Planning and Implementing User-Centred Design

Nigel Bevan and Ian Curson
Serco Usability Services, 4 Sandy Lane
Teddington, Middlesex, TW11 0DU, UK
nbevan@usability.serco.com

ABSTRACT
The tutorial presents a structured approach to user centred design, based on the principles of the International Standard "Human centred design processes for interactive systems" (ISO 13407) and other related standards. A core set of practical methods which support the approach are described. These have been selected by the European Usability Support Centres on the basis of their applicability, maturity, availability, and cost-effectiveness. The tutorial gives an overview of each method, and describes criteria which can be used for selecting appropriate methods. The benefits of demonstrating conformance to ISO 13407 are explained.

Keywords
User-centred design, usability evaluation, standards

OBJECTIVES
Many organisations now recognise the need for usability in interactive systems, and the benefits that usable systems deliver. But guidance about how to "do" usability tends to be technique-centred, concentrating on specific approaches for designing or evaluating systems. How can organisations at different levels of usability maturity, and with different criteria for usable systems, discover how to improve the usability of their systems?

ISO 13407 [11] describes how a human-centred design process can be used to achieve usable systems. The standard provides a framework for applying human-centred design and evaluation techniques, and is intended to supplement existing lifecycle models.

Different organisations are at different levels of usability maturity – from not recognising usability as an issue, to having processes in place which ensure the development of consistently usable systems. The principles of ISO 13407 can be integrated into their existing development process incrementally, to achieve an appropriate maturity level.

ISO 13407 specifies types of activity to be performed during the development of an interactive system, but does not demand nor recommend particular techniques or methods. The European Usability Support Centres (set up by the EU INUSE project [8] have agreed a set of core techniques to support the human-centred design process, selected on the basis of their applicability, maturity, availability, and cost-effectiveness. These are described in a handbook [6] which accompanies the tutorial.

USER CENTRED DESIGN PRINCIPLES
The tutorial starts by explaining the approach to usability and user centred design which is now embodied in a set of related international standards. Usability is defined as a high level quality objective: to achieve effectiveness, efficiency and satisfaction [10]. This requires not only ease of use, but also appropriate functionality, reliability, computer performance, etc. It is thus synonymous with "quality in use", which is the user's view of software quality [2,3,9, 12]. ISO software quality standards make quality in use the ultimate objective of systems design, thus providing the authority for giving usability a very strategic role in the development process. Achieving quality in use requires a user centred design process, and the use of appropriate usability evaluation techniques.
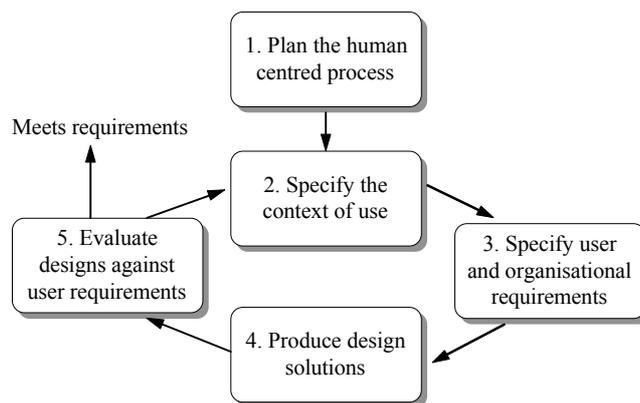

Figure 1. User centred design process

The steps in the process are illustrated in Figure 1 (based on ISO 13407), and involve an iterative cycle of specifying the context in which the product will be used and the user and organisational requirements, and then producing design solutions which can be evaluated against these requirements. Early in design the requirements will be at a high level and the design solutions are likely to be mock ups. As design progresses higher fidelity prototypes will be evaluated against more detailed requirements.

USER CENTRED DESIGN METHODS
The first step is to plan which methods are expected to be used at different stages of development. This will depend on the business case for usability, and will take account of the budget, timescales, resources, skills and other constraints. For each potential method, the handbook [6] provides information which includes when the method should be used, the type of results provided, the number of usability experts and users required, and the typical range of person days involved.

Planning may also include assessing the usability capability maturity of the organisation and identifying where improvements are required. The stages are [7]:

- Ignorance: We don't have problems with usability

- Uncertainty: We don't know why we have problems with usability

- Awakening: Must we always have problems with usability?

- Enlightenment: Through management commitment and improvement of human-centred processes we are identifying and resolving our problems

- Wisdom: Usability defect prevention is a routine part of our operation

One essential prerequisite for user centred design is to define in detail the context of use of the product. The method recommended in this tutorial, *Usability Context Analysis* [4], is based on ISO 9241-11, and provides a structured approach to gathering and documenting information about the characteristics of the intended users, tasks and environments. The resulting specification of context of use can be used to inform design, and to specify valid and consistent evaluations.

GUIDANCE AND STANDARDS

Style guides and standards can be used as an input to design, or as a means of evaluating whether a product conforms to requirements. The *ISO 9241 applicability workshop* uses the ISO 9241 parts 12-17 dialogue design guidelines as the basis for producing a style guide customised to specific organisational requirements.

EARLY DEVELOPMENT METHODS

Rapid prototyping is a collection of formal and informal techniques for developing, demonstrating and evaluating user interface designs to support rapid iteration early in the lifecycle. The techniques can be categorised depending on whether the prototypes are passive paper, animated paper or machine, and whether the user interaction with the prototype is naturalistic, prompted or participative.

Usability inspection methods include inspection by human factors experts ("heuristic evaluation"), by designers, by users or by an appropriate combination. The choice of method depends on the skills available and the potential benefits of involving designers or users in each situation.

LATE DEVELOPMENT METHODS

The type of usability testing method used should depend on the relative importance of obtaining design feedback, or obtaining measures which can be compared with alternative products or pre-determined criteria.

The *Performance Measurement Method* [14] is a structured technique for delivering meaningful and objective metrics of the performance of the user-system combination in accordance with ISO 9241-11. The metrics can be used for acceptance criteria, and to compare the performance of alternative designs and products.

User satisfaction methods can be used for eliciting the subjective opinion of users. These include the SUMI questionnaire [13] where results can be compared against the industry norm, and the public-domain SUS questionnaire.

ASSURING USABILITY

How can a purchaser judge whether a product is usable? The supplier could state the results of a usability test, but it can be difficult for the purchaser to know whether the results are valid or relevant. A partial solution is to use a Common Industry Format usability test report [5]. Another approach is to provide evidence that a user centred design process was used when developing the product. The *ISO 13407 lite conformity scheme* can provide this assurance.

REFERENCES

1. Bevan N (1995a) Measuring usability as quality of use. *Journal of Software Quality*, 4, 115-130.

2. Bevan N (1997) Quality and usability: a new framework. In: *Achieving software product quality*, van Veenendaal, E, and McMullan, J (eds) Tutein Nolthenius, Netherlands.

3. Bevan N and Azuma M (1997) Quality in use: Incorporating human factors into the software engineering lifecycle. In: *Proc. Third IEEE International Software Engineering Standards Symposium*, p169-179.

4. Bevan N and Macleod M (1994) Usability measurement in context. *Behaviour and Information Technology*, 13, 132-145.

5. Blanchard H (1998) The application of usability testing results as procurement criteria for software. SIGCHI Bulletin, July 1998.

6. Daly-Jones, O, Thomas, C, Bevan, N. (1997) *Handbook of user centred design*. National Physical Laboratory, Teddington, Middx, UK.

7. Earthy, J (1998a) Usability Maturity Model: Attitude Scale. INUSE deliverable D5.1.4s - see INUSE (1997)

8. INUSE (1997) see http://www.npl.co.uk/inuse

9. ISO/IEC FDIS 9126-1 (1999) Software quality characteristics and metrics - Part 1: Quality characteristics and sub-characteristics.

10. ISO 9241-11 (1998) Ergonomic requirements for office work with visual display terminals (VDT)s - Part 11 Guidance on usability.

11. ISO 13407 (1999) Human centred design processes for interactive systems.

12. ISO/IEC 14598-1 (1998) Information Technology - Evaluation of Software Products - Part 1 General guide.

13. Kirakowski J (1996) The software usability measurement inventory: background and usage. In: P Jordan, B Thomas, & B Weerdmeester, *Usability Evaluation in Industry*. Taylor & Frances, UK.

14. Macleod M, Bowden R, Bevan N and Curson I. (1997) The MUSiC Performance Measurement Method. *Behaviour and Information Technology*, 16, 279-293.