Engaging users in the early phases of the design process: Attitudes, concerns and challenges from industrial practice

Derya Ozcelik  
Eindhoven University of Technology  
Postbus 513, 5600 MB  
Eindhoven, The Netherlands  
+31 40 247 5228  
d.ozcelik@tue.nl

Javier Quevedo-Fernandez  
Eindhoven University of Technology  
Postbus 513, 5600 MB  
Eindhoven, The Netherlands  
+31 40 247 2514  
j.quevedo.fernandez@tue.nl

Jos Thalen  
University of Twente  
Postbus 217, 7500 AE  
Enschede, The Netherlands  
+31 53 489 3192  
j.p.thalen@utwente.nl

Jacques Terken  
Eindhoven University of Technology  
Postbus 513, 5600 MB  
Eindhoven, The Netherlands  
+ 31 40 247 5254  
j.m.b.terken@tue.nl

ABSTRACT

Product design is no longer solely driven by functionality. Usability and pleasure increasingly determine the success of a product. To address these emerging consumer needs, design literature offers various tools and methods for engaging end-users in the early phases of the design process. The study presented in this paper compares the state of the art in literature to design practice, represented by four different companies. During four separate studies the authors conducted extensive interviews throughout the companies to identify various user engagement methods, related challenges and pitfalls. The methods have been categorised according to the medium through which users provide information, namely what users say, what users do and what users make.

The result of this categorisation shows that companies primarily involve users by finding out what users say, using interviews and surveys. Only few occurrences of the other two categories were found. We identified the company culture as one of the limiting factors for engaging users in the design process. Companies prefer to rely on experience rather than end-user input, or in some cases simply do not acknowledge the importance of user engagement. Another limiting factor is the lack of awareness and knowledge regarding user engagement; companies do not know when to use which method or how to integrate the generated output in their design process. External factors, such as concerns about confidentiality of the new ideas and client-company relation are other factors that hinder the engagement of users in the early phases of the design process. The paper concludes with a set of opportunities that can be addressed to improve user engagement in the early stages of the design process.

Categories and Subject Descriptors
D.2.2 Design Tools and Techniques.
H.5.2: User-centered design

General Terms  
Design

Keywords  
User Centered Design, End-user engagement, Design tools and methods.

1. INTRODUCTION

Engagement of users in the design process is getting increasingly important in today’s commercial environment. The growing pressure of the competition, the abundance of technological developments, and the shift from manufacturing tangible artefacts to providing services and meaningful experiences has led to a change in the perspective of companies. On the one hand companies want to reach good designs with less iteration in shorter times, while on the other hand the definition of ‘good design’ has become more complex. In addition to usefulness and ease of use, experiential qualities such as pleasure of use are now also playing an important role. Under such circumstances the role of the user has become more and more important and companies are becoming aware of the need to engage users in their design processes. The need to inform the design process about the expectations of the users, as early as possible, is quite vital. However, there is not yet a consensus on what user involvement means and how it should be applied.

This paper presents the results of a study that investigates the current state of user engagement in the early phases of the design processes of four different companies. The aim of the study is not only to gain understanding of user engagement in early stages of the design process, but also to identify and explain the overlaps and discrepancies with literature.
This study is part of a long term project whose aim is to enable relevant and reliable user feedback early in the design process. For such a goal, the project works on developing tools for flexible prototyping and developing guidelines for designers on applying these tools within user-designer dialogue within the design process. The present study is the very first study done within the project which aims to identify the state of the art user engagement in design practice. The project actively collaborates with four industrial partners from the Netherlands who provide context for the studies. The industrial partners were chosen due to their interest in user-centred design process. Moreover, the companies represent different application domains which contribute to generalize the outcomes of the project; the usefulness of the tools and the guidelines. The present study is carried out with these industrial partners.

The paper starts by introducing the background and the aim of the study, followed by the description of the approach. Then the findings are described, starting with the UCD (User Centred Design) related tools and methods used by the companies, and followed by the challenges that companies face when engaging users. The paper concludes with a set of opportunities for improving the end user engagement within industry.

2. BACKGROUND
According to Jordan [6] good human factors (e.g. ergonomics and usability) are no longer enough to reach good design solutions, as they are taken for granted. Good human factors do not indicate an added value anymore, whereas their absence results in disapproval. Jordan argues his point with a hierarchical model of consumer needs, inspired by Maslow’s hierarchy of needs. According to this hierarchy (see Figure 1), the bottom layer of the pyramid is the functionality, suggesting that a good design should offer an appropriate functionality. The second layer of the pyramid is the usability. Once the functional needs are satisfied, people start to look for ease of use. Pleasure is the top layer in the pyramid. Jordan argues that people always seek for added value in their choices. After the usability concerns are satisfied, emotional benefits start to play a role in decision-making.

![Figure 1. Jordan’s hierarchy of consumer needs.](Image)

Hassenzahl [5] also makes a distinction between ergonomic (task related) and hedonic (non-task related) qualities of products, and their contribution to the satisfaction of the user. He argues that the definition of usability should be expanded and hedonic concerns should also be embraced in the concept of quality of use.

These emerging concerns also lead to a shift in the concerns of the design process; it is no longer solely market-driven but becoming more and more people-centred. Sanders [11] argues that with the shifting focus towards experiential concerns, the fuzzy front end of the design process is gaining much more importance. Thus the need for informing the early design process with the needs, values and dreams of people cannot be disregarded. Empathizing with people, understanding their cultural backgrounds and values requires new perspectives and new skills.

Over the last two decades new user involvement tools and methods for the early phases of the design process have emerged [13]. These new tools and methods have been further developed by design practice. According to Wakeford [14] design consultancies such as IDEO and SonicRim have been playing the leading role in that and these approaches are also well adopted by the in-house design teams of well-known brands in different domains, such as Microsoft, Nike and BMW. However, if we look at the broader picture of the design practice within industry the involvement of users in the design process has not yet been well applied.

Sanders [10] analyses the engagement of users in the design process through the means of involvement: through what they say, through what they do and through what they make. The first group (say) refers to methods like interviews and surveys. Sanders thinks that involving users in the design process by such means provides very limited knowledge about the users. Designers can only rely on what the users say, but the users can only talk about the things that they are aware of. Involving the users through what they do refers to the situations where users get the chance to interact with product concepts and provide feedback. With this approach designers also get the information related to the use situations. In the approach of involving users through what make, users are seen as creative individuals who communicate their concerns and desires with designers through the artefacts that they make. Sanders [10] believes that this is the approach that reveals the tacit knowledge and the latent needs of the users. Inspired by the model of Sanders, Sleeswijk Visser et al. [12] illustrate the relationship between various forms of data gathering techniques and the knowledge that they reveal (see Figure 2).

In the present study Sanders’ definition of user involvement was used in order to structure the findings, as it provides a clear and coherent framework. The framework allows the identification of both the popularity of certain types of user involvement and the challenges or opportunities to these specific types. Furthermore, such identification helps in explaining why certain methods of user involvement are more frequently used.

![Figure 2. Different techniques revealing different levels of knowledge (Sleeswijk Visser et al., 2005).](Image)

3. APPROACH
The study was performed in collaboration with four companies practising in different domains. Throughout the paper the
companies are named Company A, Company B, Company C and Company D. The companies differ from each other not only in terms of product types but also in terms of target markets (consumer vs. professional), and innovation style. Table 1 lists characteristics considered relevant for this study.

<table>
<thead>
<tr>
<th>Company</th>
<th>Products</th>
<th>Market</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>Consumer Electronics</td>
<td>Consumer Products</td>
<td>Incremental &amp; Radical Innovation</td>
</tr>
<tr>
<td>Company B</td>
<td>Office Machines</td>
<td>Professional Products</td>
<td>Incremental &amp; Radical Innovation</td>
</tr>
<tr>
<td>Company C</td>
<td>Automotive</td>
<td>Professional Products</td>
<td>Incremental Innovation</td>
</tr>
<tr>
<td>Company D</td>
<td>Food processing Equipment</td>
<td>Professional Products</td>
<td>Incremental Innovation</td>
</tr>
</tbody>
</table>

Table 1. Company characteristics.

A team of three researchers visited each company for a period of two weeks. During this stay, the R&D/Design department of the companies hosted the team. The team conducted between 10 and 15 semi-structured 1-hour interviews with people from several departments (e.g. R&D, Design, Engineering, Sales and Marketing departments). The company visits were enriched with tours through facilities such as research labs, or prototype building facilities. Each visit ended with a group workshop (involving the research team and most of the interviewees) in which the findings were presented and verified. After finishing the four visits, an overall wrap-up presentation was held to present the findings and to discuss the results with representatives from the companies.

3.1 Data Analysis
The interview transcriptions have been converted into topical codes according to the coding scheme in Figure 3. This coding process was carried out and validated within the research team. A final report containing the main findings and recommendations was written for the participating companies. In this paper only the findings concerning the user involvement will be discussed.

4. FINDINGS
Prior to presenting the findings, it is important to clarify our distinction between the terms the end-user, the client and the user representative, which all play an important role in the product development process of the companies.

- A client refers to the person that makes the decisions on the purchase of the product, but not necessarily uses it.
- User representatives are the people who have a good knowledge about the users, but they are not users themselves. User representatives are very important for R&D teams since they are an invaluable source of information in the cases where end-user feedback is not possible or feasible.
- End-users, are the people who will actually use the product.

The above distinctions should be taken into account when interpreting the findings presented in section 4.1.

4.1 Tools and Methods for User Engagement
Tools and methods for user engagement that were encountered during the interviews have been classified according to the previously discussed model of Sanders; tools and methods incorporating what users say (asking), what users do (observing) and what user make (participating). The following sub sections provide a more thorough description of each group of tools and methods. In addition, Table 2 provides an overview of where these tools and methods are utilized within the early phases of the design process.

What Users Say
This category involves the methods like surveys and interviews by which users inform the design process through answering the interests of the researchers. This type of user involvement is mainly facilitated by marketing departments, where a large amount of user data is gathered. The results are regarded useful as they indicate certain trends within user population.

Surveys and Interviews: In the product planning phase companies primarily use surveys and interviews in order to gather information from the market. Not only the end-users of the products, but also the clients are the subjects of these studies. Especially in the cases of Company C and D, the perspectives and the opinions of the clients are very important, as they are the people who make the purchase decisions.

Most of this type of research is conducted by people who are not involved in the actual design/development of the final product. The research is typically carried out by Sales or Marketing Departments in the early stages of the development process. Company A is the only company in our sample that employs external agencies to do the market research. The generated knowledge is transferred to the Product Planning or R&D Departments in the form of market wishes or consumer insights. This knowledge is generally communicated through written reports, sometimes including pictures, videos or survey results.

Scenarios: The use of scenarios in the concept definition phase is a well-established practice in the case of Company A. Carroll [1]
states that scenarios are “vivid descriptions of end-user experiences about design issues” (pp. 10). As a design method, scenario building stimulates reflection, as in order to build a scenario the designer should consider various dimensions of his design. Company A benefits from scenarios in order to elicit reflections from potential end-users, regarding early design ideas and gathering further insights from the user group. In these scenarios the ideas are explained in short stories and these stories are shown to end-users accompanied by a very simple representation of the idea (see Figure 4). The users are asked to comment on the shown scenarios indicating what they like and dislike about them. Sometimes they are shown more than one scenario per idea and the users are asked to choose the best one and specify their reasons.

![Figure 4. An example scenario [2]](image)

**Focus Groups**: Focus group is a qualitative research technique that collects information from the participants through group interaction on a topic of the researcher’s interest [9]. The idea behind the focus group technique is that the interaction within the group leads to the stimulation of thoughts and ideas among the participants. The method helps to reveal dimensions that are hard to access by means of conventional information gathering techniques, such as surveys and interviews [6].

Companies A and B use focus group studies within the concept definition phase of their design process. Company A uses focus groups in order to discuss use scenarios. Design team creates a short of list of new design concepts and represents them through a use scenario (as explained above). Once the use scenarios are ready, focus groups are organized in order to get the reactions of the users on these new design ideas. In these focus groups participants are asked to reflect on the positive and negative aspects and initiate group discussions. Thanks to these focus groups the design team gets a better feeling of which concepts should be further developed and which should be abandoned. Usually user representatives (recruited from employees not directly involved in the design process) are invited to these studies as the company is concerned about the confidentiality of new design concepts.

Company B also organizes focus groups in order to gather user feedback on the concept proposals. The aim is to get a feeling whether the team is working towards the right direction or not. Most of the focus groups are organized concerning the concepts of graphical user interfaces. Low fidelity paper prototypes are used to discuss these very early concepts. Most of the time user representatives are invited to these focus groups, however, in some cases the clients are also invited to these sessions.

### 4.1.1 What Users Do

This category involves monitoring users in their related daily contexts. These activities are typically carried out by the members of the design team, such as designers or design researchers. These techniques reveal information about the behaviour of users in their use context.

**Contextual Inquiry**: Contextual Inquiry is a UCD design method to gather information about the use context by observing and talking with the user while he is actually performing in the use context. The aim is not only to understand how users perform certain tasks, but also the reason behind it. Moreover, such a study gives information about the physical circumstances and the routines within the use context. Company B conducts contextual inquiries to observe use situations, identify problems and come up with potential solutions. A designer is responsible to carry out the contextual inquiry. S/he is sent to the client’s office where s/he spends one or two days. Soon after the designer returns, a workshop is organized where other designers question her/him about the visit. The company does these workshops in a very methodological way. Each participant in the workshop is responsible for questioning an aspect of the use context, such as physical conditions, problems and routines. After the workshop, the participants write a report and the report is distributed within the company. Designers mention that these reports are not referred very often once they have been written. Designers usually prefer to be sent for a contextual inquiry study or at least take part in the follow up workshop rather than reading a report about it. They argue that they can understand much more by seeing and the reports are inadequate in transmitting the same feeling.

**Shadowing**: Shadowing is another technique which is used in order to observe the user in the related context. The difference between the contextual inquiry and the shadowing is that in the contextual inquiry the observer is quite present and interacts with the user if necessary. However, in shadowing the observer tries to be as invisible as possible and tries to observe the natural behaviours of the user without influencing it. Company A uses shadowing in order to analyze the context of interest and to come up with new product ideas.

**Probes**: Probes are among the new generation UCD methods which supports user participation by enabling the user to observe his/her experience and self-document them through given exercises. Probe studies focus on user’s personal context and perceptions. Mattelma [7] indicates that they are good at exploring new design opportunities and mentions four reasons for applying probes; namely, (1) to enrich the inspiration of the design team, (2) to get information about the users, (3) to enable a ground for users to participate in the design process, and (4) to support the dialogue between the designer and the user within the design process.

It is not so obvious that probe studies belong to the “what users do” category since with probe studies the designers have to rely on what the users “say” to them. However, within the context of investigated companies, probe studies are primarily used as diary
Companies A and B use probes to be informed about the behaviour of the user in his daily context by letting the user capture his daily life keeping a diary. When the concept reaches a mature state (e.g. a prototype is available), Company A uses probes also for the evaluation of the prototype in real life. In this case the user experiences the prototype in a realistic mock-up of the use situation and keeps a record of his/her experience with it. In general, these studies only involve the employees of the company who represent end users, since in the early phases, due to the confidentiality of early ideas, the company is not comfortable presenting their prototypes to the outside world.

Usability Testing: Company A, B and C involve users during the concept evaluation phase in order to test product prototypes concerning usability. In the early stages, these prototypes are often full size mock-ups, for product design or paper prototypes, concerning the design of graphical user interface (GUI). Company B invites end-users to their facilities and asks them to perform some tasks during the test. Company B indicates that it is not only end-users who are invited to these tests but also the clients, as they generally appreciate being involved in the design process of new products. Company C preferably involves user representatives (people from the Testing Department) to evaluate product concepts as they do not want to disclose their concepts outside the company. Company D also uses the employees from testing department in order to test the usability of the products with the same concerns.

4.1.2 What Users Make
The last category refers to cases where users are actively involved in the design process. The users are not only involved in identifying the problems but also creating the solutions. These sessions are done with a limited number of users in comparison to the surveys and interviews. The aim is to obtain in-depth information, thus details and divergences are more important than generalizations.

### Table 2. Tools and methods for user engagement in the product development process.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Say</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Do</th>
<th>A</th>
<th>B</th>
<th>C</th>
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<th>Make</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tbody>
<tr>
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<td>Interviews</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Contextual Inquiry</td>
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<td></td>
<td>Surveys</td>
<td>X</td>
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<td>X</td>
<td>Shadowing</td>
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<td></td>
<td>Probes</td>
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<td>X</td>
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<tr>
<td><strong>Concept Definition</strong></td>
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<td></td>
<td></td>
<td></td>
<td>Contextual Inquiry</td>
<td>X</td>
<td></td>
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<td></td>
<td>Generative sessions</td>
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<tr>
<td></td>
<td>Focus Groups</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>Usability Testing</td>
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Generative Sessions: Generative sessions are organized to elicit reflections of potential users on a certain issue through creative processes. In these sessions generative [11] or projective techniques are utilized, which "invite people to express ideas, thought and feelings in forms that rely less upon verbal expressions and more upon making things, creating or reacting to imagery"[8]. These sessions are good at eliciting rich, contextual information, which will inform the designer about the risks and opportunities related to the concept under development [12]. During generative sessions the participants do exercises prepared by the researcher and create artefacts in order to communicate their thoughts and ideas. Then they are asked to present these artefacts to the group. It is the presentation period that reveals the concerns and expectations of people.

Among the companies only Company B recently explored a co-design session with end users on a domain related contextual problem. However, it was rather a trial for the company, which was initiated by a few enthusiastic designers who believe in the added value of these sessions. The designers who prepared and facilitated the session indicated that it was a fruitful session, however as it was done as a trial, the problem was beyond the interests of the company. Thus the results were not directly usable by the company. Despite the enthusiasm of the designers who took part in the study, the interviews indicated that quite some designers (more than half of the team) still think that such kind of sessions would not bring much to their design process.

4.2 Challenges in Engaging Users in the Design Process
The personal interviews revealed that companies and practitioners face some challenges in engaging users in their design processes. These challenges include the company culture, the limited knowledge of tools and methods, and a group of external factors over which practitioners do not have control.

4.2.1 The Company Culture
Company culture plays an important role in the motivation of companies for engaging users in their design process. Previous failed experiences increase the scepticism and discourage new initiatives. The researchers were told the following remark very often: “In the past we designed products based completely on input and requests from end users, and they were a failure”. This
de-motivation and scepticism prevents companies to make new efforts in engaging users in their design process and experimenting more with different tools and methods.

4.2.1.1 The role of the designer
Usually there are many stakeholders involved in the design of a product, such as designers, project managers, sales responsible or business unit members. These different people have different mindsets and perspectives. Designers appeared to be keener on engaging users than people from management for instance. However, designers have a limited effect on the strategy of the product development process. As a result, in some cases, even when there is a strong belief that a certain method could bring additional value, the idea might be discarded because of a different opinion of the higher management.

4.2.1.2 Willingness to engage real end users vs. end user representatives
Companies are frequently more comfortable involving user representatives instead of the end user. Most of the time, user representatives are employees of the company who have a good knowledge of the users. They also have necessary skills for using the product, and might also be a potential user of the product. Involving end-user representatives solves some of the problems that the development team faces when involving end-users. For example they do not take the risk of disclosing ideas to outside world. Moreover, it also eases the communication. User representatives are easier to reach, and can understand the language of designers better than conventional end-users. They also express themselves better in terms of the design terminology. However, relying on the information coming from user representatives is risky. User representatives share the company’s perspective; their needs, values and expectations are influenced by their past experiences as a member of the company. They provide valuable feedback, but they might not cover the complete spectrum of issues that end users would.

The problem of experience and preconceived believed assumptions
In many cases, companies believe that they know the need of their users from experience, as they are in the business for a long period of time. Thus making effort in order to involve users in their design process would not bring added value. Companies producing professional products (e.g. Company C) seemed to be more in line with this way of thinking since they have been developing the same kind of product for the same user group for many years. Up to a certain extent their market knowledge is indeed quite high; however this attitude also brings the risk of ignoring changes in the market. Companies who produce consumer goods are more alert on this topic, since the market they are addressing changes quite fast.

Although the opinion of individuals might differ, the company culture determines the general course of action. In some cases this culture prevents companies to think more open minded, and hinders experimenting with new methods, which could potentially provide valuable input to their design process.

4.2.2 Limited knowledge on tools and methods
Although the User Centered Design philosophy is not new, it is still not clear when and how the different methods can or should be applied. Having a positive attitude towards user engagement is just a preliminary requirement for successful user engagement. However, even when companies have that attitude, they face difficulties on the way. Companies lack a methodological approach to guide them. They do not know exactly what the contributions of different methods are. Lack of that knowledge makes it hard to decide when to use which method and how to apply it.

In some cases, even when UCD tools and methods are applied, the collected information might not be used since there is not a clear understanding on how to benefit from generated knowledge. During company visits it was revealed that in some cases, user studies had been carried out but the results had never been used. An example of such a case is Company C, where they built personas of their end users but these personas were never used within the process. Thus the question is not only how can user input be effectively collected? But also why should it be collected? And more importantly, once that it has been collected, how can it be effectively used within the process?

The study also revealed that companies often perform user studies, or usability tests with end-users, in the later stages of the design process, when the product is almost ready to go into production, if not already in production. Thus the collected feedback is not really useful for the current version of the product, but for the future releases. This might be acceptable as long as the findings are not critical. However, there is considerable risk. If the findings are critical, the project timeline, budget and viability will be highly compromised, and in some cases this might even mean having to go back to the design phase. Companies pointed out that in some cases the user studies are postponed to such late phase of the project because they do not have tools to create easy and inexpensive prototypes bringing the experience or desired functionality of a product to the end user. Thus, such user evaluations cannot be done until there is an almost finished and very expensive prototype of the product. On the other hand, companies also find it very difficult to determine which kind of prototypes to use in order to inform the end users about the concepts and stimulate related feedback. It is well acknowledged that the type of feedback gathered through a low fidelity or a high fidelity artefacts (e.g. sketches, mock-ups, prototypes) are different. It is believed that high-fidelity representations form a threshold for feedback as users tend to be quite hesitant to give negative feedback. Concerning low-fidelity prototypes, designers do not trust if the user will get the concept with the right focus. Thus designers have difficulties in deciding which one to use, at what stage and to collect what kind of feedback.

4.2.3 External Factors
In addition to the factor related to the company culture and the methods and tools, a set of external factors were also found that influence the attitude of companies towards engaging users in their design process.

4.2.3.1 Concerns on Confidentiality
The issue of confidentiality is a very strong determinant whether or not to involve end-users in the early design phase of the products. Due to the competition in the market, some companies are very much concerned about the leakage of information before the product is released to the market. As large amount of money is invested on the research and development of new products; any
leakage of information could end up being a catastrophe for the project. Non-disclosure agreements and other contracts prevent some of this leakage but companies do not rely on them and do not feel secure enough to broadly let end users experience their products before they have been actually released. Companies who are more comfortable about this risk have a higher tendency to involve real end users, such as Company D. As explained above, this is one of the reasons why companies tend to invite user representatives rather and real end users.

4.2.3.2 The client is not the end user
Another frequent factor that affects end user involvement is that often the person who decides on purchase is not really the end user. Especially in the case of professional products, although client makes the purchase decision, his employees will be using the product. The situation also hinders the reliable end user feedback since in some cases the real end users are reluctant to give negative feedback about the product as they feel that their boss (the client of the product) might think that it is them who are not competent employees, instead of believing in a problem with the product itself. As a result of this, some issues that are actually discovered by the end-users are never brought back to the company that designed the product. Thus companies feel that end users are sometimes very hard to reach. They might have access to the people in charge, but not to the people who will ultimately use their products. On the other hand this dilemma of the end-user and the client means that the success of a product might be related to their ability in marketing and selling it, instead of how good or usable the product really is, which de-motivates companies to pay more importance to end user involvement.

The aforementioned issues with clients lead to a situation where companies are more open to involve their clients into the design process rather than the end-users. It is believed that clients appreciate when a company asks them to participate in their design process, whether in the form of user studies or usability tests, as they feel that their wishes are seriously taken into account. Companies believe that the attitude contributes to the company-client relation. On the other hand companies sometimes find it risky to involve clients, especially with products that are not entirely finished yet. If they show an early prototype, the client might not get the point that this is just an early prototype, and might think that the final product will have the same problems. Companies are afraid that early evaluations will affect the purchase decisions if the client gets a negative attitude towards the product due to the inferiorities of the prototype.

5. CONCLUSIONS AND OPPORTUNITIES
The main aim of our study was to obtain a deep understanding of the perception and application of UCD among various companies, and to identify the pitfalls and challenges these companies face. The design processes of four companies have been investigated extensively by means of interviews, covering as much of the company’s organisational structure as possible. The results of the study show a generally positive attitude towards UCD, as all four companies implement some form of user awareness in their design process. The majority of tools and methods encountered focus on what users say, such as interviews and market research carried out in early phases of the design process. To a lesser extent, companies look at what users do, for instance using contextual inquires or user shadowing. Compared to the first two types of user involvement, there were only few examples of real participatory design or co-design (what users make).

In section 5.2 we identified several challenges that prevent designers from really engaging users in the design process (e.g. what users do or make). The company culture sometimes forms a barrier; professional experience overrules user involvement, user representatives replace real end-users, or the contribution of UCD is simply not considered significant. A limited knowledge of UCD tools and methods also affects the success of new UCD applications; the lack of concrete tools and methodologies prevents designers from collecting, processing and communicating knowledge. Finally, we also identified various external problems and limitations, such as confidentiality concerns and the difficulty of reaching the ‘real’ end-user.

From this overview of current UCD practice and the identification of relevant challenges, the following concrete opportunities for improving the adoption of UCD among industry have been derived.

- The awareness of UCD can be improved by providing industry with examples of how they can benefit from UCD and user engagement. Such case studies can be influential examples and can have an effect on the companies’ attitudes towards user engagement. These case studies should be chosen carefully so that they are not so far from companies’ interests and capabilities so that they can imagine how such a case would work for their company and how they could benefit from it.
- Companies need concrete yet flexible guidelines, frameworks and methodologies to decide when, how and why UCD would bring added value. These methodologies should be simple, understandable and easy to implement.
- Tools that give practitioners the ability to quickly and inexpensively bring aspects of the functionality, the use context and/or experience of a product to end-users especially at the early phases of the design process would be very much appreciated by the companies.
- In design process designers do not only need to be in dialogue with users but also with other stakeholders. Thus UCD tools and methods should not only facilitate dialogues between designers and end-users, but also support designers in communicating the generated output to other stakeholders or designers.

6. ACKNOWLEDGMENTS
The authors gratefully acknowledge the support of the Innovation-Oriented Research Program ‘Integral Product Creation and Realization (IOP IPCR)’ of the Netherlands Ministry of Economic Affairs, Agriculture and Innovation.

7. REFERENCES

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