Learning from Failure: The Benefit of Systems Thinking for Multimedia

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Abstract

This paper asks whether the emphasis of many computer professionals and academics towards engineering and rationality, in the area of IS development is wholly appropriate. The paper will suggest that it would help if, in fact, stakeholders had a wider focus. To justify this assertion, the paper examines the history of the technology used for IT and the issues identified in the literature as being perceived to have been factors leading to failure. These failures are observed not only in the systems as a whole, but in the interfaces included in it. Many of these interfaces are now addressed through multimedia. However, despite representing a mechanised and perhaps relatively error free approach, anecdotal evidence suggests that what is created could be more useful, particularly in terms of flexibility. The issues associated with difficulties for information systems development are being addressed through methods based on social science. Given the overlap between information systems, HCI and multimedia, this paper suggests that it may be beneficial to include such approaches within multimedia.

The paper will recognise the evolution in technology; education; system ideas and organisations together with their competitive environment over the last 40 years or so. The paper will show that the new approaches to the development of information systems are also useful within HCI and multimedia.

This is addressed through a consideration of the use of Activity Theory in the development of HCI.

1. Introduction

The idea behind this paper is the recognition that while information systems and HCI are distinct areas of study, they actually address similar problems and would benefit from a cross-fertilisation of relevant insights. For example, Hasan (1998) and Preece (1994) see both information systems and HCI as inter-disciplinary fields but warns that crossing the barriers between disciplines will take time and effort. Preece (1994) cites ACM SIGCHI as recognising that HCI is about the interaction of humans with elements of computer technology in the work place, in order to facilitate business processes. In broad terms, HCI aims to “develop or improve the safety, utility, effectiveness, efficiency and usability of [computer using] systems” (Preece. 1994). However, these entities could equally well act as metrics assessing the quality of a system (Bennetts and Wood-Harper, 2000). In essence, for a system to work, the users must see it as an aid to their thinking about a work process. For example, a study by Bennetts and Paterson (2000) was to shed light on the issue of how data modelling is approached in the practitioner domain by examining how experienced, skilled practitioners’ use data modelling as a thinking tool.
In more general terms, Bertelson and Bødker (2003) argue that approaches to HCI based on cognitive science gave rise several issues.

- Interfaces were designed for a generic user – as the designers were advanced users – and did not allow for work environment, division of labour,…
- The role of the interface as an artefact was not understood in terms of how the user conceived it.
- The novice-expert gap, highlighted earlier was not addressed.
- The models of task analysis were inadequate in their attempt to capture “the complexity and contingency of real-life”.
- While systems focused on a generic user, even in complex situations, the response has been to recognise this inadequacy through continuing developments which actually recognise the work place reality, in the form of CSCW.

This paper sketches the history of computers in the commercial world, in order to gain insight into why systems fail and support the suggestion that not only has technology evolved, but so have the skills required of computer practitioners to support the use of that technology in order to support the organisation in an unstable environment. However, multimedia is also affected by this environment

2. The Evolution of Information Systems

This section identifies some of the changes that have occurred over the last 40-odd years, both in the nature of the technology and the way that it is used in an organisation. This usage reflects changes of scale downwards for the technology which has allowed it to be embedded in any organisational process. Alongside this development has been globalisation. This factor alone raises issues about culture and politics,

The technology supporting information systems has enabled older facilities to become more robust and other facilities to become available. Consequently, the new facilities have provided opportunities to attempt more and more for the organisation. When computers originally became available, they were used to automate well-recognised and well-understood business processes. Subsequently, enterprise systems were used to supply information systems in which application systems were integrated and system networks spread the information across the globe. Lately, enhanced networking and interface capabilities in which the software supported the organisation strategically replaced that form of working. This historical sequence is, of itself, of little consequence. What needs to be recognised is that technology does change and consequently, the abilities of those developers involved in the new environment also need to evolve.

Indeed, software engineering was a concept derived from the NATO conference convened to discuss the Software Crisis. As a result, concepts of software quality have become more formalised. However, we need to remember the comment cited by Prem (1997) from one of the gurus of quality that “Experience alone, without theory, teaches management nothing about what to do to improve quality and competitive position, nor how to do it.” (Deming, 1986). It is salutary to have such support, although it might be argued that this has not been followed in practice. For example, it should be remembered that if actual practice is considered, that the most used methodology was "JDI" (Just Do It) (Moynihan, 1995). Again, it seems to be the case
that “good” practice has been recognised, and is taught - but it may not be followed always. This assertion is supported anecdotally. However, it is reflected by the considered opinion of some prominent people. For example, Gibbs (1994) reports Larry E. Druffel, Director of Carnegie Mellon University's Software Engineering Institute as saying that unfortunately, "the industry does not uniformly apply that which is well-known best practice". Further, even if 'best practice' is applied and enshrined in a methodology and the organisation’s processes require it to be used, this was no guarantee that this was so. This is also confirmed by the case study described by Playford (1997), in which management managed to sabotage SSADM. 

It would seem that managers have always tried to get the computer to solve problems which are, in fact, too large, or too complicated in some way. This has, of course, acted as a spur to manufacturers to produce technologically based facilities which will, in time, remedy this. This perception is confirmed by Sauer (1999) when he comments that consultants have strongly encouraged organisations to take advantage of these new technologies, but perhaps somewhat prematurely. As he puts it, “the dynamic of capability has pushed technological ambition further and further. This has continually extended the degree of organisational change demanded into territory not well understood with consequent risk of failure.” This is not a novelty, Olsson and Russo (2004) cite Espejo (1985) as still being true, when he comments “The rate at which information technology is being introduced in our institutions exceeds our capacity to generate knowledge about its effect and meanings”. Jackson (2003) considers any approach peddled by consultants in order to assuage client demands as nothing more than the latest management fad. Although these may work well with fairly easy problems, it would appear they usually fail when the problem addressed is highly complex. Given the pressure that development professionals are working under, it is not surprising that off-the-shelf answers are sought. However, Jackson is also concerned that by appealing to inadequate approaches off-the-shelf, the ability managers have to find innovative solutions to problems is diminished.

Sauer (1999) shows that the reasons why systems fail have also evolved. Thus Lyytinen and Hirschheim (1987) develop a taxonomy of system failure consisting of “correspondence failure” – where the effect of a system on the organisation’s performance did not correspond with expectations – such as improved efficiency; “process failure”, in which system development processes such as scheduling were inadequate; and “interaction failure” arises when the expected system users prefer not to use it. However, the overall perception of failure changes.

The software crisis of the late 60s was seen to be due to process failures by software engineers, although other professional stakeholders also recognised the presence of correspondence failures. Later, user resistance was recognised as being significant. However again the responses of those IS professionals with a technical focus differed from those with a behavioural focus. At this stage the technician examined user psychology in an attempt to build better interfaces. Those in the behavioural group were concerned with organisational issues such as structure, politics and power. These issues were then used to adapt the design appropriately and to develop “counter-counter-implementation” tactics. As the ability to use strategic information systems appeared to occur in the mid-80’s Sauer’s (1999) analysis is that this was so significant for an organisation’s existence, that the inherent difficulty of achieving this
was suppressed and “failures were not much in evidence”. Also, “the risks of [such]
failure were scarcely discussed or evaluated”.

Prem (1997) argues that the new environmental challenges for enterprises can be
summarised as consisting of increasing complexity; high uncertainty; rapidly
changing markets together with high rates of technological change and decreasing the
times taken to order, produce and deliver goods. These characteristics are challenges
for modern enterprises because traditional managerial principles, like those of Taylor,
have led to rigid forms of organisation which are inappropriate for dealing with
rapidly changing markets. Prem argues that there should be general
acknowledgement that the … “firm, is a complex system in a complex environment”.
Prem takes a view from cybernetics which regards an organisation as subject to
different specific observers’ views and as an object of several distinct sciences. This
view of the enterprise is a holistic and system-theoretic one. In a cybernetic approach
to the theory of the firm, the enterprise is considered as a socio-technical system that
possesses a tight coupling between the system and its environment, adapts to its
environment and is an inherently open system.”. Prem (1997) notes that the
challenges noted above cannot be controlled, however, he recommends accepting
them rather than trying to “counteract on them”. He concludes that these
organisations should

- Ensure that their business processes are tightly coupled with their
  environment;
- Ensure that these processes are driven by consumer needs and “fulfilled by
  interacting, cooperative work groups”;  
- Ensure that these work groups react to changes in their environment.

Traditionally, it would seem that software engineers have been unwilling to grapple
with management issues. For example, if we regard requirements engineering as a
branch of software engineering, "goal of Requirements Engineering is to determine
what properties a system should have in order to succeed. Sometimes this is
relatively straightforward; but often it not. Some of the most vexing difficulties are
social, political and / or cultural. Many requirements engineers feel that such issues
fall outside the scope of their profession, and instead fall under management,
interpersonal skills, or ethical quibbles; some even argue that social issues should be
ignored in the requirements process, in order to make it as clean and technical as
possible" (original emphasis). Perhaps this should not be surprising, for, as Winograd
and Flores (1988) explain, today we are taught from an early age that rationalistic
tradition, with the prestige and success it has received through scientific method has
become synonymous with "what it means to think and be intelligent". This is not
surprising, given the history of this technology. After all, the technology itself had to
be developed by engineers.

The education and training offered to erstwhile computer professionals in the era of
data processing when the course of studies was housed in departments and faculties of
science, mathematics and engineering. This provision is epitomised by degrees in
Computer Science. However, while this facility continues, the recognition by some,
that the ideas from social science are pertinent, has resulted in degrees in Information
Systems from departments in faculties of Social or Business Studies. Thus, the
support from universities have co-evolved with technology, but because universities,
if considered as a commercial organisation, deliver their “product” over a three year
period rather than overnight, the universities have changed at a somewhat slower pace.

In order to indicate possible generic enhancements to practitioner skills sets. However, to recapitulate, when, in data processing, the problems were fully understood and the methods of solution all agreed, the provision of a resolution to the problem was therefore, much more of a technical translation of an English specification into binary than anything else. The connection with the business was implicit only. This is no longer the situation, as, with the global network the computer has embedded itself into the organisation’s learning and decision making processes as well as the production processes that it started with. This has started a change of emphasis in educational direction from engineering to business applications of IT. However, it is important to stress it is a change of emphasis, as both elements are required. The modern professional is not just a technician but needs much more sensitivity to subjective issues. However, the mental framework behind some of these new approaches is significantly different to the rational tradition. The problem that this requirement for multidisciplinary skills lies in the identification of an appropriate discipline to support the research and education of the information systems professional of the 21st century. A suggestion has been made above that reductionist science is an inappropriate paradigm for the investigation of problems related to human social systems and argument has been made elsewhere that the methods of management science are inadequate for intervention into social systems (Rosenhead, 1990; West, 1991). Blackler (1991), makes the point that organisations would like to be rational and staff are expected to explain their actions in terms of appropriate goal-seeking. Blackler cites Vattimo’s post-modernist stance to explain that the apparent success of the Western intellectual tradition with truth is an illusion. Apparently, Vattimo argues that this tradition should be replaced with approaches based on hermeneutics. It is expected that these approaches will assist organisations to partner each other and enhance their collective competencies through the use of Activity Theory. Bertelson and Bødker (2003) offer this perspective on HCI so this is addressed in the next section.

3. The HCI Tradition

Activity theory is derived from work by Vygotsky and Leontjev. Activity theory takes several forms, but aims to examine the characterisations of mind and society. In the context of new systems for organisations, this approach will require the whole organisation to be considered and a data model created for the firm. This analysis will probably not be easy and may expect to deal with conflict, for example over data “ownership”. This theory recognises that the tools being used can be physical (and produce material changes) and psychological (which influence behaviour). Hence, this approach will make developers aware that the tool that they create will change work practices and cultural norms. However, it comes as theory rather than a mechanised tool set. This is expected to encourage flexibility, as argued by Jackson above.

While the concern of those performing multimedia will be to offer the most appropriate tools to support users, the users are expected to change their conception of the system over time, as they learn more about what it can do for them. Authors such as Carroll and Rasmussen have tried to move away from a situation in which
cognition and action are considered separately. Activity Theory deals with more than a generic human being. Activity Theory is expected to deal with activity that takes place at many levels in a hierarchy but that activity is not just at one level at any time. Individual users have different levels of skill. Learning from practice will imply that optimum use of the technology will also develop. Hence, not only is collective practice is expected to change, but also the “contradictions and conflicts arising from” multiple forms of use should be addressed.

4. Conclusion

This paper has used the technological history of computing in business organisations and correlated the evolution of attitudes and the facilities offered with the reasons why these systems often failed as a vehicle for recognising the wide variety of approaches to problem solving that are available. The conclusion reached is that this area should be recognised as being multi-disciplinary and that courses offering provision in this area need to acknowledge this, if those taking that provision are to maximise what they can do. Further, as part of that acknowledgement that multimedia is multidisciplinary, it will be pertinent to accept that many of the issues raised in this paper, still, in general, need to be addressed.

Activity Theory is expected to support environments which do not characterise generic users but expects a dynamic and supportive situation which will encourage users to cooperate and develop understanding and process improvement.

References

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