ISD AS FOLDING TOGETHER HUMANS & IT

Towards a revised theory of Information Technology development & deployment in complex social contexts

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1. INTRODUCTION

This paper identifies a gap in ISD research regarding the philosophy of information technology as it relates to social impact in complex organisational contexts. It recognises that this will lead to problems of organisational stability, and that too often technology and knowledge transfer is accompanied by a one-sided approach resulting in a loss of local context. It posits a revised philosophical position based upon the work of current thinkers in the philosophy of technology/human relations and applies this position to ISD. This revised perspective challenges researchers to review their working assumptions about research in general and technology development and deployment in particular.

2. BACKGROUND

It has become apparent that traditional thinking regarding the creation and deployment of advanced information technologies requires some revision (Stapleton et. al. (2001b)). One major area of opportunity for progress is in the theory of ISD as a means by which new organisational realities can be created. Instead of regarding ISD as the creation of new information technology artefacts, it is becoming evident that, in many cases, ISD has more to do with social reconfiguration and transfer (and challenging) of knowledge and assumptions in order to create a new social space (Moreton & Chester (1999), Stapleton (2001)).

Some of the major issues raised by scientists concerned with the transfer of technology and techniques across cultures include:

1. Cultural imperialism (Banerjee (2001)): ISD can be regarded as reflecting a particular view of the world which may (or may not) be culturally located outside of the IT deployment context

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2. Economic colonisation and the derailing of democracy (Chomsky (1993)): again IT is not a passive artefact but involves a cultural transfer of knowledge and ideas through global corporate business.

The specific local context in which techniques and technology are deployed is ignored, leading to major problems on the ground (a good example is Cronk (2000)).

Philosophically, engineering and technology deployment literature is strongly influenced by twentieth century positivists such as A.J. Ayer (e.g. Ayer (1936)). Functional Rationalism is a term coined in the literature to describe positivist influences in Engineering theory and practise (Bickerton & Siddiqi (1993)). Most information system development approaches are based upon functionally rationalist premises. These premises have dominated advanced technology research and practice, and has created serious problems for the study of social impact, a fact which is well documented elsewhere (Galliers (1992), Myers (1995), Stapleton (2001)). Whilst positivist science has delivered many wonderful discoveries, and has placed a human on the moon, on earth problems of social impact remain acute and poorly understood in spite of a great deal of research on socio-technical design and related areas.

Given the difficulties and criticisms associated with the functionally rational approach in inter-cultural exchange (such as technology transfer) researchers urgently need a new set of assumptions in order to guide work in this area. A new theory of technology transfer and deployment is needed which identifies and informs issues which remain poorly understood. Such a theory needs to be incorporated into research in this space. In our search for revised philosophical foundations it is important to note that alternative philosophical positions have been employed in other disciplines to address problems with positivist science in social domains.

However, these revised positions have been criticised for their own, inappropriate, assumptions when it comes to the deployment of advanced technology in culturally diverse spaces. They have also been criticised for weaknesses in the accompanying research approaches, which attempt to understand the particular cultural and social settings under scrutiny. For example, Naturalism has informed ethnographic approaches and ethno-methodology in information systems development and deployment (Suchman (1987), Bentley et. al. (1992), Simonsen (1995)). This approach has been deprecated by leading social thinkers for ignoring the intervention of researchers in the culture under scrutiny (Hammersley (1990)).

Interpretivism has also been mooted as a possible way forward. This focuses upon 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 ISD research trajectories based upon phenomenology and hermeneutics, which focus upon dialog and the inter-subjective construction of 'narratives' (Boland (1985), Myers (1995)). Social Constructivists also argue that reality is socially constructed and again emphasise the important role of narrative.

In IS research a body of literature has built up around soft-systems and the socio-technical design of computer artefacts which has been highly influenced by interpretivism. These have been characterised by Winograd (1995) as Heideggerian, although this view can be contested. Certainly, a primary philosophical underpinning is provided by the stream of thought which developed following Wittgenstein's later work on language games and Husserl's work on the development of a position now referred to as Phenomenology. This may or may not be entirely in tune with Heidegger's ideas and certainly we see a reduced emphasis upon embodiment in recent IS literature and a strong

influence of the 'rampant textuality' criticised by Ihde[†] which shall be further discussed later in this paper.

In the 1980's this work culminated in publication by, for example, the Scandinavian researchers involved in the DEMOS and UTOPIAN projects, characterised by published work such as Ehn (1988) and Dahlbom & Mathiassen (1993). Here researchers combined a political position with radical new ideas concerning participative design in ISD. Researchers attempted to establish language games which provided a space for inter-disciplinary and multi-function systems design and examined ideas which later became embodied in approaches such as prototyping and user participatory design. Whilst this work did focus upon discourse and the creation of participative, intersubjective spaces, researchers like Ehn also tried to explore the spaces in which people lived. As Ehn pointed out 'this took us away from the academic mainstream, the reason being that this is not where our research subjects live' (Ehn (1988) p. 21). However, the constant across soft-systems thinking and other similar approaches as seen in the Scandinavian's work is the influence of phenomenology, a highly interpretivist view, criticised by some philosophers of technology as having an emphasis upon discourse and language, but leaving humans disembodied: in essence losing the humans in the text (Ihde (1998)). This has resulted in criticisms of Soft Systems and related approaches by Ciborra (1997), Stapleton (2001) and others.

Dahlbom & Mathiassen (1993) state that the issues surrounding the 'fundamental questions' of ISD require a discussion of 'the things we work with' and they see development as 'the activity in which systems are being produced' whilst quality is 'the raison d'etre of our profession and practice'. For these researchers these are 'the ingredients we see in a philosophy of systems development'.

A reading of Dahlbom & Mathiesen (1993), Checkland & Scholes (1990) and other related literature reveals the development project to be fixed upon the creation of a *technical* artefact at a *certain point* in time. It is possible to see, in this emphasis, a latent functional rationalism, with the recognised faults of positivism counterbalanced by an emphasis upon interpretivist approaches heavily influenced, in particular, by phenomenology (Stapleton (2001), Ciborra (1997), Flynn (1992)).

These postures have been criticised on the basis that organisational behaviour involves more than interpretation. It involves creation as well as discovery and authoring as well as interpreting. Interpretivism has been described in organisational literature as being too passive (Weick (1995)). Some philosophers of technology and culture have argued that interpretivism and social constructivism over-emphasise the world as narrative, something referred to as a contemporary 'rampant textuality' prevalent in scientific research of social settings (Ihde (1993) p. 91). 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. A focus on action and creation has been lacking in interpretivist and social constructivist theory. Philosophers of technology have recently argued for a re-emphasis upon the concept of 'embodiment': humans (and indeed technology) seen as solid, rather than only locations of narrative (Ihde (1998)).

It is self-evident that one general criticism of all of the above philosophies is that they do not attempt to bring the worlds of technology and humans into a coherent analytical model for use by researchers and practitioners. This is a deep problem as it goes to the heart of the ISD discipline itself, and therefore requires a serious re-evaluation of the base assumptions of ISD. As Ciborra (1997) shows, these approaches remain, in essence, functionality driven.

[†] See for example the emphasis upon Deconstruction and Discourse as per Derrida in Rose & Truex (2000). Interestingly, this is one of the few papers which argues for the important contribution to IS theory of Latour's Agent Network Theory.

It is readily apparent that gaps exist in the theory of technology & social impact, particularly in the context of inter-cultural exchange. This will necessarily have a major impact upon ideas and concepts concerning social stability as it relates to IT development and deployment methodologies. ISD concerns itself with both development and deployment practises. Indeeed, from the earliest days IEEE Software Development standards see the 'installation phase' as 'the period of time in the software life cycle during which a software product is integrated into its operational environment and tested…. so that it performs as required' (IEEE (1983) p. 21).

However, the ISD literature has generally paid far less attention to deployment aspects of IT, than to the development aspect. Consequently, post-implementation (deployment) activities have received little attention, often to the detriment of ISD effectiveness (Stapleton (2000), Willcocks, Feeny, & Islei (1997)). Whilst the development phase leads to the structuring of a new technical artefact, the deployment phase is the critical phase in terms of social impact. Empirical studies show that the ISD deployment approach is critical for the overall effectiveness of ISD, including return on investment (Stapleton (2001)). This is particular true for large-scale deployments such as Enterprise Resource Planning systems and other inter-organisational solutions.

2.1. Revisiting ISD

The question is, are there alternative approaches which may draw us down different roads – roads that are neither positivist nor interpretivist? Are Dahlbom & Mathiassen's 'ingredients' the only way of looking at ISD? These thinkers, as important as they are, do not address important issues raised by Ricouer, Baudrillard, Latour, Ihde and others. If we are to continue the kind of radicalism central to the excellent work of Ehn, Checkland, Mumford and their contemporaries, it is important that ISD continually revisits and tests core assumptions and attempts to integrate contemporary movements in philosophy into ISD theory. This paper attempts to do just that by revisiting Latour's ideas in which humans and technology fold into eachother, creating new systems and addressing these systems as primarily social systems.

The remainder of this paper sets out an alternative to the current avenues of research under consideration and provides a basis for revising the theory of social impact in complex social settings. It achieves this by suggesting commonality between Latour's Agent Network Theory and Sensemaking Theory as expounded by Weick and others in the organisational literature. It is argued that this avenue paves a way between the philosophical positions of Interpretivism, Social Constructivism, Naturalism and Positivism, and provides a basis for progress in ISD theory.

3. THE RELATIONSHIP BETWEEN HUMANS AND NON-HUMANS

In order to understand and study the intercultural social impact of technology from this new viewpoint we must revisit the essential relationships between humans and artefacts. The work of philosopher Bruno Latour deals with the relationship between humans and non-humans and therefore provides a useful basis for such a revision. Whilst Latour's work has received some attention in the organisational studies and social studies literature, it has rarely been applied in the ISD discipline.

In Latour's analysis of these relationships he introduces the idea of '*interference in the program of action*' where *program of action* refers to the active use of a technological artefact (Latour (1999)). This is best illustrated by an example: the legalisation of guns in the USA. The National Rifles association (NRA) in the USA argue that guns should

remain legal because, essentially, it is not the gun which commits horrific acts of violence, but the person in control of the gun. The gun itself is a neutral object. Alternatively, the anti-gun lobby argue that the person is somehow transformed by the gun, and will act in a more criminal way if in possession of the gun. Latour argues that, from a philosophical standpoint, these positions are 'sociological' and 'materialist' respectively. In the first position, that of the NRA, this sociological position argues that the agent (gun) is a neutral carrier of the will of the actor that adds nothing to the action. It is essentially a passive conductor through which good and evil of society can flow in equal measure. It is *society* or the human which determines what will happen, not the gun. In the second, materialist, view a person is somehow transformed by the gun and is potentially far more dangerous when in possession of this weapon. It is the *material* artefact (the gun) that determines what will happen, not the human. Simplifying, in the sociological view the gun is <u>nothing</u>, in the materialist view it is <u>everything</u>. We can translate Latour's concepts directly into current discussion of advanced technologies as follows: In most of the engineering and technology research and in the general discourse of the relationship between 'humans' and 'technology', each are treated as separate entities. Either the focus is upon the 'technical' on the one hand as the important issue or the 'social/human' on the other as the important issue. Consequently, research focuses upon addressing technical issues (including techniques, methodology, etc.) on the one hand, or social issues on the other. Consequently, these approaches rarely address deployment issues associated with the implementation and post-implementation phases. 'Soft' methods and sociotechnical approaches, it has been shown that the emphasis is primarily upon the collision of two separate systems (which remain separate), rather than the folding of one into the other as is suggested for some time by researchers of ISD but which has rarely been addressed (Boland (1985), Boland & Day (1989), Hirschheim & Newman (1991), Stapleton (2001)).

It is evident that we can identify a direct correlation between the sociological and material dichotomy expounded above, and the current state of research into the social impact of technology. However, Latour shows us that these two separate entities (human and non-human) <u>interfere</u> with one another to create a hybrid. This implies a new way of thinking about social impact in general, and ISD in particular.

Latour argues that neither perspective (sociological nor material) is correct. In order to show this he asks the question 'who is the actor'? Is the actor the gun or the person holding the gun? Latour argues that it is neither and both, it is <u>someone else</u>. This someone-else he calls the citizen-gun/gun-citizen. In this argument he makes a crucial point: If we try to comprehend techniques and technology while assuming that the human psychological capacity remains fixed, we will not understand the social impact of new technology and associated processes. Also, the technique or technology is transformed by the person i.e. the gun is different with you holding it. The gun has entered 'into a relationship' with the person holding it. It is no longer the gun-in-the-drawer, in-the-armoury or in-the-holster - it is the gun-in-the-hand. Latour argues that the twin mistake of materialists and sociologists in trying to understand the relationship between humans and non-humans is their focus upon essences (artefact or human). In Latour, both are transformed into something new, as illustrated in figure 1 helping the software engineer and the information technologist understand one way in which social impact is created. The technology is no longer an essential thing, nor is the human. It is *both together*. Human and artefact are folded into each other. They are transformed into something new, a composite of social and artefact as is argued by philosophers who criticise the over emphasis of current social research upon discourse and narrative (e.g. Ihde (1998)).

We must shift our attention away from 'technology' or 'society' or 'human context' to this new combination of social and technological. Latour calls this combination the 'hybrid actor'. Once we do this, we can see that goals (or functions) change from those of the individual components (human and non-human) to the goals/functions of the hybrid actor.

This is a very important philosophical step in our base assumptions. Applying this to the work of engineering and science in the field of IT development, we now find that we must focus upon a whole new array of actors and actions – the hybrid actors and their functions. This opens a new research trajectory for the social impact of ISD artefacts. We notice that we are now dealing with, not the goals of humans or technologies, but the new, distributed, mediated and nested set of practices whose sum may be possible 'to add up' but only if we respect the importance of mediation (*interference*) in the relationship.
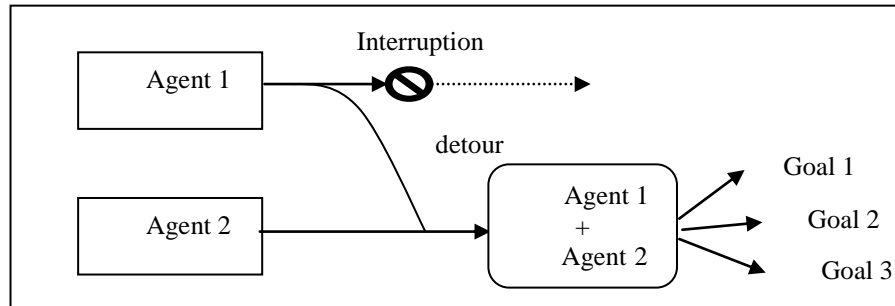

Figure 1. Interference & Goal/Function Transition (from Latour (1999) p. 170)

As this process of *interference* and *folding* develops we note how the original (perhaps explicit) goals can be lost in a maze of new goals as the entire system becomes more and more complex. For example, an early human discovers the stick, and we have a stick-human hybrid. Perhaps the human initially uses this stick to plough the ground. However, the human becomes frustrated with the stick and sharpens it thus creating a whole new set of goals and functions, such as the stick as a defensive or offensive weapon. This whole new set of goals or functions could not have been foreseen at the outset when the stick was originally discovered and deployed. It illustrates how technology deployment in human contexts must recognise that, as humans enter into and develop new relationships with the technology, goals and functions shift. This rationale directly implies that researchers of social impact in ISD must now introduce learning and adaptation theory into their armoury. Simultaneously, they must emphasise design and re-design principles for the technical component. We have not been 'made by our tools' as indicated by Marx and Hegel (homo faber fabricatus). Rather the 'association of actants' is the important thing for the researcher of social impact associated with IT deployment (Latour (1999).

Researchers must understand how
- New goals and functions appear
- New goals and functions can be understood and directed appropriately

This re-focuses our attention as ISD researchers upon processes by which organisations/societies can understand resident human/artefact hybrids within their social group. It is apparent that this requires the application of a social theory which includes organisational learning and decision making. This theory must also account for decision-making processes which are reflective, inter-subjective and iterative. Any revised theory of technology deployment must emphasise the human element of the new human-machine system and cater for humans as they attempt to make sense of the new world into which they are thrust: an inter-subjective, shifting space in which they are intricately bound with a new information technology artefact, and which often makes little sense to them (Stapleton & Byrne (2001)). Software (re-)design and deployment principles must be enhanced, or augmented, so that they can be folded into the overall management of the hybrid system. The question is, can we develop a basic theoretical model upon which these

can be brought together and managed coherently? One promising social learning framework we can build upon is sensemaking theory.

3.1. Sensemaking: An Intersubjective, local Process

Sensemaking literally means the making of sense. People 'structure the unknown' (Waterman (1990) p. 41) and researchers interested in sensemaking concern themselves with how and why people create these constructions and what the affects of these structures are. This theory is a promising departure for ISD because it enables researchers to treat humans as active bodies shaping and re-shaping their world, and making sense of that same world inter-subjectively. This goes to the heart of the ISD process as those pioneers of participative systems development and design, Ehn, Mathieson, Dahlbom, Checkland, Mumford and so many others, envisioned ISD. Simultaneously, it recognises that humans act and enact, and provides a trajectory which addresses some of the criticisms of the overly discourse-based view of ISD which has emerged around participative approaches.

It is stressed in sensemaking literature that professional problem solvers such as systems engineers and managers cannot derive adequate solutions to complex, socially located, problems through to observation and analysis alone, as is typified in the dominat approaches to ISD (FitzGerald (2000)). Solutions can only be found (and re-found) by open and active experimentation. As people's interaction and learning proceeds the very basis for an analytic solution changes. Analysis and interaction are thus seen as two modes of organisational problem solving which supplement each other (Boland (1985)). In equivocal situations, such as those which prevail in IS deployment scenarios, this problem-solving mode is more potent than comprehensive data analysis (Weick (1995)).

In sensemaking a stimulus (new technology, work practices etc.) raises a series of questions, which must be explicated and understood. These questions result in actions which change the environment, resulting in new stimuli and so the cycle begins again. People involved in sensemaking activities must interact with others in order to make-sense of organisational realities. Furthermore, there is evidence that indicates that these groups of sensemakers need sensemaking support personnel to facilitate this process (Weick (1982), Stapleton (1999), Stapleton (2001)). This cooperative sensemaking indicates the *inter-*
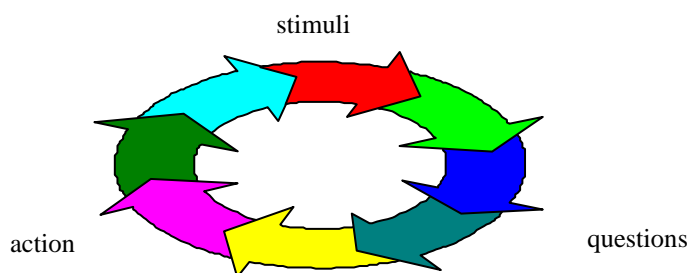
stimuli

action   questions

Figure 2. Sensemaking Cycles (from Stapleton (2001) p. 82)

subjective nature of technology deployment activities (Boland & Day (1989)). For example, if technology driven change occurs, many people and groups must work together in order to come to some sense of what the change means and what the appropriate responses are. This only happens as people engage with(in) the new system. In this way new goals and functions are created or discovered. Inter-subjectivity implies a high level of

trust between participants in the process. Indeed, research based upon these types of activities emphasise the building of deep friendships and common understanding (e.g. Klein & Hirschheim (1991)). The convergence upon solutions implies a cyclic process during which questions we are trying to answer are progressively reviewed and understood. Sensemaking theorists argue that when the question is adequately understood then the required solutions should be obvious (Weick (1995)). This cyclic process of sensemaking is illustrated in figure 2.

In the context of technology deployment, sensemaking theory shows that the management of the introduction of technology into a social setting, and thereby the creation of a hybrid, must equally engage all major stakeholders in cooperative sensemaking. This viewpoint has important consequences for ISD. ISD methodologies generally ignore the cultural differences that exist in differing organisational settings. However, these differences are widely recognised as part of the critical backdrop that is the organisational field in which the technology will be deployed. Indeed, some philosophers of culture argue that technology is not a non-neutral artefact from a cultural perspective. Ihde (1999) shows how technology deployment involves the creation and deployment of, what he terms, 'techno-cultural' artefacts. These writers argue that technology cannot simply be transferred from one culture to another as if it were a passive, neutral object. Some argue that this cultural affect is utilised to the advantage of colonial aspirations (Banerjee (2001) and there are strong political and philosophical underpinnings for these arguments (Chomsky (1993), Baudrillard (1999)). ISD methods were created in a western intellectual space which may (or may not) be appropriate in post-socialist countries, or in so called developing nations (Stapleton et. al. (2001)). Methodology must take these local contextual issues into account. This can only be achieved by the establishment of processes which draw upon local circumstances for their energy and dynamic. Which ever approach we take to the creation of new ISD research trajectories, Bannerjee (2001), Chomsky (1993), Ihde (1999) and others show that there is a moral and professional responsibility upon ISD researchers and practitioners to recognise these techno-cultural effects. The establishment of egalitarian partnerships with associated, explicit, sensemaking processes is critical to the successful deployment of technology across inter-cultural domains. In this context, it is evident that sensemaking provides a theoretical basis for an ISD theory which enables researchers to weave local, human issues into the deployment of IT artefacts, whilst allowing us to maintain Latour's idea of folding of humans and technology into eachother. We can thus address the local, cultural contexts in which people live out their daily lives. The human does not disappear in a mist of discourse and narrative, but is centred in, and central to, the ISD support process.

4. TOWARDS AN ISD THEORY OF HUMAN-TECHNICAL HYBRIDS

The theory of sensemaking can be co-opted into Latour's vision of the human-machine hybrid. This requires a series of steps. The first step is to revise the sensemaking cycle depicted in figure 2 to a spiral. This emphasises how humans who are trying to make intersubjective sense of the new world introduced by the technology, discover new realities in their work lives as a direct result of their being part of the hybrid system. New goals and functions will emerge and must be made sense of. This is diagrammatically depicted in Figure 3. Similarly there is a spiral of redesign for the technological element of the hybrid system. As the social world changes in response to the initial impact of the human-machine hybrid, new goals and functions emerge for the technological component of the hybrid system. This requires a continuous review of how the technology operates, how it can be used in new ways, or how it must be redesigned in order for the hybrid system to remain effective. Thus the spiral in figure three is entirely appropriate for the activities
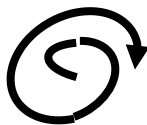
Figure 3. Sensemaking Spiral

associated with the deployment of IT, especially as regards the sensemaking support processes which are necessary for successful post-implementation (Halpin & Stapleton (2002)). Thus the weaknesses of Agent Network Theory as it has been presented in ISD (see Rose & Truex (2000) can be addressed.

In both cases the spiral represents a moving outwards to new functions and goals, and de-emphasises the more simplistic cyclic motion of the sensemaking cycle in figure 2. The centre of the spiral marks the origin of the system, the point at which the human & machine interfere with eachother. This dramatically alters Latour's view of a straight-line movement towards new goals and functions, a view which is not easily supported within theories of decision making and organisational learning (e.g. O'Keeffe (2001)).

The model remains incomplete. In our revised theory of social impact in inter-cultural contexts, a third element is needed for successful technology and knowledge transfer. Here this is termed sensemaking support and elsewhere as the 'explication process' (the term is used here in its philsopohical sense (Stapleton (2001), Blacburn (1994)). This is a spiral of continual interaction and re-interaction with both the re-engineering/re-design process and the human sensemaking process. Explication is deployed to help make sense of changes
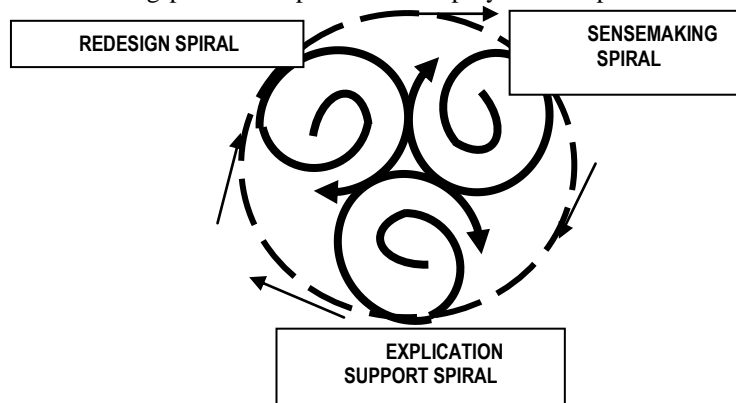

Figure 4. Revised Model of Technology and Knowledge Transfer

concerning the technological subcomponent, and the human process subcomponent of the hybrid. Bringing the entire model together gives figure 4.

It is evident from the model in figure 4 that the design and deployment of a knowledge and technology transfer approach must address the entire system in a unified way. Furthermore, it must recognise that the entire hybridised system is an *open* system, i.e. there is a sharing and transference of energy and resources between the hybrid system and its environment. This is a stark omission in Latour's model, but critical if we are to begin to understand inter-cultural exchange in which very complex environments are created that impact upon the human-machine hybrid.

This model addresses the inherent ambiguities and complexities within Latour's hybrid systems by way of sensemaking support, which in turn feeds into and out of an engineering re-design process. This support feeds into, and out of, technical and non-technical elements of a hybrid system, whilst still treating it as a coherent whole.

5. CONCLUSION

The model of social impact illustrated in figure 4 can be used to drive forward theory and practice. Researchers can adopt this basic framework to identify the most effective ISD approaches. Several promising approaches have begun to appear in the literature. Firstly, at a very general level, the e-Mode2 approach (Stapleton et. al. (2001)) provides an excellent technological and organisational infrastructure within which knowledge can be produced, and in which the model presented here can be incorporated and supported. At a more operational level, the COPIS approach (Jancev & Cernetic (2000)) recognises the importance of peer relations and trust, team building and support processes in knowledge and technology transfers between EU and Post-Socialist societies. ISD researchers need to push this work forward in order to ensure that we address hybrid systems holistically rather than focussing upon the individual components. This paper also shows that it is apparent that researchers information technology development and deployment be:

1. Made aware of the particular assumptions underpinning their work
2. Encouraged to challenge working assumptions and identify new perspectives.
3. Build new theories and practices upon these revised sets of assumptions

This requires a fresh impetus within ISD which actively studies philosophical positions and inquires into those positions which are useful to researchers and practitioners of ISD. This has been strenuously argued elsewhere and the call is renewed here. This is especially true in the modern organisational setting of highly complex organisational structures where managers often exist 'at the edge of chaos' (MacIntosh & MacLean (1999)). These settings are often created by the information technologies deployed. Research should pay particular attention to inter-organisational systems such as Enterprise Resource Planning and other large-scale inter-organisational solutions (Stapleton (2001), Davenport (1998)). These solutions are often accompanied by severe organisational trauma. This trauma has been directly linked to ISD practise and typically is associated with poor sensemaking support processes (Stapleton & Byrne (2001)).

E-Mode2, COPIS and other approaches mark the beginnings of a new trajectory in the study of the social impact of technology in an inter-cultural context. However, these theoretical developments largely exist outside the ISD discipline. This paper provides an important impetus for the crucial debate concerning the cultural and social impact of ISD. It recognises that new 'things' are created by ISD and attempts to understand these entities i.e. the human-machine hybrids, in a fresh way. It also provides a basis for driving this research trajectory forward. It is vital that researchers devote their efforts to moving this work forwards and uncover new pathways for research. If not, then ISD is doomed to continue creating systems that inflict themselves upon organisations, rather than enhance their effectiveness.

Latour's approach and sensemaking theory have not been brought together theoretically within the ISD literature. It is evident, however, that these two provide ISD researchers with new ways of thinking about what ISD addresses in the 21st century. ISD becomes the creation of social, hybridised systems, moving us away from the creeping functional rationalities which remain so central to the ISD domain.

6. ACKNOWLEDGEMENTS

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