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A holistic approach to usability

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A narrow, ‘information processing’, approach to studying the interaction between human beings and computers has met critique. Based on a more holistic approach, an investigation into the usability of VSOP tools reveals a complex usability problem picture. Some problems are related to the artefact (e.g. poor user interface designs and lack of system functionality); others to user issues (lack of proper skill/training). Also unrealistic expectations on the new tools and external influences, such as a continuous updating of the tools, add to the picture. Overall, the results demonstrate the importance of a more holistic approach to usability issues.

1. Introduction

The usability of products has often been addressed as 'information processing' problem. However, such a narrow approach to studying the interaction between human beings and, e.g., computers has met critique. Instead, interaction must be understood as a consequence of the surrounding environment in which (inter-)action takes place, to which the individual adapts, and with which the individual and the artefact interact. Therefore, a more holistic approach has been advocated by several researchers, e.g. by Bødker (1991), Rasmussen et al. (1994, and Winograd and Flores (1986).

An example of a more holistic approach is a framework developed by Karlsson (1996, 1999). The theoretical basis for the framework is human factors systems theory (e.g. Meister 1989) and activity theory (Leontjev 198), as described and adapted by, e.g., Bødker (1991).

The proposed framework suggests that five dimensions need to be explored and analysed on different levels in order to reach an understanding the role of, and the requirements for, an artefact in a use activity (Figure 1).

In short, the first dimension – *goal/-consequence* – is concerned with the out-come of interaction and use. The second dimension – *activity* – is divided into three levels; an operation level, an action level, and an activity level. The third dimension – *user* – can be studied,‘objectified’ into different properties, he/she could be seen as an individual with knowledge and experience or as an individual in social interplay with other people.

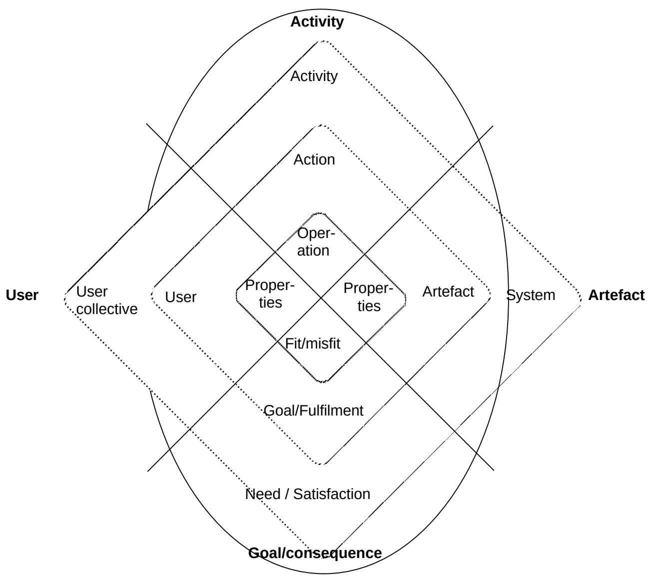

Figure 1. The suggested framework for the study of the relation between user and artefact based on systems theory and activity theory (Source: Karlsson 1996).

The fourth dimension describes the way the *artefact* can be broken up into single properties, be regarded as a complete product or seen as part of a product system or alternative systems. Finally, *context* or *environment* is where actions and operations take place and shaping part of the conditions for how actions and operations can be carried out.
The analysis moves between 'higher' levels of analysis related to motives and goals and 'lower' levels related to specific local circumstances that trig specific operations.
The assumptions behind the framework is that the use situation as a whole must be addressed and understood before any recommendations can be made as to the design of the artefact-to-be, and hence, of the use situation-to-be.

2. An illustration

2.1 Background

A case study will illustrate the approach. The specific project was initiated in order to investigate the usability of VSOP tools, i.e. computer tools for Visualisation, Simulation, Off-line programming, and Production (Bondesson & Lindqvist 1998).
The manufacturing industry faces a growing demand for faster and more flexible product development and manufacturing processes. To meet these demands, many companies have introduced different VSOP tools. These tools can be used for planning and optimizing product systems and for evaluation of e.g. construction designs. However, studies have shown that the tools are used only to a very limited degree. The assumed reasons are a possible lack of knowledge of the benefits of the technology and what results may be achieved and/or that the systems are too complex and interaction between user and computer is deterred due to poor usability.

2.2 Method

The study encompassed personal interviews with 23 users of VSOP tools in Sweden, in this case Robcad, Igrip, and Quest. In addition, a questionnaire was distributed to 38 companies. Twenty-eight answers were received. The framework (see Figure 1) was used as a tool for planning the investigation, as well as for analyzing the collected data.

2.3 Results

The study revealed that the users of VSOP tools constantly faced problems when creating simulation models and when importing CAD objects. New versions of both VSOP and CAD tools were introduced often which meant that the users repeatedly had to learn how to use, or rather to manipulate, new versions, e.g., in order to overcome problems with transfer of data.
Poor user interface designs caused problems for novices, as well as experienced VSOP users. The systems did not provide proper feedback. The systems were inflexible whereas the experienced users would have liked to be able to create customized menus in order to "*. . . simplify the interfaces*". The overall structure of the systems, with a large number of menus and windows made users feel –"*. . . . lost in the system, not knowing what you have done or what you are expected to do next*." On-line help functions and manuals were not considered to solve the problems.
Most users had participated in different courses in order to learn how to use the VSOP tool but they were, in general, unsatisfied with their training. One reason was that the courses did not take into account that users were different in terms of experience. Another reason was that most often time elapsed between the course and actual use of the VSOP tool. Many users felt that they had forgotten most of what they had learnt when they started using the tool. Also, the courses had had the wrong focus, emphasizing 'the interface' of the tool while the users claimed that one had to learn a completely new way of working with (or through) the tool.

Furthermore, the work with VSOP was considered dependent upon good communication and co-operation within the organisation, e.g. in order for the users to have early access to data on different construction designs. The VSOP tool was expected by management - and customers - to solve, very quickly, existing production problems and result in higher productivity –"*Expectations are high. Not all people realize that it's just a tool. Many believe it's the total solution*." Overall, the users meant that while the tools were overrated, the problems associated with the introduction of the tools were underestimated. Not enough of the resources were allocated learning, or in different project the production of models – "*Management does not understand how much work is behind a model.*" In addition, resources in terms of computer power were often lacking which made models difficult to create and time consuming to run.

2.4 Analysis

A number of identified problems are considered to contribute to prolonging the implementation time of the new tools (Figure 2). Some of the identified problems are considered to an inefficient use of the new system as illustrated (Figure 3).

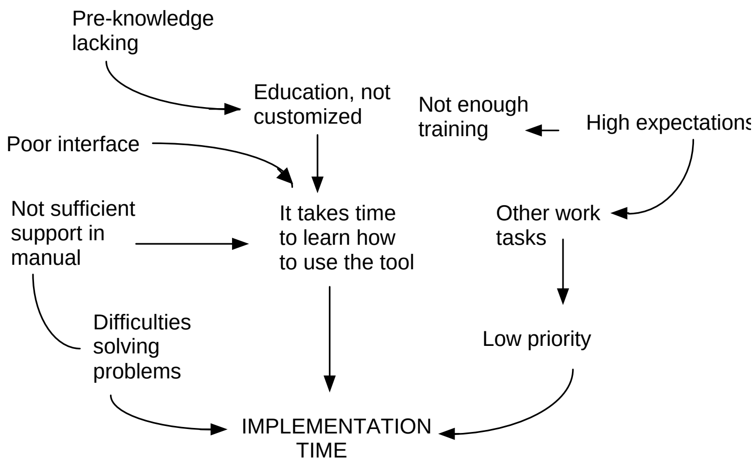

Figure 2. Problem picture resulting in prolonged implementation of VSOP tools. (Source: Bondesson & Lindqvist 1998)

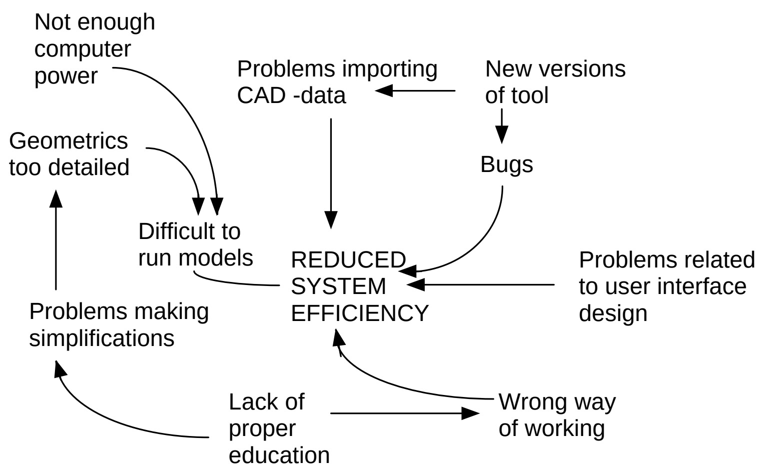

Figure 3. Problem picture resulting in reduced system efficiency. (Source; Bondesson & Lindqvist 1998).

Analysed in terms of the framework, the problems could be related to the 'properties' of the *artefact*; e.g. poor user interface designs. It could also be related to a lack of proper manuals and help functions, and insufficient computer power, i.e. a system aspect. The problem picture is also influenced by several *user* aspects on an individual level, e.g. lack of proper skill/training, but also the characteristics of the organization (e.g. poor communication between individuals). Unrealistic expectations could be considered a *goal* issue, also affecting the user's relation to the VSOP tool. Figure 4 is an attempt to summarize the problem picture.

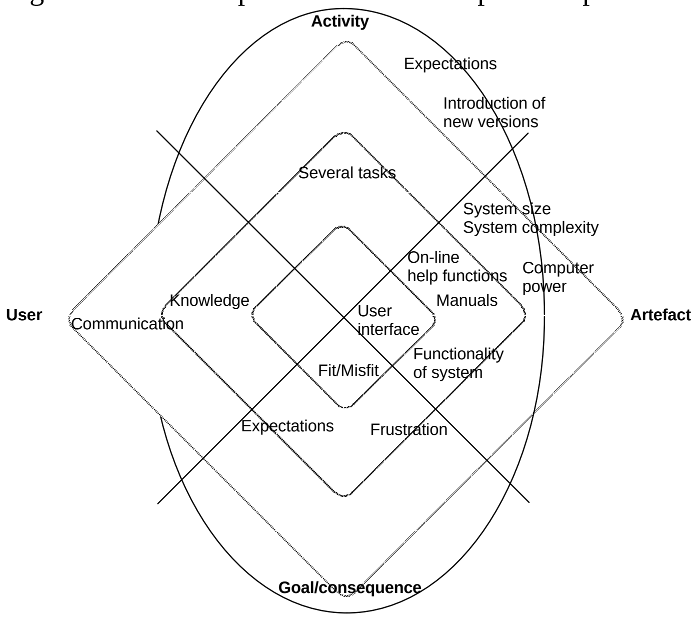

Figure 4. An attempt to summarize the problem picture in terms of the proposed framework (Adapted from Bondesson & Lindqvist 1998).

3. Summary and concluding remarks

Usability may be regarded as a quality of the user interface only and approached as an 'infor-mation processing' problem.

In contrast, the study reported here has taken a more holistic approach to usability. The study shows that a number of factors contribute to the way by which VSOP users could achieve their goals. These factors include but also extend well beyond user interface issues. Even though modifications of the user interface could be expected to improve the usability of the system, the improvements must also encompass system functionality, system compatibility with other computer tools, help functions and manuals, as well as training programmes and managerial support in order to be compatible with users' needs.

Even though there are definitions (or descriptions) of usability and related concepts take a more comprehensive view on usability (e.g. Allwood 1991, Löwgren 1993), the ISO definition seems to be the most appropriate: "*Usability is the extent to which a product can be used by sp. cified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*" (ISO 9241-11, 1998).

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