Web, attention has also turned to appropriate Web-development methods. The requirement for speedy development and implementation of Web-based systems in 'internet time' (Baskerville & Pries-Heje, 2004) means that such methods must be flexible and quick to use, not cumbersome and bureaucratic, as some earlier IS development methods have been (e.g. SSADM [Eva, 1994]). Agile methods have therefore been used by some Web developers. Methods focused specifically on Web development have also emerged, such as WebML (Ceri *et al*., 2000) and OOHDM (Schwabe & Rossi, 1998). However, these share the shortcomings of earlier methods: they are based on a positivist philosophy and pay little attention to the organizational context of ISD. For example, they take a positivist view of 'audience', assuming that an audience for a Web site and its needs can be easily identified by any developer rather than recognizing that an audience is a social construction of the developers and other ISD participants (Hine, 2001; Oates, 2002). They concentrate on the engineering of a technical artefact and do not provide adequate support for requirements analysis, where the need, purpose and objectives of such a technical artefact are socially negotiated, nor do they address successful implementation of an artefact into its organizational context (Retschitzegger, 2000; Bahli & Di Tullio, 2003; Escalona & Koch, 2004).

There continues, therefore, to be inadequate attention to the socially constructed context in which the development and use of computer-based information systems occurs, with the consequent likelihood of dissatisfaction and failure. However, the criticism of technically oriented, positivist methods and calls for interpretivist methods is in danger of becoming a stagnant discourse based on position statements and little more. We therefore sought to move the issue on by enabling systems developers, who knew only conventional systems development approaches, to use a richer view of organizations than simply a machine view. We also wanted to guide them towards a more interpretive approach to systems development, where they would recognize a range of ways of interpreting reality, both for themselves and in others' interpretations. It would not be enough to say to developers, 'There can be different ways of interpreting an organisation'. Instead, we wanted to *help* them find multiple ways of interpreting reality. MMM offers such an approach, as we explain in detail in succeeding discussions, by offering a range of ready-made, previously used metaphors to understand an organization so that they can learn to move between different ways of 'reading' the social context in which ISD occurs.

THEORETICAL UNDERPINNINGS

The theoretical underpinnings for MMM consist of organization analysis theory about metaphors for organizations, cognitive psychology theory about thinking via metaphors and previous IS research.

Organization analysis

Morgan (1986) criticizes the then-dominant view of organizations in the organizational analysis literature: an organization was seen as a rational, machine-like entity (the view inherent in many current ISD methods, as we explained previously). He argues that such a machine view can be useful but is too simplistic to be used on its own. Instead, it should be seen as a partial view, or metaphor, for an organization. He offers seven *additional*, alternative views, or metaphors, for any organization: organism, brain, culture, political system, psychic prison, flux and transformation, and instrument of domination. Because any single metaphor or way of seeing an organization has its limitations, he argues that we should become skilled in the art of reading and interpreting an organization by using more than one metaphor and by recognizing each metaphor's limitations. Instead of seeking a single, all-encompassing reading (cf. seeking the 'true' requirements specification), we should accept that multiple, often conflicting readings are necessary. We thus adopt an interpretive approach using a range of metaphors to 'see' a problem domain in different ways, 'framing and re-framing' a situation as 'reflective practitioners' (Schön, 1979; 1983).

Morgan's eight organizational metaphors are summarized in Table 1, all of which have now been widely used in the organizational analysis literature. Each highlights a particular way of seeing an organization but offers a partial view because it does not include the ways of seeing provided by the other metaphors.

Table 1. Morgan's organizational metaphors

Metaphor	Characteristics
Machine	Hierarchical set of interdependent parts, all working together efficiently to achieve machine's overall function in a routinized, efficient, rational way
Organism	Living creature existing flexibly in a wider environment on which it depends to satisfy its needs and in which it must compete with others for resources etc.
Brain	Self-organizing system that holds and processes information, communicates, controls, solves problems, makes decisions
Culture	Tribe of people with customs, rituals, ideas, beliefs that guide practice and behaviour, often as taken-for-granted assumptions
Political System	Loose network of people with different goals that they strive to satisfy in the context of conflict and power issues
Psychic Prison	Individual or group behaviour is constrained by innermost thoughts and unconscious mind, which is then reflected in overall organization behaviour
Flux and Transformation	Structures can emerge and evolve from chaos and complexity, and as a result of dialectical tension between opposites
Instrument of Domination	Despotic imposition of will on others, using them until burned out and then discarding them

We made Morgan's eight metaphors the basis of MMM. We developed a guide to the MMM approach with one page per metaphor where we explain that way of seeing an organization, suggest how it might be relevant to ISD and indicate that metaphor's limitations, that is, aspects of an organization that it does *not* reveal. A maximum of one page per metaphor was deliberately chosen to ensure that the interpretations of the metaphors by the author of the guide were not allowed to dominate the thinking of the IS developers who would use MMM. Instead, the notes serve as a possible starting point for systems developers, who are free to create their own interpretations of the metaphors and map them onto their particular organizations.

In *Imaginization: The Art of Creative Management*, Morgan (1993) encourages manager practitioners to go beyond his eight images and develop their own metaphors, again moving between different ones to 'see' an organization in different ways. MMM similarly encourages developers also to devise their own metaphors for articulating their personal ways of seeing an organization.

When borrowing a theory from another discipline, it is important also to study that other discipline's literature for criticisms of the theory (Truex & Baskerville, 1998). Some researchers have criticized Morgan's use of metaphors. Mangham (1996) criticizes Morgan's use of quirky, conceptual metaphors (such as a spider plant in *Imaginization*) rather than looking for the 'basic conventional metaphors' on which they are based. Morgan (1996) responds that today's idiosyncratic-seeming metaphors can become tomorrow's conventional ones. What is important is that a metaphor has 'resonance' for individuals, enabling them to link two things together in a meaningful way, which could produce new insights. Morgan's eight metaphors in *Images of Organization* have become widely known and used. They could now be seen as conven-

tional and therefore 'safe' to use in the research described here. In addition, the systems developers/co-researchers with whom we worked were encouraged to find their own resonant metaphors for their client organizations.

Chia (1996) criticizes *Images of Organization* for offering a series of 'static images' of an organization. It concentrates on their *content* rather than on the *process* of 'metaphorization' – a process that recognizes the role of metaphor in everything we do and know. 'Metaphorizers' (people following this process) should seek to challenge taken-for-granted ideas, resuscitate dead metaphors, deconstruct existing cognitive frameworks and deliberately move between paradigms of thought so as to learn to 'think beyond the thinkable'. Morgan (1996) responds that his book *does* model a process of 'metaphorization'. Each metaphor provides a way of seeing an organization, but at the same time, each metaphorical frame has the effect of deconstructing the others. Organizations are examined as a machine, culture etc., but there is no claim that an organization *is* any of them. The reader must make his/her own interpretations of an organizational situation, coping with paradox and contradiction. *Images of Organization* 'is a perfect example of Chia's metaphorization in practice' (Morgan, 1996, p. 238). In our research, we turned to the literature of cognitive psychology to understand more about the process of 'metaphorization', that is, thinking using metaphors (see succeeding discussions).

Morgan (1996, pp. 234–235) himself lists important weaknesses of metaphor. For example, it can carry the user away on flights of fancy, can be difficult to tie down, and can be superficial, creating surface rather than deep understanding. It is subjective. It ignores the role of power and class in the social construction of society and knowledge. These limitations do not negate the strengths and potential benefits of metaphor, but they must be addressed, often by using *several* conflicting metaphors, not just one. Morgan (1996, p. 228) suggests that cognitive and brain research, rather than linguistics and philosophy, are likely to provide the breakthroughs in understanding how metaphors work because metaphors' linguistic aspect is only a surface expression of a deeper process of meaning-creation and understanding. We therefore drew upon cognitive psychology theory about thinking via metaphors to provide the underlying framework for a methodology based on Morgan's metaphors.

Cognitive psychology

For MMM, we have utilized Holyoak & Thagard's (1996) model of metaphor and analogical thinking, which is well cited in the cognitive psychology literature. To use a metaphor is to think about an entity as if it were a different entity, e.g. 'an organisation is an organism'. When using a metaphor, we compare our mental model of the entity in which we are interested (the *target*, e.g. an organisation) with our mental model of the entity about which we already know something (the *source*, e.g. an organism). This enables us to take a 'short cut' to knowledge by building on what we already know, and requires reasoning by analogy, or 'analogical thinking': finding similarities in both the target (organization) and the source (organism) and using these similarities to generate new meanings and understanding about *either* the target or the source. A metaphor therefore provides a framework to conceptualize the target in a particular way. However, it always provides a *partial* way of seeing something (see also Black,

1979; Schön, 1979): through concentrating on similarities, the analogical thinking produces a particular interpretation but forces other interpretations into the background. Thus, a metaphor can reveal but also conceal, or, 'a way of seeing is also a way of not seeing' (Morgan, 1996, p. 232). Hence, we must be alert to the differences between the source and the target, and use additional metaphors to highlight other aspects of the target.

Note that the meaning of metaphor has been extended from a rhetorical or linguistic device to include the notion of visual metaphors (e.g. a pair of swans in a painting as a metaphor for enduring love) or a metaphor expressed through behaviour (e.g. the ritual of the Japanese tea ceremony as a metaphor for the natural world) (Holyoak & Thagard, 1996).

The cognitive processing involved in processing metaphors via analogical thinking is summarized as four stages (Holyoak & Thagard, 1996, pp. 116–137):

1 *Selection*: a source metaphor and our mental model of it are retrieved from memory.
2 *Mapping*: the source and target are mapped or compared, and inferences are generated about similarities between them.
3 *Evaluation*: the inferences are evaluated and adapted as necessary to take account of any unique aspects of the target, including identifying where there are differences between a metaphor and the target. The inferences may lead to new insights about the source or target and/or decisions to act. If found not to be useful, the metaphor is abandoned.
4 *Learning*: something more general is learnt from the success or failure of the metaphor.

From study of the cognitive psychology literature, we have also derived a set of 12 maxims for effective metaphor use, which are included in the MMM guide. Space limitations prevent a full discussion of the maxims and their derivation, but they are summarized in Table 2 and further detail is available from the authors. Holyoak and Thagard's model of thinking via metaphor, and the 12 maxims for effective metaphor use, helped to structure both the developers' use of metaphors and MMM in the action research reported here, and also our subsequent analysis of the action research data.

Cognitive psychologists argue that using metaphors is one of our fundamental ways of thinking. It supports learning and can be useful, for example, to:

- explain a concept (Gentner, 1982);
- view something from different perspectives (Hesse, 1980);
- develop new hypotheses or theories (Boden, 1990); and
- challenge conventional assumptions (Muscari, 1992).

Organizational metaphors are therefore *potentially* relevant to ISD by:

- supporting the understanding of the organizational context (explaining a concept);
- enabling the interpretation of this organizational context in different ways (viewing something from different perspectives);
- supporting new ideas about the organizational context (developing new hypotheses or theories); and
- contesting the machine-based view of an organization in ISD methods (challenging conventional assumptions).

Table 2. 12 maxims for effective metaphor use

Maxims	Example from the literature
1. People might need to have a superficially dissimilar source metaphor pointed out to them.	In experiments, most subjects could not solve a problem until given a hint to use an analogous story provided earlier (Gick & Holyoak, 1980; Holyoak & Thagard, 1996)
2. Access to a source metaphor is strongly aided if the source and the target have similar objects.	Subjects were given a problem concerning destroying a stomach tumour. Most of those who had previously heard a story concerning destroying a *brain* tumour solved the problem. Most of those who had heard an analogous military story concerning a general destroying a fortress did not solve the problem (Keane, 1987).
3. The target problem is likely to cue other information of more obvious relevance.	In solving the stomach-tumour problem, subjects are more likely to focus on knowledge of cancer than on military strategy (Holyoak & Thagard, 1996).
4. Once a metaphor has been found, most people can map between the source and the target.	Once advised to use the general and the fortress story, most subjects could find the appropriate mappings (Gick & Holyoak, 1980; Goswami, 1989).
5. Finding a mapping between apparently unrelated domains is often pleasurable.	Seeing one thing as another creates a tension between two perspectives: the thing as itself and as something else. Resolving this tension is satisfying (Holyoak & Thagard, 1996).
6. Others' knowledge may be organized in different ways, leading to different metaphor interpretations.	We each construct our own internal representation of knowledge, leading to differences in the way we perceive objects, concepts and relationships between them (Holyoak & Thagard, 1996).
7. Always evaluate a metaphor, looking for significant differences between the source and the target.	There are always unmapped differences, elements that do not participate in the mapping at all, and therefore are not covered by the metaphor. The activity of mapping the source and target tends to blind us to the unmapped differences (Holyoak & Thagard, 1996).
8. Facilitator should use 'analogy therapy' to explore others' understanding of a subject.	Analogies and metaphors are explored, misunderstandings are corrected and the participants are led to metaphors that are more effective (Holyoak & Thagard, 1996).
9. Facilitator should be alert for others developing inappropriate mappings.	Medical students often compare a failing heart to a sagging balloon – both increase in size as they fail. However, students might infer that the tension in the heart wall will decrease as the heart fails, as the tension in a balloon fails because of air leaking out, whereas tension increases in the heart wall (Spiro *et al*., 1989; Holyoak & Thagard, 1996).
10. Use multiple metaphors, noting where each is appropriate.	When studying electricity, its flow can be compared to water in a pipe, where flow is caused by pressure from a reservoir. This is useful for inferring the effects of batteries (batteries are mapped to reservoirs). However, for resistors, a better metaphor is a crowd of people moving along a corridor, where parallel resistors are mapped to gates in the corridor (Gentner, 1983; Spiro *et al*., 1989).
11. Use multiple conflicting metaphors to reduce the possibility of unmapped differences being overlooked.	The earth can be compared to an egg (molten core maps onto the yolk), but also comparing it to a peach would prevent students thinking it had a hard shell (Holyoak & Thagard, 1996).
12. Multiple examples can help learning of a schema.	Subjects were much more likely to solve the stomach-tumour problem if they had read two analogous stories rather than one (Gick & Holyoak, 1983; Holyoak & Thagard, 1996).

In our action research we identified five types of consequences of using organizational metaphors and MMM during ISD practice. These are detailed later in this paper.

Previous IS research

The third theoretical strand of MMM is based on previous IS research. IS researchers' criticisms of ISD methods, and the consequent rationale for MMM, have already been explained. Here we focus on previous IS research that has used organizational metaphors.

An early argument for using metaphors in ISD is given by Lanzara (1983). He criticizes the assumption of technical rationality for not taking sufficient account of the complexity of design activities. He argues instead for Schön's 'reflective practitioner' who uses metaphors, and calls for more study of the cognitive work and the frames and games enacted by designers and other actors during ISD.

One approach to such study is *inductive*, where researchers seek to discover the underlying organizational metaphors that people already use and that influence their thinking and actions (e.g. Kendall & Kendall, 1993; 1994; Schultze & Orlikowski, 2001). We, however, are concerned with a *deductive* approach, where researchers take a metaphor, map it onto a phenomenon (e.g. an organization) and see if it offers something useful.

Such a deductive approach is adopted by Madsen (1989; 1994), who uses metaphors for organizations to simulate a 'breakthrough by breakdown'. This can help developers imagine new ways of seeing an organization and therefore potential ways in which computer systems can be used to support it. MMM offers developers a range of possible metaphors. Walsham (1991) argues for using several of Morgan's metaphors simultaneously to overcome the narrowness of the conventional view of organizations. He later makes a deductive use of two of Morgan's metaphors (culture and political system) in case studies of organizations where computer-based systems were developed and implemented (Walsham, 1993). More recently, Drummond & Hodgson (2003) use two metaphors, a machine and a chimpanzees' tea party, to understand different approaches to IT project management. MMM offers developers all eight of Morgan's metaphors as well as encouraging them to think of their own.

Soft Systems Methodology (SSM) (Checkland, 1981; Checkland & Scholes, 1990) uses organizational metaphors, but implicitly rather than explicitly. The logical stream of SSM uses several notional human activity systems to structure debate about a problem situation. A notional system is described as the 'logical machine' (Checkland & Holwell, 1998 e.g. p. 17) required to pursue the purpose expressed in a root definition. Thus, SSM implicitly uses a variety of machine metaphors for possible systems. However, such machines are all based on the notion of a system as defined by General Systems Theory, one with which not everyone is familiar. SSM's cultural stream examines the intervention itself, the situation as a social system and the situation as a political system. Hence, Morgan's culture and politics metaphors are also implicitly used. MMM makes the use of these and of other metaphors explicit.

An explicit use of metaphors is made in Soft Information Systems and Technologies Methodology (SISTeM), an extension to SSM (Atkinson, 2003). Like MMM, this uses a range of metaphors to frame and re-frame problem situations and thus generate new insights and

understanding. However, all SISTeM's metaphors are again based on systems, specifically the concept of a system as a viable whole (von Bertalanffy, 1968). As the cognitive processing of metaphors relies on transferring knowledge from a known domain to a different domain, using SISTem must require that IS developers are already familiar with these viable system metaphors. The appeal of Morgan's metaphors, as used in MMM, is that each metaphor (brain, organism etc.) already has some meaning to developers from their everyday world.

Other IS researchers have used some of Morgan's metaphors including: organism (Mumford, 1995), brain (Heiskanen, 1993), culture (Hirschheim & Newman, 1991), political system (Markus, 1983), psychic prison (Wastell, 1996), flux and transformation (Truex *et al*., 1999), and instrument of domination (Zuboff, 1988). These studies helped us identify each metaphor's potential relevance to ISD for inclusion in the MMM guide. However, many of these researchers do not acknowledge their view of an organization as being metaphor based; rather, they imply that their view is the way that all organizations *are*. They also generally focus on a single organizational view, whereas there have been calls for a pluralist approach using a *range* of organizational metaphors (Morgan, 1986; Boland, 1989; Madsen, 1989; Walsham, 1991). As any individual metaphor will always have limitations (see also Maxim 11 in Table 2: *use multiple conflicting metaphors*), we similarly believe that a range of metaphors should be considered during ISD.

Many of the IS researchers who have used organizational metaphors do not explain their conceptual basis for metaphor, or if they do, they tend to draw on linguistic theory, particularly Wittgenstein's work and Lakoff & Johnson (1980) research. This is inadequate because, as we noted earlier, the meaning of metaphor has been extended from that of a rhetorical or linguistic device to include the notions of visual metaphors and behaviour as metaphor (Holyoak & Thagard, 1996). Metaphor is now seen as a cognitive structuring device that is fundamental to our existence and ways of acquiring knowledge. It is therefore appropriate to draw on cognitive psychology, the study of our mental processes, to explain this cognitive structuring. Our research therefore makes an important contribution to the use of metaphors in IS by utilizing cognitive psychology theory about thinking via metaphors.

RESEARCH STRATEGY

So far we have given a theoretical argument and underpinning for MMM. In our empirical research, we have investigated the practical relevance of our argument by addressing two related questions:

- *Could* IS developers, who were already educated in technically oriented, positivist methods, use a range of organizational metaphors during their ISD practice to interpret an organization in alternative ways to the conventional machine-view?
- Did any insights gained from the developers' use of these metaphors shape their decisions about the ISD process or products, indicating the practical and theoretical relevance of MMM?

Our research strategy was based on interpretive action research, two cycles of which we report here. Action research provides a way of evaluating theory in real-life situations, leading to both

practical and research outcomes. For example, Checkland (1981; Checkland & Scholes, 1990) used it with his students to develop SSM. (For reviews of action research in IS see Lau, [1997] Baskerville & Wood-Harper [1998], Oates [2006] and the special issue of *Information Technology & People*: IT&P [2001].) Checkland (1981; 1991) discusses action research in terms of F, M and A. Action researchers do not develop hypotheses (as in positivist science) but declare a framework of ideas (F) as the theory base for the research and the methodology (M) within which they are embodied. They then follow M in a real-world problem situation or 'area of application' (A), aiming to help the people in that situation bring about changes that they agree to be improvements. While doing this, action researchers should reflect upon the declared F and M, modifying them as necessary, in an iterative cycle of action and reflection. Outcomes can be both practical and theoretical: changes in the situation and learning by the participants about F, M and A.

Checkland's characterization of action research via F, M and A has now been refined and extended. McKay & Marshall (2001) argue that *two* methods are used in parallel in action research: the method used for addressing a real-world problem, which they name M_{PS}, and the research method used for learning about the action in a problem situation, which they name M_R. (Oates [2006] uses M for the problem-solving method and R for the research method.) McKay & Marshall (2001) also add P: a specific problem situation that allows the researchers to investigate an area of application (A).

We participated with systems developers on ISD projects in real-life organizations, facilitating their use of a technically oriented method and MMM in parallel. Our framework of ideas (F) comprised Morgan's organizational metaphors (Morgan, 1986) and the cognitive psychology theory about thinking via metaphors. Our methodology (M or M_{PS}) was MMM – the conscious, deductive use of metaphors, particularly Morgan's organizational metaphors, during ISD work. MMM was made tangible in a guide that (1) explained how we think via metaphors; (2) discussed each of Morgan's metaphors and their potential relevance to ISD; and (3) provided the 12 maxims for effective metaphor use. Our area of applications (A) was the issue of enabling developers to adopt a richer view of organizations and a more interpretive stance during ISD. We used MMM in four problem situations (P): real-life ISD projects for local organizations that had requested the university's help – they were convenient rather than being deliberately selected, and the organizational members agreed that the academic research imperatives were as important as their IS requirements. The research method (R or M_R) for the two cycles reported in this paper is summarized in the remainder of this section.

June, one of the authors of this paper, worked with systems developers involved in IS projects for four organizations. She and these practitioner-researchers agreed that they would use organizational metaphors and MMM whenever they seemed appropriate during the projects, and reflect on their use both individually and collectively. The meetings between June and the practitioner-researcher in Cycle 1 were tape-recorded; those in Cycle 2 were minuted by June, and the minutes were then emailed to the others for confirmation and as a group resource. Other data sources were the developers' notes from client meetings, the participants' personal research diaries, ISD documentation created during the projects and the developers' final written reports. Hence, qualitative data was generated.

For data analysis, the focus was on the use of organizational metaphors in the participants' discourse. All uses of the metaphors were traced in the data to see how each metaphor had been mapped to the client organizations and whether the developer-researchers explicitly related this mapping to their ISD process or product. Holyoak & Thagard's (1996) model of analogical thinking and the set of maxims concerning metaphor use provided a structure for this analysis and interpretation. This data analysis was undertaken by all the practitioner-researchers during the projects, and further passes through the data were made by June afterwards.

The two research cycles differed in the participants involved, in the ISD methods used in parallel with MMM and in the problem situations addressed. In Cycle 1, which lasted for 4 months, the researchers were June, one of the authors of this paper, and Sally, a Masters student who had previous experience of working in ISD and was already familiar with metaphors as cognitive structuring devices. The problem situation (P) was Shepps Engineering, a small, light engineering company based in the North of England. The client was this company's owner. The company's main product is compaction plates, but it also often takes on small engineering jobs that larger companies would not find profitable. Closely linked to Shepps Engineering is a second small company, Harries Engineering, owned by the father of the owner of Shepps Engineering. Its main business is the manufacture and sale of generators and compressors. The two companies supply goods to each other and share staff and resources as necessary, and may gradually merge so that the father can retire. At the start of the action research study, the information systems (for both companies) were partly automated and partly manual, and individual applications were not integrated. There were problems of data duplication between separate programmes, lack of data integrity, excessive input and output tasks to multiple programmes, insufficient collection of business data and data errors. The client believed that these problems could be alleviated through an integrated computer-based information system for Shepps Engineering, which the researcher-developers were asked to develop, covering sales and marketing, order handling and stock management. This was all that was known about the client organization at the start of the project – a richer understanding emerged through the conscious use of metaphors, as we discuss later.

MMM was used in parallel with an ISD method based on the structured approach (Yourdon, 1989), which is popular in Europe and North America and typical of conventional methods that adopt a machine view of organizations and their requirements. Sally made twice-weekly visits to Shepps Engineering to analyze the information systems and to observe and interview the client and employees. June and Sally also met 11 times during the project, each meeting lasting for approximately 1 hour (the shortest was 30 minutes and the longest 75). They also held a final evaluation meeting 6 months after the completion of development work. These meetings were used to create shared understandings of the client organizations, aided by the metaphors and MMM, to reflect on the action taken, issues arising and lessons learned, and to plan further action.

Cycle 2 kept MMM the same but moved the action research on by involving practitioners who were experienced systems developers but had no previous knowledge of metaphors – the participants in Cycle 1 were primarily academic researchers with previous knowledge of

metaphors as cognitive structuring devices. The participants were June and three mature computing degree students in their final year of studies (Alan, Marcus and Peter). The latter three already had an average of 3 years' previous ISD experience and were returning to IS developer roles on completion of their studies. Hence, they were potential beneficiaries of our research ideas on MMM who should participate in its development, evaluation and dissemination. These practitioner-researchers worked with the clients and employees involved in three different ISD projects:

- Alan: To develop an information system for Ableton Council's Structures Department (responsible for inspection and maintenance of all bridges in the area). Currently, the records were paper based – an online replacement database/geographic information system was requested.
- Marcus: To develop an information system for the Diabetes Care Centre of Victoria Hospital (a publicly funded hospital in Ableton). This was a 'green-field' ISD project, developing a system to support a clinical research project.
- Peter: To develop an e-commerce portal for We-DIY (a company serving the DIY market with several retail stores). The organization had a limited Web presence and was keen to expand its online presentation and services. It asked for a prototype Web portal and e-commerce site to demonstrate the possibilities.

Again, this was all that was known about the client organizations at the start of the ISD projects – a richer understanding emerged through the conscious use of metaphors, (see succeeding discussions).

Cycle 2 also moved the action research on by using MMM in parallel with agile methods: Martin's Rapid Application Development method (Martin, 1991) with Ableton Council's Structures Department and the Diabetes Care Centre of Victoria Hospital, and December's Web-development method (December, 1997) with We-DIY. (In Cycle 1, MMM was used in parallel with a conventional structured method.)

These projects each lasted 9 months. Each developer made weekly visits to his client organization to analyze the information systems and observe and interview the employees. The three developers and June also met as a group 11 times during the ISD projects, and once more in a reflection meeting 2 months after the projects' completion. Afterwards, the developer-researchers also completed anonymous questionnaires on how they had found the action research and MMM. (A fuller discussion of the action research process in this group-based 'cooperative inquiry' [Heron, 1996] of Cycle 2 can be found in Oates [2004].)

ANALYSIS OF METAPHOR USE

In examining the use of metaphors, it is tempting to say, 'The use of metaphor X caused the participants to do Y'. However, this would be a reversion to positivist thinking, looking for cause and effect. It is more appropriate to say that the analysis of the research data investigates how the participants used a metaphor as a shared cognitive structuring device to structure and

articulate an interpretation of a situation, and on the basis of that interpretation made assertions about the organization and/or decided to take particular actions. This section shows how metaphors were used in this way.

Cycle 1: use of metaphors

Cycle 1 involved June and Sally and an ISD project for Shepps Engineering. In this section, we focus on our analysis of the use of MMM – which metaphors were selected, how they were mapped to Shepps Engineering and how this influenced the ISD process or product. MMM was used throughout the ISD project in Cycle 1 (Table 3). Here we can only give examples of this metaphor use – a full analysis of all uses of the organizational metaphors is available from the authors.

The *machine* metaphor was used when producing the models required by the Structured Approach, such as data flow diagrams and entity relationship diagrams, which assume that an organization is an information-processing machine. June and Sally were alert, however, to this metaphor's limitations:

> (Sally) When my mind turned to the mechanical metaphor, which it did as soon as I got to the functional analysis, the first thing your head does is it turns everything you're thinking about into a machine, things have got to connect – which is all very sensible because that's the way your mind's thinking. But one thing I did think was, 'Hang on. Stop this, be careful with this metaphor, it's pervasive'.

Sally felt that using the machine metaphor pushed her almost unthinkingly towards developing an efficient data-processing system with all duplication of effort removed. Yet it became clear that such a system would not be the best design for her particular client. He wanted to keep sales information in a separate programme and batch process it through his accounts package only later. Sally therefore recognized and then rejected the underlying machine metaphor, and designed a system where the production of both delivery notes and invoice notes was

Table 3. Use of metaphors during ISD project meetings, Cycle 1

	Meeting											
Metaphor	1	2	3	4	5	6	7	8	9	10	11	12
Machine	*	*	*	*	*		*	*	*	*	*	*
Organism	*	*	*	*	*		*			*	*	*
Brain		*					*				*	*
Culture		*		*	*		*	*			*	*
Political system	*	*	*	*	*		*	*	*		*	*
Psychic prison				*								*
Flux and transformation												*
Instrument of domination	*											*

ISD, information systems development.

assigned to a new software programme, not to the existing accounts programme, which already contained such a feature. This appeared to be an inefficient design, with unnecessary duplication of effort and at odds with the conventional search for an efficient information-processing machine, but it suited the particular organization for which she was working. Recognition and evaluation of the machine metaphor enabled her to resist its use in shaping her IS design.

The *organism* metaphor highlighted that the organization/organism needed to be flexible and adapt to changes in its environment, prompting the researcher-developers' decision to use evolutionary development in the ISD process rather than the conventional waterfall model assumed in the Structured Approach:

> (Sally) Because how you perceive the organisation, well, if you perceive it as a machine, then you would want to automate everything. If you perceive it as an organism you're going to be more contingent about what you're going to automate.
>
> *(June) On what does the thing need now, yes.*
>
> What does it need now, and what will it need in the future, and will that be possible, so you're getting into more of a prototype. So you prototype, you implement almost the prototype, because that'll do for now, and then you build on that. So rather than having a simple waterfall model, which sort of stops, doesn't it? you have a series of mini waterfalls once it's implemented.
>
> *Yes, evolutionary development, that's what they call it.*

They initially developed and implemented a database and functions for the processing of customer inquiries and orders, and for conducting promotions. Further elements were designed, including fully automated stock control and purchasing systems, to be implemented only when the business 'grew' sufficiently to merit the investment. Hence, the organism metaphor affected the *process* of systems development.

Using the *organism* metaphor also brought the realization that Shepps Engineering and Harries Engineering were not really separate entities. Although Harries seemed a separate company, it was owned by the father of the owner of Shepps Engineering, cooperated closely with it and would probably eventually merge with Shepps Engineering. The developers designed and implemented for Shepps Engineering an IS product with an incremental and modular structure capable of adapting to these organizational developments and used a database programme compatible with Harries Engineering's systems. Hence, the organism metaphor influenced the systems development *product*.

The *brain* metaphor was used when discussing the need for a computer-based IS. As the organization had expanded rather than formalizing an IS that could be used by everyone, the two owners had *become* the information systems, i.e. 'walking databases' where the organization's IS was physically in the two owners' brains. Currently, no one else had 'neurological connections' to the owners' brains, so if they were absent through sickness or holiday they returned to a long list of queries and incomplete tasks that no one else could

handle. A new IS would substitute for some of their brain-based knowledge, holding information and supporting communication, control, problem solving and decision-making. The brain also has the ability to self-organize if, for example, some parts are damaged (Morgan, 1997, p. 100). This highlighted how the planned IS would support self-organization in the company in that the other employees would have access to more information and be able to make decisions when the owners were absent. This view helped Sally 'sell' the idea of a computer-based IS to the other employees during the ISD process – the brain metaphor influenced the *process* of ISD in that it helped Sally both understand and explain the anticipated usefulness of the new system.

The *culture* metaphor highlighted the importance of 'the family'. The two owners were father and son, they employed their wives, and the other employees were viewed as an extended family:

> (Sally) . . . they're either family members, or family friends . . . even people who weren't family friends when they started off, because of the culture, they then sort of get taken into the fold.

June and Sally thought that the strong idea of family, mutual support and compromise had enabled the *ad hoc* working practices (previously mentioned) to continue. For example, although Shepps Engineering and Harrries Engineering supposedly had separate stock, they borrowed from each other if one was short of something, and such temporary loans were not generally recorded but simply remembered. The developer-researchers felt, however, that if the business grew, the informal, *ad hoc* ways of working would have to become more formalized. A computer-based IS would also require a change of culture if it were to be a success, otherwise it might be ignored and not serve as a replacement for the owners' brain-based knowledge. During the ISD process, Sally therefore explored with the owners and their employees the cultural changes required. Hence, the culture metaphor influenced developer activities during the ISD process.

> (Sally) And it's a lot 'culture', because the company will not grow until they decide they are going to change.

The *political system* metaphor highlighted how the father and son owners vied for position as head of the family. This was shown as a storm cloud on a 'rich picture' (A rich picture shows people in an organization and the perceived problems, processes, issues and conflicts [Checkland, 1981; Checkland & Scholes, 1990].) To illustrate the conflict in Shepps Engineering: Sally felt she could only draw this storm cloud on the rich picture when both owners were present, otherwise, when they saw it later, each would suspect the other of telling her things behind his back. Hence, the use of this metaphor influenced the developer-researchers' behaviour during the ISD process.

The *psychic prison* metaphor highlighted differences between the father and son in their attitudes to borrowing money and risk, suggesting that this was the reason Harries Engineering had so far remained separate from Shepps Engineering:

> (Sally) You see they'd never, ever agree on anything financial if they were actually partners, because the father's much more cautious and the son's much more willing to risk money. He will borrow what gives the father – he'd have to sit down for 2 days! – and he will borrow lots of money and he's always been successful at it, and he's invested it and used it, and it's worked. But there's no way the father would ever have borrowed – he'd spend the money if he had the money in the bank, he would risk it, but he wouldn't borrow it. Different mentality you see. They'd never agree. That's why, I think, it's stayed separate.

This could be seen as an example of the owners' own thought processes influencing their view of the two companies and how they should develop. The father was happy for his company to stay as it was, whereas the son wanted his company to grow – which would probably involve borrowing money and taking more risks.

> (Sally) . . . The father's quite happy with the size of it. He makes enough money, he's quite pleased, he doesn't see why he should want any more, yes? And it's the son who's a little bit more ambitious.

June and Sally recognized that this difference might affect future decisions on investing in further increments to the IS product, so that the additional functionality they had designed (see previous discussion) might never be implemented. This insight led to them spending more time deciding what should be in the first IS (and possibly only) product to be implemented – i.e. it affected both the process and the product.

The *flux and transformation* metaphor was not used in Cycle 1. Possible reasons for this are discussed later (see 'Evaluation and learning').

The developer-researchers realized that although there was a strong family culture, with organization members looking after each other, the *instrument of domination* metaphor could still be applied. Just because people worked until midnight if there was a rush order, that did not mean that they wanted to; there could have been an element of compulsion or fear. They further reflected that the final IS systems design had potentially increased the organization's ability to be an instrument of domination. The metaphor therefore highlighted for them the role they and the ISD product potentially played in increasing the dominance of the organization over the employees; although it had no direct influence on either the process or product, it did enrich their understanding of their own role and effect.

MMM encourages developers both to use Morgan's metaphors and also to develop their own. Sally suggested one additional metaphor: a *dismembered football player*, to suggest that each part of the organization was solid and well proportioned but disjointed from each other part. She conceptualized the new ISD product as the means to join the parts together – this helped her 'sell' the product to the employees. The metaphor thus affected the *process* of ISD.

In summary, seven of Morgan's eight metaphors were selected and mapped to Shepps Engineering – the exception being *flux and transformation*, which occurred only in the final reflection meeting where June and Sally agreed they had made no conscious use of it. The mappings led to a rich understanding of Shepps Engineering and the ISD context, and, as our examples show, the mappings did indeed influence decisions about the ISD product and process.

Some metaphors were used more than others – this is discussed later. Nevertheless, Cycle 1 suggested that MMM could make a useful contribution to ISD in ensuring a richer view of the organizational context than the conventional machine-view, which would also have practical relevance. More cycles of action research would be needed, however, to explore its relevance in other contexts.

Cycle 2: use of metaphors

Cycle 2 involved June, Alan, Marcus, and Peter and ISD projects for Ableton Council's Structures Department, the Diabetes Care Centre and We-DIY. Again, we concentrate here on our analysis of the use of MMM, giving examples of metaphor use during the ISD projects. The use of metaphors in Cycle 2 is shown in Table 4 and this section provides illustrative examples of their use.

The *machine* metaphor focuses on modelling and automating recurring functions. Through making conscious use of it, Marcus noticed one activity that had not previously been seen as recurring: medical secretaries at the diabetes centre often had to hand-compile patient treatment summaries when requested by the doctors. Instead, he designed a function in his new IS system that automatically generated them on request. The use of the machine metaphor thus influenced the end *product*.

In response to a changing consumer environment, part way through the project, We-DIY decided to remove a large number of stock items, introduce new items and rebrand itself via an expensive relaunch:

> Peter told us of radical new plans at his organisation – new stocklist, purchasing chains, company logo etc., and most staff don't yet know (very confidential). The changes will affect his designs – whether to go with current system, which will be obsolete by the time he submits them, or go with the new, but danger of staff finding out through him. (Minutes of fourth group meeting)

Table 4. Use of metaphors during ISD project meetings, Cycle 2

	Meeting											
Metaphor	1	2	3	4	5	6	7	8	9	10	11	12
Machine	*	*	*	*	*	*						
Organism	*	*	*	*		*						*
Brain												
Culture	*	*	*	*								*
Political system			*	*								
Psychic prison			*									
Flux and transformation												
Instrument of domination												
24-hour clock			*									
Conductor and orchestra							*					*

ISD, information systems development.

These changes had a major impact on the Web site being developed and on the ISD schedule, and other employees' priorities changed so they were not always willing to give the analyst their time. The *organism* metaphor helped Peter interpret the situation:

> With the new information about the company changes the organism metaphor now applies. With We-DIY spending nearly £12 million on a new image re-launch, I believe they are adapting to the changing consumer environment. (Peter's personal log)

Other metaphors were also used by the group to understand We-DIY:

> Peter told how metaphors helped him think about what was happening e.g.:
>
> Culture – do they have a culture of keeping staff in the dark for as long as possible?
>
> Politics – is this about senior managers maintaining power by keeping hold of information as long as possible?

June added:

> Machine – the way systems developers are often trained to think of organisations, basically unchanging, producing things in a regular way, whereas often better metaphor is organism – organisation changes, often quite quickly, responding to things in its environment e.g. competitors' actions, (perceived) customer demands, trading figures, so that the system we design is often obsolete by the time we deliver it (so another argument for prototyping & incremental delivery rather than waterfall model).

By shifting between different metaphors, the developer-researchers explored different possible interpretations which helped Peter reflect on his role and negotiate with the managers about what IS product he should develop.

Marcus compared the Diabetes Centre to a *brain*:

> Focussing on the information side of the department, one can see the similarities the Diabetes Care Centre has with a brain. Hundreds of patients seen by the staff each week generate large amounts of data for storage and processing, the data is then filtered, in a way similar to that in which the brain filters the information it's getting, and is stored in different registers, which assists in better processing of the data. This metaphor helped to focus the concentration on this project as one of the registers in the Diabetes Care Centre, identifying its processing needs without forgetting the data origin or the need for communication with other registers. (Marcus's project report, p. 14)

The brain metaphor highlighted a way of seeing the database Marcus was designing as one of the centre's/brain's registers. It reminded him to consider the origins of the data his system would use, and the need for communication with other 'registers', that is, the links between his system and those owned by others. Hence, it influenced his design.

The *culture* metaphor for We-DIY highlighted for Peter how the company had patterns of belief and shared meaning with a strong focus on 'serving the people in our community'. This led to discussions about the design of the Web site (i.e. product) which could reinforce or

contradict this message of serving people, e.g. by making a customer feedback facility either prominent (the chosen approach for We-DIY) or hidden away.

> (Minutes of first group meeting) Culture metaphor discussion:
>
> Peter said:
>
> Boots [a UK department and pharmacy chain]: Shelves must look good so customers can find products.
>
> Morrisons [a UK supermarket chain]: That doesn't matter – if they want it they'll find it.
>
> Group discussion: WE-DIY?? shelf stacking policy might actually tell us something about how a company views its customers – and that might have implications for type of web page we design.
>
> Alan said:
>
> BT [A UK telecommunications company): Web page – v difficult to find email address so could send complaint.
>
> Group discussion: does that indicate to us how they view customer correspondence ie it's not welcome? ⇒ What message re customer correspondence should Northern DIY's web page convey?

Hence, the group used the culture metaphor to reflect upon possible Web site designs, which Peter then explored with the company.

In reflecting afterwards, Alan used the *political system* metaphor for the Structures Department to understand his role during the ISD process. He had less power than the client's employees, so that he had insufficient control of the development process and had allowed the employees to become overenthusiastic about his prototypes, and subsequently impatient with the time taken for full development:

> The problems encountered with the prototyping models and the clients getting ahead of themselves could be resolved with more experience, also the unique situation between a student researcher and a client may lead to the student not taking as much control as may be necessary . . . (Alan's project report, p. 22)

The *psychic prison* metaphor led Marcus to consider whether one employee's hostility to the proposed new IS was not necessarily based on rational thought processes, but could be the result of an unconscious fear of the unknown, or her reluctance to lose the current system might be compared to a child's unwillingness to be parted from a favourite teddy bear. He treated her with more understanding throughout the rest of the ISD process – the metaphor influenced the ISD process.

The *flux and transformation* and *instrument of domination* metaphors were not used in Cycle 2. Possible reasons for this are discussed later.

The developer-researchers also suggested their own metaphors: a 24-hour clock, a conductor and orchestra, and an ecosystem. The *24-hour clock* metaphor was suggested by Alan,

using the compression of time to capture the Structures Department's history in the same way as popular science often conceives of Earth as 24 hours old so that human existence would have started at only a few minutes to midnight. This was mapped to stages of technical evolution in the Structures Department and helped explain the historical, current and future context of the ISD project. Instead of treating the IS as a discrete entity, the metaphor highlighted for him the web of history and infrastructure in which the technical system was implemented (Kling, 1987; 1992):

> The whole concept of this metaphor has helped me remember the historical roots of the structures department, the current agenda and their expectations or projections for the future. (Alan's project report, p. 29)

Peter used a *conductor and orchestra* metaphor: the idea of an orchestra divided into sections and the conductor working with each section, bringing all together into a musical performance. This suggested to him the importance of We-DIY's marketing director (conductor) to the success of the ISD project. At the start of the project, she had just been appointed:

> Having just discovered this metaphor, it seems to map to Cathy [the Marketing Director], who can be thought of as a conductor who has just walked onto the podium, as she tunes up each section of the orchestra. (Peter's project report, p. 64)

She became increasingly influential, until by the end of the project she was the key figure for Peter:

> Peter: Seeing Claire as a conductor though she wasn't actually the boss, affected his actions, needed to deal directly with her. Without the metaphor, he might have seen her as just another contact. (Minutes of final group meeting)

Hence, the metaphor influenced the process.

In no meeting but in his final report, Peter also suggested an 'ecosystem' metaphor, using the idea of an ecological system containing species that can be born, evolve or die out, where usually the system is balanced but changes affecting one species can affect the whole ecosystem. This highlighted for him how his ISD project might upset the company ecosystem, so must be introduced carefully – the metaphor influenced the ISD process.

In summary, six of Morgan's eight metaphors were mapped to a client organization, two further metaphors were suggested at the group meetings (24-hour clock, conductor and orchestra) and a third (ecosystem) in Peter's final written report.

Some metaphors were used more than others – this is discussed below. Nevertheless, Cycle 2 confirmed the findings of Cycle 1 in showing the possibility of using MMM alongside a technically oriented method and in demonstrating the potential relevance of organizational metaphors to ISD practice. A range of metaphors was mapped to the client organizations, leading to insights into the social, political, and historical contexts of the client organizations and the roles of the developers within them. Some of these insights had practical relevance in terms of subsequent decisions about the ISD process or product. Just as MMM and the structured approach usefully complemented each other in Cycle 1, MMM and the agile methods were complementary in Cycle 2.

The developers in Cycle 2 had no previous knowledge of metaphors as cognitive structuring devices. Their use of the original MMM metaphors and successful invention of their own metaphors, with mapping to the client organizations and relevance found to the ISD projects, shows that they had learnt how to use an interpretive approach, using a range of metaphors to 'see' a problem domain in different ways, 'framing and re-framing' a situation as 'reflective practitioners' (Schön, 1979; 1983).

The potential for MMM to make a useful contribution to ISD in ensuring a richer view of the organizational context, which would also have practical relevance, was therefore demonstrated in three more contexts.

EVALUATION AND LEARNING

A practical outcome from Cycle 1 was a working integrated information system for Shepps Engineering. The client agreed that it solved many of the identified problems of information management by integrating the manual and automated information systems, removing data duplication, capturing more business data, reducing the number of input and output tasks, and incorporating automatic error detection and correction. Practical outcomes from Cycle 2 were database management systems for the Structures Department and Diabetes Care Centre and a prototype e-commerce portal for We-DIY. The two database systems were subsequently fully implemented in their organizations, but the e-commerce site was not because We-DIY was taken over by a larger organization shortly after delivery of the prototype. Hence, three of the four ISD projects resulted in satisfied clients, and the fourth could not be evaluated because of events beyond the developers' control.

In this section, we offer reflections on the action research into MMM and consider what was learnt about the use of organizational metaphors. These reflections emerged during group discussions by the developer-researchers in Cycles 1 and 2 and in our subsequent analysis of the collected qualitative data.

Cycles 1 and 2 showed that the developers *could* use MMM during their ISD practice. Organizational metaphors were *selected* and *mapped* to the client organizations and *evaluated* for their usefulness (Stages 1–3 of Holyoak and Thagard's model). The mappings were often linked by the developers in their discourse to the ISD process and/or product, indicating the practical relevance of MMM to ISD practice, at least in these particular projects. The metaphors did not just give the developers a richer understanding of the social, political and historical contexts of the client organizations, they also provided insights that impacted upon the process or end-result of their ISD work. The technically oriented methods used in parallel contained no techniques to highlight such aspects. They *might* have been noticed anyway by the researcher-developers, but MMM and its organizational metaphors gave the developers cognitive structuring devices to sensitize them to aspects of the organization beyond a machine-view and to articulate their emerging and changing interpretations of the organizations. Based on their interpretations, decisions were made about the ISD process and product.

Table 5. Consequences of using metaphors via MMM

Consequence	Characteristics
1. Increased understanding	Insight for the developers into the social context of the ISD, enabling a more rounded understanding of the current or future requirements, ISD process or implementation of the eventual computer artefact
2. A decision to take a particular action	An effect on the activities of the developer, i.e. on the systems development *process*.
3. A decision to produce a particular design	An effect on the activities of the developer, i.e. on the systems development *product.*
4. A reaction provoked in others	An effect on the interactions between the developer and other stakeholders, i.e. on the systems development *process.*
5. Hindsight	Through reflection, an insight into the systems development process or product which was not apparent at the time and which could be carried forward into subsequent projects.

The implications are that systems developers using MMM can continue to use their technically oriented methods with their much-criticized machine-view of organisations, but recognize that this view is a partial view, just one of several possible metaphors. They can compensate for its limitations by using additional, alternative metaphors supported by an understanding of how we think via metaphors. This should support the design and development of IT systems that mesh more smoothly with their social and organizational setting.

During group discussions and data analysis in Cycle 2, the developer-researchers identified five consequences of using an organizational metaphor (see Table 5) – generalizations that can be explored through further research. Table 5 illustrates Stage 4 of Holyoak and Thagard's model: *learning*, something more general is learnt from the success or failure of a metaphor:

1 *Increased understanding*. For example, the group came to understand the historical roots of the Structures Department, its current agenda and its expectations for the future through Alan's *24-hour clock* metaphor. As discussed in the Introduction, conventional ISD methods assume (falsely) that a technical system can be studied and developed separately from the organization and its historical and social context as a 'discrete entity' (Kling, 1987; 1992).

2 *A decision to take a particular action*. For example, Peter's use of the *conductor and orchestra* metaphor highlighted the need to work closely with the Marketing Director if his ISD project was to be successful.

3 *A decision to produce a particular design*. For example, the use of the *machine* metaphor highlighted for Marcus an additional regularly occurring activity which he included in his IS design.

4 *A reaction provoked in others*. For example, explaining a metaphor-based view to someone could help them see a situation in a new way. For instance, Sally used the *political system* metaphor for Shepps Engineering to highlight for the clients their power struggles as father and son vied for position as head of the family.

5 *Hindsight*, the realization that we could have, or should have, done something. For example, June only noticed afterwards the *machine* metaphor underlying and strongly influencing the group's information modelling work in Cycle 2, which should have been explored at the time.

This knowledge about five possible consequences emerged from the action research and using MMM and metaphors in practice, and complements the knowledge derived from the theory on which MMM was first based. The theory provided a rationale for *why* MMM could be an improvement on conventional IS methods; the practice provided experience-based evidence of *how* MMM could be relevant to ISD practice. Hence, as expected in action research, theory was applied to practice, leading to practice informing theory.

Each of the developer-researchers indicated that they found MMM and the organizational metaphors useful, and planned to use them again and to recommend their use to others. For example, two written comments from the developer-researchers in Cycle 2 were:

> The power of metaphors becomes apparent when one tries to apply a method, a structured way, in order to gain a deeper understanding of the subject in question . . . [The metaphors] provide a powerful tool for developers, a teaching vehicle for lecturers and a learning vehicle for students. Furthermore thinking of an organisation using a metaphor can help when settling into a new job or when undertaking a placement year. . . . All the metaphors that were used for this project reflected the organisation in part, but never to its whole. The 'gaps' left by the mapping of one metaphor were 'revealed' by the use of another metaphor. (Marcus' project report, p. 16)

> . . . this approach is not only helpful when one comes in contact with a new organisation for his/her project but for later life when getting a new job. (Respondent C in anonymous evaluation questionnaire)

For both cycles, the meetings took place throughout all stages of requirements analysis, design and implementation. Table 4 indicates a gap in Cycle 2 (meetings 8–11) where no metaphors were used in the group discussions – possibly because they were not felt useful at that stage of ISD, or because the developer-researchers had other issues they wanted to discuss. Cycle 1 (Table 3) shows no such gap – only at meeting 6 was there no explicit use of any metaphor. It is therefore not possible to say whether the metaphors were more useful in some stages than others – we suspect this will depend on the problem situation.

Note that we have not counted the number of times a metaphor was used *within* a meeting. More frequent usage might be inferred by readers to mean 'of more use' – whereas we believe that even a single use could be hugely insightful for a participant. In Cycle 2, six of the original MMM metaphors were mapped to a client organization. The Machine, Organism, Culture and Politics metaphors were most used, the Brain and Psychic Prison were used a little, and 'Instrument of Domination' and 'Flux and Transformation' were not used at all (see Table 4). Cycle 2 therefore shows that some, but not all, of the original metaphors resonated for the IS developers in these particular contexts. Similarly in Cycle 1, the Psychic Prison and Instrument of Domination metaphors were used a little, and the Flux and Transformation metaphor was not used at all, only referred to in the final evaluation meeting (see Table 3). Hence, the relevance

of these particular metaphors to ISD practice has not been fully established. Possible reasons for little or no use of these metaphors in both cycles include:

- They might have been considered by individuals but abandoned after an evaluation of their usefulness (Stage 3 in Holyoak & Thagard's [1996] model), and so not discussed in the documentation or the group meetings.
- Although some metaphors could map, nothing occurred during the project to trigger the researchers' use of them. However, just the decision to try to map a particular metaphor would probably have resulted in a mapping. (*Maxim 4: Once a metaphor has been found, most people can map between the source and the target*).
- The Machine and Organism metaphors are well known so that people commonly assume organizations to be rationally designed and efficient, and to have needs and exist within an environment. These two metaphors are therefore more obviously relevant and likely to be used more. The Brain, Psychic Prison, Flux and Transformation and Instrument of Domination are less well-known metaphors for an organization, and it was easy for the researchers to overlook their relevance. (*Maxim 3: The target problem is likely to cue other information of more obvious relevance*).

A future action research study could therefore examine the metaphors that were less well used in our study to see whether they can be mapped to the client organizations and the mappings linked to ISD practice in other contexts.

CONCLUSION

We conclude that the two cycles of action research reported here have demonstrated the viability and usefulness of using organizational metaphors, supported by MMM, during ISD. The MMM approach can contribute to ISD practice by raising awareness and helping developers interpret organizations during an ISD project, enabling them to tailor the process and the IS product to the specific organizational context.

As the research reported here is based upon MMM's use in just four ISD projects, we cannot generalize and say it will be useful to all IS developers in all settings. Nor would we wish to generalize in this way. Our study is an idiographic one, using interpretive action research to examine the use of MMM in four (possibly unique) contexts by a group of (possibly unique) developer-researchers. MMM was found useful by these individuals in these settings, and it is left to other researchers and developers to explore the usefulness and relevance of MMM in their own ISD projects and to discover whether the five consequences of using organizational metaphors we identified also occur in other contexts.

MMM is an agile approach as it uses individuals' creativity and innate cognitive ability to think via metaphors as a 'short cut' to richer conceptual views of organizations. It extends earlier instances of metaphor use by IS researchers by incorporating a wider range of metaphors and using the cognitive psychology literature for its theoretical foundation. The model of thinking via metaphor we offer here, and the 12 maxims for effective metaphor use, could be used in other research which analyzes how metaphors are used in IS. Our experiences so far show that the

maxims are straightforward for developers to understand, and that developers can read easily the MMM guide and quickly start to put MMM into practice. Hence, MMM does not require developers to undertake a large amount of training. A facilitator can be useful to remind developers about metaphors and to suggest alternative metaphors (*Maxim 1: People might need to have a superficially dissimilar source metaphor pointed out to them*). June played this role in Cycles 1 and 2 of our research, but one development team member could easily adopt this role.

MMM can be used alongside technically oriented methods. In Cycle 1 it was used alongside the structured approach; in Cycle 2 it was combined with two agile methods, Martin's rapid application development (RAD) and the December Web-development method. It could also be compatible with more recent methods. For example, XP recommends as a key practice that developers identify metaphors for ISD projects (cf. Beck, 2000) but provides no additional guidance on how this may be achieved. Thus, an approach such as MMM, particularly the 12 maxims for effective metaphor use, is required. The Adaptive Software Development approach (Highsmith, 2000) specifies a three-phase life cycle, Speculate, Collaborate and Learn, and we see MMM as particularly relevant to the Speculate and Learn phases. Likewise, the Naked Objects approach (Pawson & Matthews, 2002) recommends a three-stage approach to ISD, Exploration, Specification and Delivery, and the MMM approach would be a suitable method for the Exploration phase. Further research should explore in greater detail how MMM can complement existing and emerging ISD methods. It should also explore whether tangible benefits from using MMM to appreciate the organizational context can be identified and measured – this would be important to clients.

MMM offers a well-grounded, low-overhead and agile approach, which can complement existing ISD methods, raise awareness and help developers interpret organizations. Further action research will explore its use with other IS developers, in other ISD projects and alongside other ISD methods. This will enable an investigation of MMM's wider applicability as an approach that can help systems developers become 'reflective practitioners' (Schön, 1983) who use metaphors to move between different ways of appreciating the complex organizational context of information systems and their development.

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