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# Developing Information Systems in the Absence of Purpose: A complex & autopoietic view

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## Abstract

*Within the Information Systems (IS) literature, an assumption underlying the development and implementation of IS is that the system should support the goals and purposes of the organisation into which it will be introduced. This paper questions the validity of this assumption in light of theoretical developments in the complex systems literature. From a complex systems perspective, the purposeful nature of social systems is brought into question, with the idea of intention giving way to the non-linear emergence of behavioural patterns. This paper will address the question: what are the implications for information system development of a non-intentional social world?*

## Keywords

Complex Adaptive Systems, Autopoiesis, ISD, Intentionality, Social Systems

## INTRODUCTION

The role of purpose in Information System Development (ISD) has been largely uncritiqued. Essentially, it is assumed that determination of the purpose for an information system in a given (often organisational) context is fundamental to the success of the system. Indeed, studies of why ISD initiatives fail often attribute a lack of clarity in the objectives and requirements of the project as a key reason. The Standish Group's (1995) Chaos Report noted that 'Incomplete Requirements' were the single greatest reason (13.1% of responses) why projects were either impaired or failed. Significantly, 'Changing Requirements & Specifications' (8.7% of responses), and 'Unrealistic Expectations' (9.9% of responses) were also amongst the highest ranking reasons for project failure. These findings would all suggest that the management of purpose/s is vitally important and needs to be understood.

The socio-technical nature of ISD, however, means that establishing 'the' purpose of a system is not an easy task. Often there is considerable ambiguity about purpose arising from the different and continuously changing needs, and desires of actors, and a lack of agreement about what the resulting system is intended to do and how it will do it.

In large organisations, the ISD process takes place within the broader context of IT Strategy and conceptually the IT strategy should support the broader goals and purposes of the organization (Leonard, 2001). This has given rise to a considerable literature on the necessity and benefits of achieving strategic alignment between the IT and business functions of organisations (Luftman, 1996; Reich & Benbasat, 1996; Papp, 2001). Within this literature, two dimensions of strategic alignment are commonly identified: intellectual and social.

Intellectual alignment is concerned with the planning process and planning methodologies (Horowitz 1984; Reich & Benbasat, 2000). An implicit assumption here is that, given a good enough planning process, issues relevant to the socio-technical system design can be anticipated and an appropriate system engineered to satisfy the purpose. Social alignment has been defined as "the state in which business and IT

executives within an organisational unit understand and are committed to the business and IT mission, objectives, and plans” (Reich and Benbasat, 2000, p. 82). This dimension is concerned with the degree of commonality in views between the IT and business functions of an organisation regarding the purpose of the system. It is assumed that where a higher level of alignment exists the outcomes of the IS implementation will be more successful (Leonard, 2001).

While these dimensions arguably capture the key design challenges inherent in ISD, research on both dimensions generally assumes a linear view of the development process: strategy leads to plans, plans lead to projects, projects lead to IS developments, IS developments lead to improved organisational outcomes. Significantly, the assumption of linearity also invades our understanding of the social processes involved. Broadly speaking there is a pervasive assumption that the organisation itself has a purpose; that this purpose can be understood, that management are rational and will work towards it and that this will be the primary determinant of the resulting social dynamics. In effect this assumes a relatively stable and predictable backdrop for the design process and hence the assumption that a well conceived system will directly support the purposive behaviours of organisational members in predictable ways. But what if this is not the case?

In this paper we will approach this discussion from a different perspective and ask the question: What if the nature of social systems (and hence organisations) is such that:

- the unambiguous identification of purpose is not possible?
- what drives organisational behaviour is not the intentions of any specific individual or collection of individuals?
- actors cannot discern how and why what they do impacts on the wider system’s behaviour?
- no amount of information can remove uncertainty about the impact of key design decisions on organisational behaviour?
- The act of design, changes the design parameters in un-anticipatable ways?

These points are some of the implications of assuming that organisations are not purposeful entities but complex adaptive systems. We adopt this position because there is increasing evidence that current thinking about organisations is not well founded (Stacey et al 2000; Stacey 2001; Marion 1999). Furthermore research into ISD cannot be expected to shed light on ‘what works’ if the assumptions upon which it is based are fundamentally flawed.

We would argue that if we are to address the so-called ‘Software Crisis’ (Day, 2000), we need to begin at what we believe to be the source: assumptions about the nature of sociality. Within the IS literature these assumptions have essentially been drawn from the variety of paradigms within social theory (Burrell and Morgan 1994). In this paper, we will outline an alternative concept of sociality based upon a combination of the theory of complex systems and the related theory of autopoiesis. Drawing on this perspective as a conceptual lens we will then discuss the implication of this perspective for ISD.

## **CAN ORGANISATIONS HAVE A PURPOSE?**

Social theory presents a range of alternative paradigmatic assumptions. The assumptions that most commonly underpin the IS literature can be identified as functionalist. This is consistent with the vast majority of social and institutional theory and assumes a central role for intentionality or rational decision making in the process of social order creation (Burrell and Morgan 1994). Order and structure is commonly assumed to be a consequence of common goals (companies, clubs) or common interests (political systems). Hejl (1984,p 69) recalls Max Weber’s definition of social action as an action “which through the intention of the actor or actors is related to the behaviour of others and whose course is oriented at their behaviour.” For Weber then, social behaviour is intentional and cooperative. Similarly Ryle (1949), in a discussion of what he calls heedful behaviours, alludes to the role of purpose as an ordering agent, “People act heedfully when they act more or less carefully, critically consistently, **purposefully**, attentively, studiously, vigilantly, consciously, pertinaciously”. Within these views, the guiding hand of common purpose is always there to provide the environment through which social order emerges.

The importance of rational intent as the primary source of organisational order has been increasingly challenged within the wider organisational literature (see McKelvey 1995; Boisot 2000; Stacey 2001). Ralph Stacey, for example, challenges some of the fundamental assumptions underpinning traditional approaches to strategy development. He says “underlying today’s mental models is the unquestioned assumption that observed effects can be directly linked to causes in a straightforward, linear fashion—that our actions and their outcomes can be, in principle at least, unequivocally connected to each other” (1992, p. 41). This leads him to limit the value of strategic planning to that of ‘anxiety minimisation’ rather than as a substantively valuable activity in itself.

Bill McKelvey (1997) has argued that social order should be understood as a complex product of the interplay between various sources of order; specifically field forces, biological order, rational order and complexity order. This proposition challenges the common assumption that social order is largely a product of rational choice making by free individuals and suggests that the more interesting aspects of social behaviour may derive from the complex interplay between intentional behaviours and other sources of order. McKelvey left open the mechanisms by which these influences may take place but suggested that they stood as an important area for future study.

Within the literature on ISD, we find assumptions of linear causation and an emphasis on rational order emerging repeatedly (Truex et al, 1999). There are, however, some more recent departures. One is to be found in the work of Truex, Baskerville and Klein (1999) and their argument for an emergent view of IS. From this perspective, emergence is considered as “the state of being in continual process, never arriving, but always in transition” (p117 ). Strategy, here takes a backseat to the ebbs and flows of the system and its coevolution with the organisational environment. Truex et al, while silent on the issue of intentionality or purpose, consider the system as remaining in a state of “flux”, with no clearly defined endpoint. Within this view it is assumed that the purpose is under continuous change, in effect a part of the process, rather than a state of being. This position is, however, an exception; differing considerably from the dominant research on the importance of IT strategic and business alignment (Henderson et al, 1996, Chan et al, 1997) and its role in the success of ISD.

If one accepts the implications of an emergent view of social systems, and its associated consequences for the development of IS, then arguably a complete reconceptualisation of the basis for ISD is required. Furthermore what theoretical frameworks are available that may be of value in this reconceptualisation? In the next section we will introduce one potential approach to this problem based upon a synthesis of Maturana and Varela’s (1980) autopoietic theory and complexity theory.

## **TOWARD A COMPLEX AND AUTOPOIETIC VIEW OF SOCIAL SYSTEMS**

Recently, Goldspink & Kay (2003; 2004), have proposed a view of social systems based upon a synthesis of Maturana and Varela’s autopoietic theory and the growing body of research known as complexity science. The rationale for this synthesis is based upon the need to “distinguish between observable phenomena or pattern and the causal laws which generate them.” (Goldspink & Kay, 2004) They argued that through the combination of these theories the basis for an explanation of these causal laws and patterns exists.

From the complex-autopoietic perspective, social systems are considered “as networks of intersecting systems of operationally closed and structurally coupled unities” (Goldspink & Kay, 2003 p. 466). This description of social systems requires some explanation before the implications for intentionality and ISD can be explored.

Autopoietic theory (see Maturana and Varela, 1980, 1992) is a biological systems theory, designed to explain the distinctive nature of living systems. The theory describes the process by which living systems interact with their environment, are cognisant and how this cognisance changes over time in response to interactions with the environment and other people (seen as elements of the environment). Furthermore, the theory describes the way in which language emerges and is maintained via ongoing recurrent interactions between people. There have been a variety of attempts to apply the theory to social systems, giving rise to a considerable debate on the most defensible approach. (Mingers, 1995; Kay 2001)

The basic building block of a social system emerges through what Maturana and Varela describe as structural coupling. Structural coupling arises when two individuals undertake recurrent interactions in their environments such that a commonality in their cognitive structures may emerge. This process has a broad range of implications for the operation of social systems, for "as humans enter into reciprocal interaction over time, there emerges, as a consequence of structural coupling, a certain alignment of their behaviours, including their linguistic behaviours". (Goldspink & Kay 2004) This idea is similar to Hejl's definition of a social system, which also draws heavily on ideas from autopoietic theory. Hejl conceptualises a social system as "a group of living systems which are characterized by a parallelization of one or several of their cognitive states and which interact with respect to these cognitive states." (1984, p 70).

One of the most significant outcomes of the structural alignment between individuals is the emergence of what Maturana and Varela term a consensual domain. A consensual domain can most simply be described as "...a domain of arbitrary and contextual interlocking behaviours" (Mingers 1995 p.78). Consensual domains refer to all types of behaviours, including language. If a consensual domain emerges in and through language, we can distinguish a linguistic domain. The linguistic domain of an individual is the domain of all linguistic behaviours and is in a process of continual change, responding to and affecting the individual's ongoing interactions with the environment. The webs of interactions created as individuals interact with one another and their environment often also become a subject of distinction by those individuals so the web becomes recursively layered. It is within such a web that an observer may distinguish as a social system (i.e. a group, organisation, team etc).

These concepts have a number of philosophical implications that should be made clear. Firstly, autopoietic theory adopts a distinctive epistemological and ontological stance, known as "objectivity-in-parenthesis" Maturana (1988). This position is very much at odds with the philosophy characteristic of functionalism and hence mainstream thinking about social organisation. Among other things it requires the observer's explicit acceptance of, " (a) that as a human being he or she is a living system; (b) that his or her cognitive abilities as an observer are biological phenomena because they are altered when his or her biology is altered, and disappear with him or her at the moment of death; and (c) that if he or she wants to explain his or her cognitive abilities as an observer, he or she must do so by showing how they arise as biological phenomena in his or her realization as a living system" (Maturana, 1988, pp30).

What exactly this means in the broader scheme of things has been the source of some debate within the literature. Without the intention to continue the debate here, for the purposes of this paper we will agree with Mingers (1995) who has argued that this position "with minor modification may be considered as being consistent with the critical realism of Roy Bhaskar (1997). Objectivity-in-parenthesis is important to our discussion due to the associated implication, that any description of social or organisational phenomena will be created from the perspective of a particular observer. The observer may consider themselves a part of the social system or external to the social system, either way this will be a function of their specific structure at that specific point in time. The individuals may distinguish themselves and the patterns of interaction in which they are participating. What and how they distinguish will, however, be shaped and constrained by that participation. There is no 'objective' standpoint.

Human individuals can distinguish 'self' from 'other'. This is possible through the distinction of 'I' and is important as it gives rise to the possibility of intentional behaviours, i.e. behaviours purposefully designed to change the relationship between the 'I' and the environment. Furthermore the distinction of behaviours as being intentional by others also arises and will change the way others interact with the individual. However, any random change in behaviour, i.e. non-intentional act, will have the same effect. For an intentional act to be different from a random act, we would need to be able to anticipate the consequences and adjust our initial change in behaviour in such a way that the sets of relations creating the social dynamic of which we are a part changed in a predictable way. What we are learning about complex non-linear systems, however, makes clear that this level of anticipation and prediction will seldom if ever be possible.

From this perspective, what an observer may distinguish as an 'intentional act' is just one of many events which influence the dynamics of a given social system. The distinctions emerging from a particular event will be different for each observer. It does not matter whether the perturbations generated by one individual and effecting another are intentional or not, or rational or not, or in service of some higher

purpose. What is rational for one observer may be irrational from the perspective of another. What we call rational behaviour or intentional behaviour may be considered so only from the point of reference of a particular observer and even then their perspective is not constant. The notions of purpose or intention in these ongoing processes are far from certain and could more accurately be described as by-products of the process of distinction making rather than the basis for social ordering.

The social systems perspective outlined above therefore views the notion of structure quite differently. Structure no longer refers to the traditional structural concerns of management, given concrete expression in the organisation chart and in hierarchical rules and procedures; but to the many formal and informal ways in which the individual people who comprise the system become connected (Nonaka 1988). This connection will be through the mutual coordination of behaviour, by actions and in language: structural coupling. The conventional actions and interventions of management, including the introduction of new IS will simply constitute perturbations of this system. These perturbations, irrespective of the level at which they are applied, have the potential for global effect and it is not possible to determine *a priori* what effect such changes would have.

Intentionality therefore, cannot be seen, from this perspective, as 'the', or even a primary determinant of order or social action. It is simply a distinction, and it folds back into the unfolding social nexus in the same way as any other distinction. The processes giving rise to order are operating at a different phenomenological level. Intention is not the source of social order but a product of it.

## **IMPLICATIONS FOR ISD OF A WORLD WHERE INTENTIONALITY IS EMERGENT**

If we give up the tendency to view organisations as stable entities, and instead view them as emergent phenomena, several key assumptions underpinning conventional approaches to ISD become untenable.

The assumption that there can be a singular design for an IT system which will fit with a knowable purpose and objective need cannot be defended. An IS design is itself a complex product of a set of social interactions. The specifics of its conception may be sensible within the social domain in which they were conceived but this is but one possible way of conceiving of such a design. The design is the artefact of a particular set of social interactions undertaken at a particular time in a particular context.

Neither can the assumption that it is possible to anticipate the consequences of the introduction of an IT system into an organisational context be defended. Any analysis of an organisational context and the framing of a need or statement of purpose is, as has been shown above, a social artefact. Furthermore, it is not possible to fully understand the processes which characterise the organisational context into which such a system will be introduced. Any such understanding will also be a social artefact and the (organisational) phenomena being studied are complex and non-linear and hence not analytically reducible. The introduction of an IT system into an organisational context will perturb many established dynamics and generate alternative social behaviours. The nature, extent and long term consequences of such a perturbation are inherently unpredictable.

The implication of these observations is that the value of up front research (requirements engineering) and implementation planning has been significantly overstated relative to the expected outcomes of an ISD. If the perspective discussed in this paper is accepted, then no amount of requirements analysis will necessarily lead to an appropriate IS design, which is understood in the same way and interacted with as intended by the developers or by all stakeholders. No amount of planning can completely remove the uncertainty about the range of possible consequences which may be associated with the introduction of a new system. Rather, the emphasis needs to be shifted to processes which support flexible design and post implementation adaptability both technologically and socially. If the organisation's needs and purpose are ambiguous and the impact uncertain, then adaptability becomes a key design attribute.

Any given IT system will give rise to a particular pattern of behaviour within the particular context in which it is located. These patterns may or may not be stable over time. The particular dynamic generated may be seen as an attractor and there may be several possible patterns (a 'rejection' pattern or 'acceptance' pattern for example). The organisational system (including the IT artefact) may change between these patterns in response to internal adaptations and or external perturbations. As Truex et al (1999) observe "IT systems that do not produce stable systems drag are designed to adapt with an organisation, shifting the

organisation's essential adaptation constraints to the external environment and not its own rigid internal IT framework" (p. 118)

The role of ISD would therefore be to:

- a) influence the specific dynamics of a current pattern or
- b) to perturb the system such that it moves to an alternative pattern – one which is hopefully more desirable.

Leifer (1989) discusses Jantsch's (1980) three paradigms of change—*deterministic, equilibrium* and *dissipative*. The first is Newtonian—according with the mechanistic metaphor of organization and early technical IS design methodologies, the second is derivative of systems approaches or cybernetics—consistent with many contemporary ISD methodologies, while the latter is dynamic with few clear precedents in ISD. It is towards this latter paradigm that we argue we need to move.

Dissipative systems operate far from equilibrium and in a state of perpetual change, undertaking deformations and compensations in response to exogenous and endogenous changes without the need for directed or forced transformation. Systems which demonstrate this type of behaviour have significant adaptability.

Loye & Eisler (1987) point to the potential for complexity to lead to a better appreciation of the basis for intervention. Working from first principles it is clear that a critical factor in choosing an intervention is to isolate the loci of change, i.e. the parameters to which the system is sensitive. This will generally involve active experimentation or may be derived from collective experience of participants in that social network, whose varied experience, in effect, constitutes the experiment. Approaches to change based upon Participatory Action Research (see Carr and Kemmis 1986 and Whyte 1991) are consistent with a viable approach as are contemporary approaches to organisational learning.

## CONCLUSION

In this paper we have questioned the assumed role of purpose in ISD. We argued that the IS literature, drawing inspiration from social theory, unduly privileges the role of purpose or intentionality in the creation of social order and with that limits its ability to adequately conceptualise and inform the ISD process. Adopting a position based upon a combination of autopoietic and complexity theory, we have argued that the implications for information system development of a non-intentional social world is that the focus of ISD initiatives should be redirected away from the requirements engineering and systems analysis process towards understanding and establishing adaptive system processes in the socio-technical environment of the IS. Such IS will be more able to support the ever changing and ambiguous needs of the social system of which they are a part. This calls for the development of systems (both technical and social) which have high intrinsic flexibility and adaptability.

We would argue that the ability of the IS field to significantly improve practical outcomes will suffer ongoing limitations unless a fundamental re-evaluation of these ideas occurs.

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