8-15-1997

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Challenge Abstract

Early problems associated with the development of computer systems led to the much cited 'software' crisis, which in turn has engendered an understanding of development that has sought a solution in terms of control and standardisation. However, systems still continue to disappoint and this paper proposes that two challenges provide one research avenue where greater understanding is required. The research avenue is that of developing *adaptive* information systems. The challenges are those of *complexity* and *change*. A growing realisation of the former is noted through a discussion of the emergence of interpretivism as a method of understanding failure. A discussion of the poor, or lack of, understanding of the latter challenge leads to a conclusion that a different philosophy is required for developing information systems in modern environments.

Introduction

Computer based information systems (CBIS) may be argued to be intentional artefacts that model aspects of business organisation. Since the mid-1950s the growth, diffusion and use of computers within business has been profound, in some cases changing the nature of business itself. During the early part of this period, what were seen to be flaws in the development process resulted in the much cited 'software crisis'. Systems took too long to build, cost too much and did not work very well. The increasing complexity of systems was seen only to compound such problems and many researchers in the field saw a solution in terms of increased control and the widespread adoption of rigorous and formalised systems development methodologies (Fitzgerald 1996; Friedman and Cornford 1989; Hirschheim et al. 1995). However, though such approaches represent the dominant view, many systems still disappoint (Gibbs 1994 p. 72-73):

"Studies have shown that for every six new large-scale software systems that are put into operation, two others are cancelled. The average software development project overshoots its schedule by half; larger projects generally do worse. And some three quarters of all large systems are "operating failures" that either do not function as intended or are not used at all"

This paper proposes that two challenges provide one research avenue where greater understanding is required. The research avenue is that of developing *adaptive* information systems. The challenges are those of *complexity* and *change*. A growing realisation of the former is noted through a discussion of the emergence of interpretivism as a method of understanding failure. A discussion of the poor, or lack of, understanding of the latter

point leads to a conclusion that a different philosophy is required for the development process.

Failure and complexity

There have been numerous attempts to identify what causes the success or failure of an information system (see, for example: Bailey and Pearson 1983; Benbasat et al. 1981; Ives et al. 1983; Lucas 1976; Swanson 1974). The majority of these may be argued to be *positivist* in their outlook. In broad terms, they view knowledge as an objective entity that can be collected by the researcher and used to test prior hypotheses or theories. Indeed, in DeLone and McLeans' (1992) review, few of the 180 references listed digress from a positivist perspective. Evidence for positivism as the 'orthodox' published approach to information systems research is also offered by Iivari (1991) and Orlikowski (1991). However, more recently, an increased awareness of the complexity of the issue has prompted the research community to increasingly accept *interpretivism* as a valid approach to research (Boland 1985; Orlikowski 1991; Orlikowski and Baroudi 1991; Walsham 1993; Walsham 1995). This adopts the position that knowledge of reality is a social construction by human actors. As a result, more pluralistic approaches to failure have started to appear based upon interpretations of case studies rather than surveys and laboratory experiments (see Beynon-Davies 1995; Christiaanse et al. 1986; Noble and Newman 1993; Sauer 1993).

Lyytinen and Hirschheim (1987) arrive at their conceptualisation of failure in much the same way as DeLone and McLean (1992); through review of the empirical literature. After an extensive survey and classification, they define failure in terms of the inability of an information system to meet a specific stakeholder group's *expectations* (where stakeholders may be defined as those who have a vested interest):

"Expectations represent evaluative dispositions which are derived from the stakeholders common pool of values. In many cases these expectations are vaguely expressed, and are never rationalised or verbalised as real concerns . . ." (Lyytinen and Hirshheim 1987: 263)

In turn, we propose that the expectations of stakeholders are relative to *intentionality* (Searle 1983; 1984; 1995). This may be defined as the capacity of an individual to represent entities and states of affairs of the world to themselves (through beliefs, desires and alike). To say a mental state is intentional is simply to say that it is about something or directed at something. At an individual level, intentionality is not 'value free' by virtue of the process of socialisation. At a collective or societal level, this intentionality becomes embroiled in an ensemble of structures, practices and conventions (the forms, rules and norms of business organisation for example) which individuals exist within, reproduce and/or transform (Bhaskar 1979). For the purpose of considering information systems within organisations, we may frame such intentionality within three interacting circuits (Scarborough and Corbett 1992):

- *Circuits of power*; concerned, in the main, with the political considerations of stakeholder groups. In dichotometric terms, this revolves around the tendency of such groups to use the information system to reproduce or expand their power and

influence, set against the loss of such power and influence - via the information system - to a wider range of groups, contexts, and knowledge.

- *Circuits of meaning*; where the objectivity of the material form of the information system may disguise levels of subjective intent and knowledge - intentionally or unintentionally. Thus, on the one hand, stakeholders may translate their interests and perceptions into powerful and coherent ëideologiesí whilst, on the other, implicit and protracted use of the information system may ëreframeí the way the real world is perceived - thus reshaping values.

- *Circuits of design*; which can be broadly seen as the flows of knowledge, information and artefacts between the processes of invention, exchange and use (characteristics of the innovation process). This may be seen as the political and ideological ëframeí within which new technologies and new ideas may be evaluated.

Finally, we would highlight that neither individual or collective intentionality, or the circuits in which they operate, are static notions. The environment within which information systems development, operations and use takes place is dynamic, turbulent and complex.

Change and Adaptive Information Systems

During the analysis and design stages of the development process, we attempt to model aspects of this complexity using a variety of tools, techniques and methods of abstraction. These are often sold in the form of methodologies and encompassed within a project mentality. Again there is strong evidence of a generalised positivist approach (see Iivari 1991). Baskerville (1996) proposes that this should be no surprise as, at the abstract level, the methodological approach is inherited from science: seeking a universal approach to a wide family of problem situations, reducing them to an abstract set of symbols, thus allowing elements to be manipulated with a finite set of operations in order to deductively arrive at a 'solution'. Thus, a complex social situation is abstracted from in a structured and communicable manner to be represented in terms of a model which, in turn, is expressed through a computer-based medium. The form of representation is partly constrained by the nature of the computer itself, which expresses complexity through the large number of physical switches and its ability to complete many simple binary operations in a very short time.

The problem this leaves us is that these temporal 'snapshots' then provide *the* picture of reality for the duration of the project. This is exacerbated by the project mentality which, by virtue of limiting the development timescale, leaves us with static systems that are asked to work in dynamic environments (see Grindley 1986; Kanellis and Paul 1995; 1996; Paul 1994). Though some approaches allow for limited iteration in the design process, they fail to allow for change in the wider context, that is: change in individual and collective intentionality; change in the business; change in the organisational environment. However, recourse to recent industrial history shows that change is the

hallmark of organisations past, present and future (Wilson and Rosenfeld 1990). The point that we would propose here is that our current understanding of development points us toward a Platonistic view of change: principally, that which is observable (the development model) is fixed and unchanging. The fallacy of this is realised through 'maintenance', with some 88 - 98 percent of total maintenance cost being spent on *enhancement (Fitzgerald 1990). This significant amount provides good pragmatic justification for research.*

What maintenance tells us is that change will affect an information system throughout its entire lifetime. Olerup (1991) notes that whilst much work has gone into mechanistic and goal-centred approaches to information systems development, approaches based on principles of design as ongoing process are rare. It is the latter approach that we would advocate. Firstly, adopting a form of systems-fit approach emphasising an architecture that allows the system to grow, adapt and evolve with its environment. Secondly, providing mechanisms to allow a system to inherit or acquire modifications that make it better suited to survive and reproduce in a particular environment. Lastly, allowing it to evolve complexity: as Booch (1991) notes, a complex system that is designed from scratch never works and cannot be patched up to make it work.

Conclusions

Though there has been much progress made with regard to information systems development, systems still continue to disappoint. Through a review of changing attitudes to understanding information systems failure, we have discussed the challenges that complexity and change pose to the development of information systems. In turn, this has led us to propose a conceptual reorientation with regard to information systems development: a shift in the design process, from one where the designer is required to forsee every contingency and/or articulate every requirement of a design, to one where the principles of design are inherently an ongoing process. Our belief is that information systems should not be developed as static entities, but should be allowed to grow and adapt, having a genuine historical identity extended and unfolding in time.

Our aim has been to articulate a conceptual challenge. There are no 'silver bullets' here. Our own research into the plausibility of such a development understanding currently takes two forms. Firstly, through external-reference and external-modification, examining 'tailorable systems' as a way of giving stakeholders better real-time control over their particular part of an architecture. Secondly, through combining external-reference with self-reference and self-modification, examining how component based architectures may aid the search for adaptive ability. However, though we are not alone in our views (see Oei et al. 1994; Pawson et al. 1995), we would venture that major improvements in information systems development will only occur when many more, if not most people involved, take on the paradigm shift necessary.

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