Low Cost Prototyping: Part 2, or How to Apply the Thinking-Aloud Method Efficiently

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ABSTRACT
Customer satisfaction with regard to user interfaces becomes increasingly more important and is, eventually, decisive for the selection of systems within a competitive market. End-users demand benefits and a clear increase in value. They expect efficient and optimum support in their work with their interfaces. One possible method to achieve this is User-Centered Design, which means to incorporate end-users in the interface development from scratch. Essential is the knowledge about the end-user, which in return, will lead to better insights into their thinking and behavior, consequently resulting in better user interfaces. The challenge is to combine complex back-end functionalities with a well operated, attractive, effective and efficient user interface. Thinking Aloud (THA) is one of the most valuable usability engineering methods to address this challenge. In combination with the use of paper mock-ups and appropriate tasks software engineers are able to gain insight into the thinking and behaviour of their end users. Videos taken during the THA sessions can be analyzed and the insights integrated into redesign. THA was first used by psychologists during research in problem solving.

Categories and Subject Descriptors
H.2.2 [**User Interfaces**]: *evaluation/methodology, prototyping, screen design, user-centered design.*

General Terms
Measurement, Performance, Design, Reliability, Experimentation, Human Factors.

Keywords
Thinking aloud, method, usability, cost reduction, user-centred design.

1. INTRODUCTION
Based on the paper-mock ups produced in part 1: how to produce better ideas faster by getting user reactions early and often, in this part delegates will learn how to apply the THA method to test these designs and to gain valuable insights into the thinking and behaviour of end-users.

After considering the necessary theoretical background and showing examples, the delegates will use their paper mock-ups and develop appropriate tasks to study potential end-users and to apply an appropriate experimental setting. Videos taken during the experiments will be analyzed and the results and insights discussed and integrated into the redesign of the mock-ups. This part focuses on the combination of rapid prototyping with thinking aloud studies. Beginning with the necessary theoretical psychological and engineering backgrounds, the session will increasingly engage the delegates in practical activities. The combination of psychological theory with engineering methods will provide delegates with a powerful tool for embedding user-centred thinking in their design decision-making.

2. LEARNING OUTCOMES
By the end of the tutorial delegates will be able to

- understand the theoretical psychological background of the THA method;
- apply this method together with paper-mock ups;
- gain insight into the thinking and behaviour of end-users;
- bring the results and lessons learned back at systemic level into the redesign of their mock-ups;

3. THEORETICAL BACKGROUND
From the spectrum of methods in Usability Engineering [4], one method particularly stands out due to its practical realizability: Thinking aloud (THA). This method originates from problem solving research [2], [3] and permits insight into the mental processes [8]. The test person (end user) receives a completely defined set of tasks and is asked to express, out loud, all – also fleeting – ideas and thoughts during the execution of this task. It is advantageous to record this procedure with a video camera because it is then possible to draw conclusions on the work habits from both the verbal and the facial expression and the gestures of the test person, in particular, it is possible to judge their subjective impressions and feelings. The behaviour patterns recorded on the video tape and/or the log file analyses usually make it possible to identify

where the test person has problems and how, and why, they take certain actions. Additionally, with a behaviour observation software (for example INTERACT from the company Mangold Munich, Germany), the video material can also be compared to that of other users in order to find particular behaviour patterns. According to [7], 3 to 5 end users are sufficient to obtain valid statements; however, for scientific studies, it is sometimes necessary to increase the number of test subjects [1]. The principle of breaking off the tests when no further increase in knowledge is effected, has proved satisfactory [6].

4. METHODS AND MATERIAL

The earlier in the software development that this method is applied, the better it is possible to understand the target group and to gain insight into their demands, requirements and problems.

This "understanding" of the end user is particularly valuable for software engineers, and has proved very reliable in practice [5]. Therefore, this method is ideal for use with rapid prototyping methods (e.g. user studies with the help of paper mock ups, but can be helpful in a lot of other situations, where insight into end user behaviour is essential. The method is also ideal for including the end users, with their constraints/premises and needs, into the software development process and is therefore a foundation-stone for User-Centered Development (UCD). It is important to maintain a constant operational sequence ("whatever you do, do it consistently") in order to ensure the reliability of the methods. A simple variant can look as follows:

Welcome and exact briefing

Setting the task

Execution of the task

Conclusion, review and debriefing.

After the welcome, the briefing serves to create a pleasant atmosphere for the test subjects, to give them an overview and, above all, a feeling of security. Tests with Paper Mock Ups have proved valuable in practice, in particular with older and/or partly disabled people (partially sighted etc.), because they have, per se, a certain "anxiety" connected with computers. The briefing is enormously important, because it must be clear to the test persons that they are to express EVERYTHING that goes through their brains during the task processing. Demonstrating a short video clip of a preceding investigation has proved to be helpful. It must be made clear that the articulation of intentions, feelings, thought etc. is equally as important as the task itself. At the same time, a reference to the approximate duration of the task must not be forgotten. If no suitable video is available to serve as an introduction, examples, in the form of statements, can be communicated to the test subjects, such as "… I am now considering how … " or "… I do not understand this …" or "… I have no idea what that is supposed to be …". The content of the task should not be described. This also applies during the execution of the task: The test subjects should be constantly encouraged to express themselves ("… what are you thinking of at this moment … "), and short feedbacks can be given ("… super, clearly expressed… ") but assistance with the content should be given only when the test subjects are absolutely unable to continue alone. This should then be noted in writing (with a time stamp). After the completion of the task, a small (standardized) interview can take place, in which problem areas, located during the tests, are addressed purposefully. A review and a

reference to the fact that the test subject has made an important contribution to Research & Development rounds off the test process. One of the advantages of this method, is that a wealth of information can be obtained with a relatively small number of end users, above all however, insight into the motivation of the end user and why they do things a certain way. Thus, it is possible to recognize, early on, where difficulties arise. No advantage without disadvantage: many people feel too self-conscious to really express their thoughts out loud. The expenditure and preparation time for this method are relatively high. The method is "intrusive" i.e. the method influences the test person, for example, experiments have been shown to have a positive influence on performance with problem solving [9]. Nevertheless, this method can obtain valuable knowledge for Research & Development and therefore, rightly be designated the "royal method" in Usability Engineering. It is important to implement this method as early as possible in the software development process or, to put it another way, the later that understanding of the user's behaviour is gained, the more improbable it is that these can still be integrated into the development.

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