

# Implementation of a User-Centered Design Process in a large Software Development Organization

Natalie Woletz  
University of Paderborn, C-LAB, Germany  
natalie.woletz@c-lab.de

Dirk Zimmermann  
Siemens Med HS CS, USA  
dirk.d.zimmermann@siemens.com

## Abstract

*Requirements for software systems are well known and can be found in software-ergonomic literature in form of style guides, ISO standards or guidelines. Also a lot of Usability Engineering models do exist, consisting of stages, tasks and methods that are thought to be necessary to accomplish an optimal design. In those models the Usability Engineering Process mostly is described independently from other business processes within an organization, like sales and marketing processes, software development, testing or requirement engineering. Especially how to integrate a complete Usability Engineering Process (UEP) into an existing organisation is not well described in current publications. How can overlapping or differentiation from existing processes be defined? What are the interrelations between organizational aspects on one hand and a successful UEP on the other hand? The authors will describe what aspects have to be considered while implementing a UEP not as a “stand-alone” process but as one out of many processes, already implemented in an organization. This will be described using an example, where a UEP was gradually implemented in a large software development organization over a period of three years. The aim of this paper is to provide a good practice example that allows practitioners to derive ideas for introducing a UEP into their organization. In addition, this article encourages research activity in the field of organisational development in the HCI field.*

## Keywords

User centered design process, usability engineering, process implementation, organisational aspects of user centered design process, organisational development, business process reengineering

## INTRODUCTION

The reasons for and benefits of usability engineering and are well known in the HCI community and among software producers. The legal basis for software-ergonomic demands consists of ISO norms, EU framework directives and other standards or de-facto standards. These regulations are helpful for usability practitioners who plead for consideration of usability aspects during software product development. They are formulated on a generic level and only give limited guidance on how to apply the general software-ergonomic requirements to concrete user interface design. This can rather be found in enterprise or product specific guidelines or style guides. These guidelines usually aim at a consistent user interface layout for a product family or corporate design and branding and therefore are not focusing on issues of functional design, task adequacy, task distribution between human and machine, etc. There is an observable trend in the HCI community, where the focus turns from designing the user *interface* to designing the human computer *interaction*. Even though it is often referred to as User Interface Design rather than User Interaction Design (cp. Karat & Karat, 2003). Within this context many authors addressed the question of how to structure a design process that leads to a maximum usability for the end product (Nielsen, 1993; IBM, 1996; Mayhew, 1999; Vredenburg et al., 2002; Cooper & Reimann, 2003). In most cases the authors presented more or less comprehensive usability engineering models. What all models have in common is the division into stages (e. g. analysis, design, build, evaluate) and the explicit or implicit reference to the principles of Gould and Lewis (1985). In addition a lot of experience reports were published which describe how a usability process or program got integrated into an existing organization (Wiklund, 1994; Rudisill et al., 1996; Winograd, 1996; Savage & Pearsall, 1998; and many more). These are exemplary descriptions that relate to specific circumstances and conditions of the respective situation. Although some authors address organizational issues (e. g. Quesenbery, 2001), they do not provide a systematic approach of how to implement a usability engineering process. The authors believe that usability engineers have to take ownership of the process *implementation* in the same amount as of its *execution*. The analysis and design work will be of maximum benefit to an organization when the overarching process takes user centered design into consideration on all levels.

## IMPLEMENTING A USABILITY ENGINEERING PROCESS

When a complete usability engineering process gets implemented in a software company, some parts of such a process are often already applied. There are people communicating with the customers about their requests, needs or wishes. In some organisations the people specifying the product functionality are also designing the graphical user interface, in other cases this is done by the software developers. Also testing of the implemented code is done in a more or less systematic way – but rather with focussing on technical aspects like errors, stability and security. Thus a lot of usability tasks or at least similar or comparable tasks are already applied. In such an organisational environment the implementation of a new, complete usability process means to re-arrange the way things are done, to change the range of individual responsibilities, and to set new priorities. It also often leads to new tasks and job enlargement, which usually requires additional qualification. Also the authority to make decisions and the area of accountability has to be revisited. Furthermore, any new process influences the already established processes, for example the marketing process (Woletz & Laumann, pap. sub.), the software engineering process and other processes like requirement engineering or testing.

In the example described in this paper the situation prior to implementing a new user centered approach to product analysis and design was far from optimal. The company had an infant, centralized usability engineering team and a usability lab for validation, but their influence on the organization has been minimal. They did get product teams to add a phase for usability testing just prior to the product's beta test, but were not successful in convincing them to incorporate better design practices up front. When looked at closely, it became obvious that User Interface Design actually was not even a defined task in the systems analysis and design processes in use. The Product Analysts usually included sketches, example screens from other systems or their own mock-up screens to illustrate the concept of the desired functionality – expecting the technical designers and developers to translate these into consistent screens. On the development side, however, the sketches were often enough taken verbatim and coded exactly as shown by the Product Analysts' artefact, even though they were labelled as illustrations or examples. Both sides expected the other party to come up with the actual UI design, a situation that is not uncommon in a lot of traditional development processes.

### Goal and Expected Outcome of the Process Redesign

The question of “evolution vs. revolution” is frequently asked in process redesign. For every new project, product, or release, an organization usually evaluates whether an optimised process could improve their performance in meeting the company's business goals (e.g. decrease time-to-market, increase usability, decrease requirement volatility). However, the value of stable and predictable processes should not be underestimated. The key stakeholders (product analysts, UI designers, and system designers) gather experience and skills and any new process requires re-training or brings along other process losses. For example, if the method of writing/managing documentation is changed, there is also a risk of needing to re-do at least part of the already existing artefacts, which is generally not productive work. In the authors' experience, the deciding factor is the degree of innovation or independence from existing solutions. For example for a new release of an existing product, it's usually not worth completely changing the process model, so an evolution in smaller steps is more appropriate. On the other hand, for the next generation of a product, revolutionizing the process is appropriate in order to set it up correctly from the beginning.

There were several key goals for the new analysis and design process. From a UI/UCD point of view, the first one was to ensure proper user and task analysis and sufficient stakeholder and user validation to complement and confirm the analysis work. The second one was to define a consistent UI design framework as a basis for all upcoming products within the new family of products. There were of course other goals that needed to be met from an overall organization's perspective, e.g. conformance/integration with the RUP/OOA model, the generation of testable requirements or internationalisation. This paper focuses on the UCD related process elements of this transition.

### Introducing the New Process:

The first level of introducing the process changes was adapting and optimising a requirements analysis process based on use cases. The designated role for this task was the product analyst, but since a good part of the use case audience was the UI designer, there was a lot of initial collaboration to focus the artefact on the right elements and levels of detail. The benefit of this use case based analysis was not only continued conformance with the UML based analysis process in place, but also generally to convey much more domain knowledge than stand-alone requirements. The use case documents allowed the subject matter experts to share their knowledge and experience with the downstream organization in a structured and effective way. During the collaboration on use cases, the new artefact called *User Interface Specification* was introduced. This allowed the product analysts to concentrate on workflow and non-functional requirements, while on the other side it took away parts of their traditional tasks and responsibilities. A lot of emphasis was put on collaboration and shared ownership of a complete analysis package to convey that the product analysts would still be involved in the definition of the user interface. Thus the initial work was rather educational and focused on obtaining buy-in than looking at the mere analysis

work. Eventually this was perceived as a valid and helpful distinction of specification documents, with experience being the biggest comforting factor. The collaboration between product analyst and UI designer has been carried all the way through the analysis phase and often ended up being an almost symbiotic relationship with very close cooperation. In order to extend the knowledge to the downstream organization (the development team), the work mode of collaboration was also introduced at the handover point between the elaboration and build phases. In these sessions, the developers and testers on the development side were walked through the complete body of analysis for a given project or module in order to ensure unambiguous and complete understanding on their side.

The second level of process rollout was to establish ownership and decision authority. In a large enterprise, this is a crucial element of process introduction. Following an ISO 9002 model, the complete analysis and design work needs to be traceable in documents or repositories. Therefore the organization relies on the various stakeholders to write up their results and relate them to existing requirements. Usually a review and release process is applied to prevent errors from occurring in the process or from being identified too late. Considering these factors, the UI Specification (owned by the UI design team) was introduced as a new mandatory artefact in the company's Quality Management System. The QMS group understood its benefit for ensuring traceability of workflow and UI requirements through the process and provided outstanding support for ensuring compliance in the organization. As a second route, review and approval authority was established. As analysis and design documents were reviewed and approved by a multitude of stakeholders, the UI designers were included as reviewers for those documents that govern their work (both project and product related). After a while their role was extended to approver (i.e. approval required for release) for the key documents utilized as baseline for the UI work (e.g. Use Cases, Project Plan, etc.). The UI team thus gained a considerable influence on the direction of the project and the respective product, moving from document contributors to reviewers to approvers. This ensured a UI focus on almost all levels of product and project planning.

It took about one year to build the trust that the new approach will actually not just fulfil all product requirements but also provide additional benefits for the users. It is fair to assume that every attempt to change a process will be regarded with a bit of scepticism. Along the way compromises have to be made and not every step can be a forward one. It's helpful to have a strategic roadmap of process components to be implemented and gradually formalize them into the organization's standard procedures.

The two strongest supporters in doing so were upper management and quality management. Upper management had to be convinced that the change is actually going to improve product quality as they had the power to establish the organizational framework (in terms of headcount, reporting structure, roles) and to communicate the changes to the affected teams. Quality management's main goal as a group is to establish repeatable and manageable processes throughout the organization. Thus a more structured process instead of a generic feature based analysis one is very likely to find their support and facilitates the implementation into the organization's standard process model.

## **SUMMARY AND OUTLOOK**

Taking all of these outcomes together, the organization has achieved a solid base for user-centered design. While continuing to evolve and optimise the UCD approach, the fundamental perception throughout the organization has changed towards seeing UI Design as an integral part of every analysis effort and the UI team as a key player in a sustainable and profitable product development process.

The main factors of this successful implementation of a user centered design process are:

- Support by upper management and quality management
- Establishing a new team, which is responsible for the usability of the product
- Organisational integration of the UI team into the Product Management division, fostering a close collaboration between UI Designers and Product Managers
- Re-definition of responsibilities and decision making authority (here: giving the UI Team authority of approval about key documents)
- Adjustment of operations including re-assignment of responsibilities between different roles, definition of dependencies between specific tasks and process steps and introduction of new artefacts as mandatory deliverables for all projects.

Although the present implementation of the usability engineering process is quite mature, there are still aspects that have to be addressed in the future. To further improve the user centered design process the interplay of the sub-processes of UI Design and downstream organisational units that have a strong relation to the user centered design process should be intensified. Among these are Application Design and Global Testing, which - for example - should be able to not just test the technical and functional requirements but also whether the product meets usability and user interface requirements.

This case study shows that the implementation of a usability engineering process mainly aims at organisational issues. The authors believe that it is necessary but not sufficient to deal with aspects on a mere operational level, e.g. what methods should be conducted or what tools should be used. The main focus has to be the organisational level. Thus, the implementation of a usability engineering process is a significant intervention and needs to be conducted systematically and with knowledge about organisational conditions and constraints. Sciences like Industrial Psychology, Economics or Organisational Sciences deliver valuable knowledge regarding job and task design and organisational change and development. However, their application area lies predominantly in the producing industries, which allows only limited translation of their insights into information transformation processes like usability engineering. Only few research studies have been conducted concerning the introduction of a usability engineering process into a software-producing organisation. In future research the influencing factors, dependent and independent variables should be further described and analysed and a systematic evaluation should be conducted. Consideration of neighbouring disciplines could facilitate the generation of appropriate organization and process models. The authors see this as an important emerging area requiring further research.

## REFERENCES

- Cooper, A. & Reimann, R. (2003). *About Face 2.0*. Indianapolis, IN: Wiley.
- Gould, J. & Lewis, C. (1985). Designing for Usability: Key Principles and What Designers Think. *Communications of the ACM* 28, no 3 (March), 360 - 411.
- IBM (1996) [http://www-3.ibm.com/ibm/easy/eou\\_ext.nsf/publish/1996](http://www-3.ibm.com/ibm/easy/eou_ext.nsf/publish/1996)
- Karat, J & Karat, C. M. (2003). The evolution of user-centered focus in the human-computer interaction field. *IBM Systems Journal*, 42, 4, 532 – 541.
- Mayhew, D.J. (1999). *The Usability Engineering Lifecycle*. San Francisco, CA: Morgan Kaufmann.
- Nielsen, J. (1993). *Usability Engineering*. Chestnut Hill, Mass: Academic Press.
- Quesenbery, W. (2001). Applying a UCD Process to Implementing a UCD Process. In: *Proceedings of the 48th Annual Conference, Society for Technical Communication*, 2001.
- Rudisill, M., Lewis, C. Polson, P. B. & McKay, T. D. (1996). *Human-computer Interface Design*. San Francisco, CA: Morgan Kaufmann.
- Shneiderman, B. (1998). *Designing the user interface*. Reading, MA: Addison-Wesley.
- Vredenburg, K., Isensee, S. & Righi, C. (2002). *User-centered design: An integrated approach*. New Jersey: Prentice Hall.
- Wiklund, M. E. (Ed.). (1994). *Usability in Practice: How Companies develop user-friendly Products*. Boston: Academic Press Professional.
- Woletz, N. & Laumann, S. (in preparation). Impact of User Centered Design Approach on the Marketing Department. Paper submitted to 11<sup>th</sup> International Conference on Human-Computer Interaction, Las Vegas, Nevada, 22. – 27. July 2005.

## ACKNOWLEDGEMENTS

The material presented in this paper is based on an R&D collaboration between University of Paderborn/C-LAB and Siemens Medical Solutions. The authors acknowledge the support through individuals in both of these organisations.

## COPYRIGHT

Natalie Woletz & Dirk Zimmermann © 2004. The authors assign to OZCHI and educational and non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to OZCHI to publish this document in full in the Conference Papers and Proceedings. Those documents may be published on the World Wide Web, CD-ROM, in printed form, and on mirror sites on the World Wide Web. Any other usage is prohibited without the express permission of the authors.