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Socio-technical systems and interaction design – 21st century relevance

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ABSTRACT

This paper focuses on the relationship between the socio-technical system and the user–technology interface. It looks at specific aspects of the organisational context such as multiple user roles, job change, work processes and workflows, technical infrastructure, and the challenges they present for the interaction designer. The implications of trends such as more mobile and flexible working, the use of social media, and the growth of the virtual organisation, are also considered. The paper also reviews rapidly evolving technologies such as pervasive systems and artificial intelligence, and the skills that workers will need to engage with them.

1. Introduction

When a new system is being designed the main focus may be on specifying a logical entity that works reliably and accurately on a high specification computer in the software development lab. But when deployed, the system may fall short of expectations. It may not run as efficiently as expected on the local platform, the users might feel that it does not support the way they work, while the user interface may seem to offer a poor match with the requirements of the task. Researchers such as Enid Mumford (1987) were among the first to show that even when the underlying technology was adequate, a failure to address the social needs of the organisation could result in an unsatisfactory outcome. To address this problem, the 'socio-technical systems' approach, a term coined by the Tavistock Institute of Human Relations in London (Trist, 1981) was developed. Its aim was to help achieve the effective blending of both the social and technical sub-systems of an organisation, including any new technology that may be introduced into it. Ken Eason, while at the Tavistock Institute and at Loughborough University, has been one of the leading researchers in understanding the difficulties encountered when trying to harness information technology and in developing tools and techniques to help achieve quality in people's work lives (Eason, 1988). Case studies of socio-technical considerations in practice may be found in Klein and Eason (2010). This paper focuses on one part of the socio-technical system – the interface between the user and the technology. If this is designed without consideration of socio-technical issues, it can lead to problems for the user and the organisation.

Research into the operations and structures of organisations has identified the *main elements* that make up the socio-technical system (Eason, 2010). These include:

1. *The collective operational task* where the system undertakes the operational delivery of the overall task objectives.
2. *Social and technical sub-systems* in which the complete task performance is undertaken by human resources in the social system using technical resources in the technical system and where the two are ideally co-optimised.
3. The attribute of being an '*open system*' which is influenced by the environment and so has to adapt as environmental conditions change.
4. The idea of being an *unfinished system* that needs to be flexible enough to deal with new demands in the short term and where there is provision to review and refine the system as these demands become confirmed as new requirements.

An example, from the author's experience, is the design of a new offender case management IT system for a national prison service, an organisation engaged in the collective task of looking after offenders. The social sub-system is made up of work roles (prison reception, censors, custody and supervising officers, wing staff, security staff, and finance personnel). The processing of the offender case data is performed through the technical sub-system. Each person in a particular role is assigned with some parts of the collective task which had to be coordinated if the collective task was to be accomplished. However as the organisation is an open

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system it, has to adapt to changing demands, for example, new forms of offender risk assessment or new procedures of operation within the prison. So there are many challenges for user interface design to make sure the technical system maps onto user needs.

Fig. 1 is a diagrammatic representation of the socio-technical factors that influence the design and implementation of a new system, including factors relating to the design strategy, the social sub-system and the technical-sub-system. These are also important considerations when the user interface to the technology is designed. Each of these factors is discussed in the following sections of the paper and how they might influence the design of the user interface to the technology.

2. Design strategies and context

When a new IT system is to be developed, the design strategy will affect the outcome for the users and their work. This section discusses some of these aspects of strategy and the implications for user interaction with the system.

2.1. User involvement in system design

The importance of user involvement in systems design is well established by Eason (1982), Shackel (1985) and Damodaran (1996). Although strategic design decisions will drive the overall concept of a system, Harris and Roland Weistroffer (2009) report that users may have little involvement in the fundamental design and may only have limited influence on the technical functions. Yet it is the users who will know the practicalities of the task and be able to make suggestions to ensure that the design is feasible. Attarzadeh and Ow (2008) state that one of the main causes of IT systems failure has been of a lack of user input into the systems design process and the specification of requirements including user requirements.

To maximise the benefits of user involvement, representatives need to be given the confidence to critique the current design and knowledge to appreciate the potential of technological innovation. For the offender management system, it was proposed that prison staff record onto the computer all movements of prisoners from one location to another. The users thought this was an additional labour intensive task for staff that already have a high workload It was suggested that a more practical alternative was a scanner system where tags worn by prisoners could be recorded automatically which would make tracking them more accurate and efficient.

2.2. Designing for usability and accessibility

When designing for usability it is particularly important that this be related to the socio-technical context. What is usable for some users in the organisation may be difficult for others so mapping the usability needs across the organisation is necessary. This is particularly true when comparing users who have a good knowledge of the task domain and IT systems with those who require more support in performing the task and in operating the system. Writers such as Tognazzini (1992), Nielson (1999), Norman (2002) and Shneiderman et al. (2009) and have established principles and guidelines for user interface design in order to achieve usability. Many of these have been captured within the ISO 9241-110 standard, 'Dialogue Principles' (2006). These include: suitability for the task, suitability for learning, suitability for individualisation, conformity with user expectations, self-descriptiveness, controllability and error tolerance. Other parts of the same standard cover specific topics such as menus, forms, software individualisation and accessibility. While such guidance is useful it should always be interpreted for the socio-technical context. For example, when the usability of a system is being evaluated this should take place following consideration of the context of use ISO 9241-11 (1998).

Equal opportunities regulations in many countries mean that organisations are required to employ people with disabilities as well as serving customers who may have disabilities. Partly because of such regulations, the importance of accessibility within work systems to achieve inclusive design for users is now recognised. The move towards systems based on internet browser technology allows benefits to be gained from the standards for accessibility and assistive technology support established by the World Wide Web Consortium (W3C-WAI, 2012). In December 2010, the British standard BS 8878 (2010) was launched to address web accessibility and the challenge of digital inclusion which can apply to workers as well as customers.

2.3. A more technology savvy workforce

In the past, when a new IT system was introduced, workers often felt daunted by it and reluctant to use it. Some would need extra training in the use of basic computer facilities such as mice and keyboards. With the widespread ownership of home computers, smart TVs, tablets and mobile phones, people are now generally

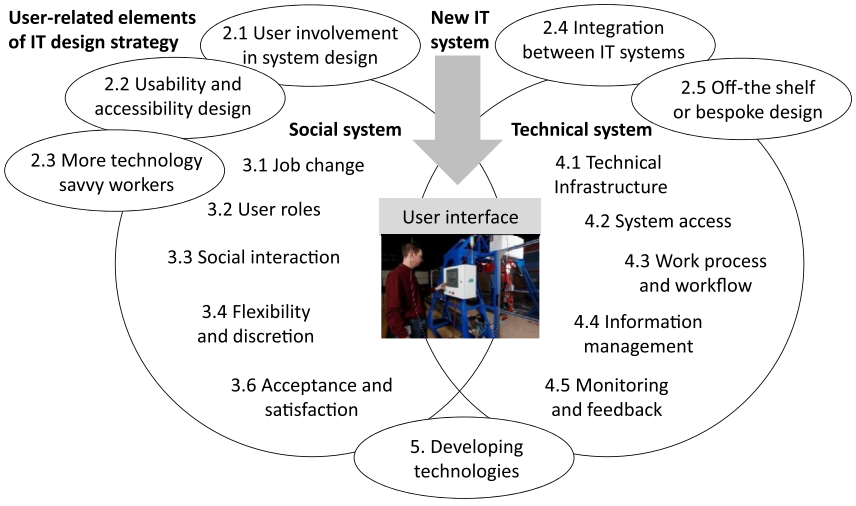

Fig. 1. Elements of the IT introduction and socio-technical system that may affect or be affected by the user-interface.