

From remembering to envisioning product use: an informal design technique

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Abstract: To be able to get insight in potential use experiences of design proposals, designers would ideally have continuous access to a diverse group of end-users who could give feedback. Since in practice this is not possible designers often have to rely on other sources to be able to reflect on the use issues of their design proposals. Previous research has shown that designers often apply informal techniques to reflect on use issues, in which personal knowledge and experience of previous projects serve as a frame of reference.. However, this knowledge often remains implicit. In this study we explore a technique in which members of a design team make all personal knowledge and assumptions about use in a certain product domain explicit. In this technique we distinguish remembering, imagining, experiencing and envisioning use. The information that is gathered in this way is captured in a matrix which structures use situation aspects and corresponding use issues. These issues concern user experience, usability as well as performance. In three workshops with different designers we explored the benefits and limitations of such a technique. Particularly iterating between remembering, imagining and experiencing worked very well to evoke experiences of the designers.

Key words: *user experience, usability, informal design activities, evaluation of use*

1. Introduction

The success of a product depends to a large extent on how people experience its use. Therefore designers need insight in the consequences of their design decisions with regard to potential user experiences. To anticipate use in the design process, human factors research has advocated for years now to apply user testing (e.g.[1-2]). However, our recent studies have shown that, in addition to formal user testing, in practice designers also apply more informal types of user testing such as testing with colleagues, family or themselves [3-4]. With this informal testing the designer is closer to the testing process. However, this incurs the risk that the testing is not sufficiently contextualized. The importance of this contextualizing is discussed by for example Green and Jordan [5] who state that designers should have insight in use situations to be able to design products that are pleasurable to use whatever the circumstances. For valid testing of use the test conditions should reflect the expected use situations the product will meet as much as possible. To achieve this a designer needs insight in both the use situations a product will meet and corresponding use issues [4]. For example, when designing a mobile phone, designers need on the one hand to know the circumstances of use, for instance about weather

conditions. On the other hand they need to know what these circumstances mean for the use of the product, for example whether the screen is readable in bright sunlight, whether the buttons are controllable with gloves on when it is freezing and whether it does not feel slippery when you have sweaty hands from the heat. Personal experience and experience of previous projects help designers in constructing a frame of reference for informal testing. However, this knowledge often remains implicit and is not communicated between design team members. This study shows the development of a technique that supports ‘contextualizing’ informal user testing by gathering as much information (and potential gaps) about use in an early design phase. It takes the form of a workshop in which this information is gathered from project team members and in which a frame of reference is created to take into the design process.

1.1 A technique for reflection on use

Designers apply different means of informal use testing. To stimulate these informal ways of testing we developed a workshop which combines story-telling, role-playing and scenario-building to create a frame of reference for designing. The technique combines stories that capture actual experiences of design team members with scenarios that show assumptions about use. Using stories and scenarios can help designers to switch from a technical view to an experiential view on their product. A story recalls an event that actually happened to a specified person, and includes how that person experienced that event. A scenario, on the other hand, creates an event that might happen to a specified, possibly imaginary person, and speculates how that person might experience that event.

1.2 A frame of reference of use

When evaluating use the focus should not only be on how to evaluate but also on what to evaluate. When considering use we can distinguish user experience and usability. ISO 9241 defines usability as the extent to which a specified user can achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. Law, Roto, Hassenzahl, Vermeeren and Kort [6] review definitions of the term user experience and conclude that the proposed ISO definition, “*A person's perceptions and responses that result from the use or anticipated use of a product, system or service,*” is broadly supported by the user experience research community. Desmet and Hekkert [7] argue that usability is not a part of a user's experience with a product since usability is not an affective experience. Rather than being an experience itself they consider usability to be a source of a user's product experience. Although it remains debated whether satisfaction is not an affective experience, we adopt this distinction between user experience and usability.

Since both user experience and usability are an outcome of a product-user relation and not just of product characteristics, a more valuable evaluation of use can be achieved by relating the use issues to a specific use situation [4]. Because use situation aspects do not change with a design (use issues do), a structured overview of potential use situation aspects can serve as a frame of reference of use for the design process. We developed a ‘matrix of product use’ to achieve this goal. Using the matrix can enable designers to discover where the critical use issues in a story or scenario are located, while at the same time showing the issues’ context and origin.

2. Method and results

Like designing products the development of a design technique requires an iterative approach. In three workshops with different participants we developed the technique. Because all participants had different backgrounds we chose a topic that would be familiar to many professionals: the design of a wireless presentation microphone. The results and conclusions of each workshop lead to an adjustment of the technique and a new set up for the subsequent workshop.

2.1. Workshop 1

The first workshop was held at a company that develops office equipment for ten participants from the team of designers and usability specialists. The researcher held a one-hour preliminary version of the workshop.

Set up workshop 1

The workshop had a simple set-up which sought to demonstrate the difference between experienced use and imagined use. That is why a distinction between story and scenario was adopted, following Erickson [8]. First a story was prepared about a recent experience of using a presentation microphone, and use issues were to be collected that occurred in the story. Then a scenario was situated in the present by acting it out. Again, use issues were to be collected. The aim was to compare whether different issues would arise in each case. Having collected the issues, participants were asked to make a redesign in a short time and in three teams using tinkering materials, and then present the redesign by acting out a scenario.

Results workshop 1

First, the researcher told a story about a recent experience of using the microphone. The participants then brainstormed about use issues which the researcher collected in a simple list on a whiteboard. Participants also recalled and contributed issues from their own experience. Issues mentioned included freedom to walk around, uncertainty whether the microphone is on and at the right volume, and difficulties of attaching it to a dress. The researcher then presented an experience scenario: the researcher acted out the scenario using a mock-up of a presentation microphone. The scenario-play incorporated actual experiences with a real presentation microphone. The participants observed this action and then brainstormed on use issues again. When the researcher asked the participants to consider product characteristics that might play a role, they enquired what the researcher meant by this. In response, the researcher drew a simple matrix on the whiteboard showing aspects that might play a role in an interaction: characteristics of people and of products, and actions of people and of products (figure 1). In this second brainstorm, the issues mentioned now became more specific to the product. For example, uncertainty whether the headset is properly attached to the head, undesirable interference with hairstyle, and difficulties with the mute button. Some issues related to user experience, such as unwanted exposure of clothing parts. The participants found it easy to produce a redesign in a short time. They then acted out a scenario with it, though this sometimes turned into explaining their redesign.

Conclusions workshop 1

The participants commented that working with stories worked well for them. The first story made participants associate their own memories and in this way elicited new stories. The participants also said that the acting out

provided insights one might not have when just imagining what a persona would do. The participants discussed how they could combine these techniques with the process they are now using. They commented that the designing part did not have added value for them. The matrix had been a spontaneous clarification tool here and this could be developed further.

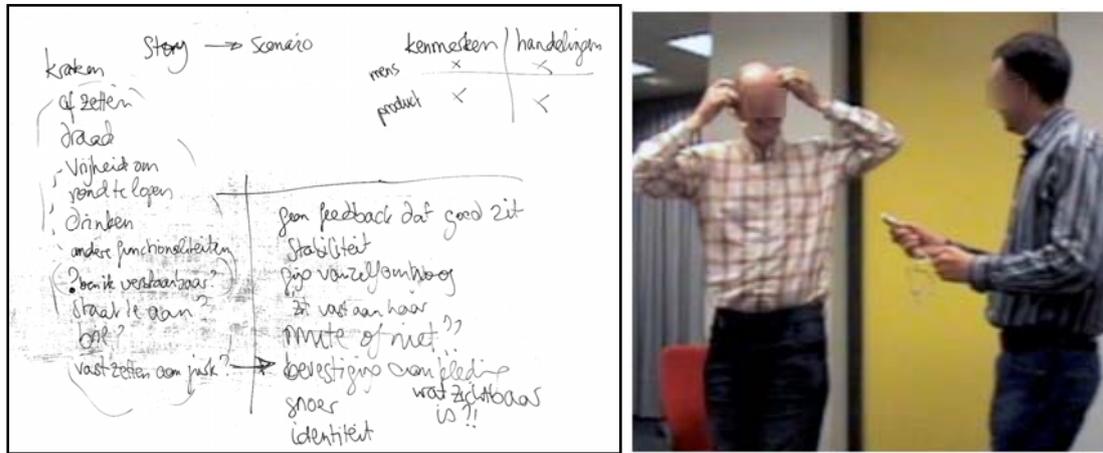


Figure 1: *Left*, whiteboard with the first lists of use issues, left, from the stories, right from the scenario-play. Top right corner of whiteboard: an initial matrix. *Right*: two participants playing a scenario with a rough model.

2.2. Workshop 2

The second workshop was executed at the Design for Usability symposium at Delft University of technology[9]. Thirteen experienced professionals from ergonomics, software design, appliance design and design education participated in the workshop which lasted 2,5 hours.

Set up workshop 2

In the second workshop we extended the story technique with a technique that stimulates imagining potential use situations. Furthermore we explored the added value of adding a role-play with an existing product to the workshop, expecting that this might allow for observation of more veridical use issues. We gave the workshop a more explicit structure which includes the following steps: remembering use, imagining use, experiencing use and envisioning use. Remembering use gathers previous personal experience and observational data. Imagining use gathers assumptions about use and use situations. Experiencing use is about having designers role-play with either existing products or early prototypes. Envisioning use considers creating new ways of use with a new solution.

The matrix of product use was adjusted as well. While the first version was not yet structured, mainly a list plus an illustration of aspects that might give rise to use issues, this version of the matrix was more structured and explicitly charted the relationships between product parts and use situation characteristics by connecting each with specific use issues or problems. The use situation was presented as dynamic, charting the different use phases of the product. This is illustrated by the workshop results below. Issues were written on post-its to allow for adjustments during the creation of the workshop. For each information source we used different colored post-its to be able to trace back the origin of each issue.

Results workshop 2

In a plenary session stories about the use of existing presentation microphones were gathered. These came not only from the personal experience of the participants but also from watching the presenters in the morning sessions of the DfU symposium. Examples were that people with long hair struggled to put on the headset, and that there were difficulties in finding and using the tiny mute button in a dark environment. The top row of the matrix (figure 2) was filled with aspects of these use situations, which were also categorized by use phase. For instance the aspect 'hairstyle' was assigned to the phase 'attaching'. The corresponding product part, for example the headset, was written in the left column. The use issue itself was written on a blue post-it and positioned there where the product characteristic and the use situation characteristic intersected in the matrix.

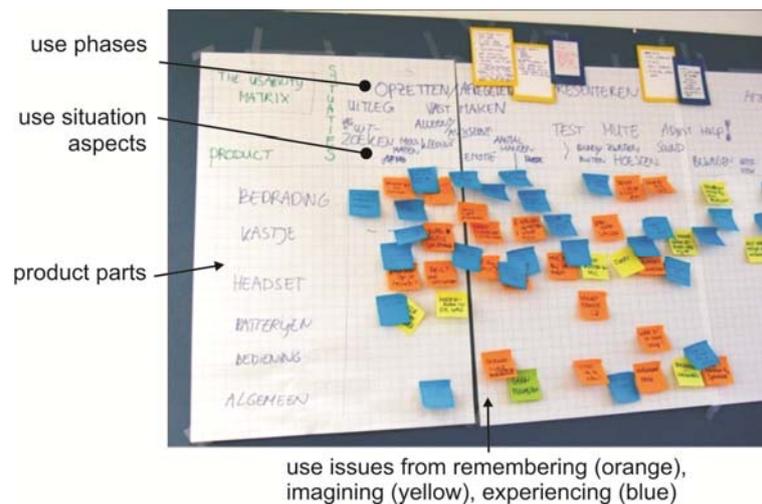


Figure 2: The matrix of product use of the second workshop

Secondly more use issues were gathered by imagining use scenarios. Pictures of different users and presentation contexts (figure 3) were handed to the participants for inspiration. They brainstormed on other use problems or issues than the ones already gathered by means of the stories. These issues were then put in the matrix in the same way as the memories, but using yellow post-its to make the difference between memories and imagination explicit.

Thirdly participants could experience the use of an actual presentation microphone in a role-play. The participants were handed presentation texts and asked to choose a role-play character and a context of use. Then one participant played the character in a simply simulated environment. The other participants observed the use issues that surfaced during the role-play. These issues were gathered in the matrix of product use by means of orange post-its.

Finally the participants developed new ideas for presentation microphones in small groups using tinkering materials (figure 3). During the tinkering participants were asked to envision the use that would result from the new design. As a final step each group presented their best idea to the other participants.

Conclusions workshop 2

The remembering, imagining and experiencing phases gave quick insight into use issues that play a role in the design of a presentation microphone. However, some participants questioned the value of the envisioning phase because they did not have enough knowledge about potential technical possibilities and limitations.

The total matrix of product use, when filled, turned out to be rather complex. Ways to structure the matrix visually need to be developed further. Some issues that emerged could not be connected to a specific use situation aspect. For example the issue ‘the device gives bad feedback’ is not related to a specific use situation. There should be space in the matrix to capture these ‘independent use issues’. A perceived benefit of the matrix was its overview of all the experiences, observations and ideas that are present in the minds of a design team. Moreover the matrix can make the gaps perceivable that exist in the designers’ thinking about the use sequences of a product. One participant remarked that often you only focus on a few things. The matrix gives an overview of all the issues, alerts you to the gaps, and facilitates decisions on what issues need to be addressed.



Figure 3: *left*: examples of inspiration cards (yellow are context cards, while blue cards consider users) and *right*: participants making quick designs using tinkering materials

2.3. Workshop 3

The third workshop was executed in an academic setting with three colleagues who had one to ten years experience in product design practice. This workshop took 2 hours.

Set up workshop 3

Compared to the second workshop the technique was adjusted as follows: since the top row of the matrix of product use which contained the use situation characteristics got very full and a little messy we added more structure to it (see figure 4). Firstly we added another row which distinguishes use situation variables and instances. Variables consider categories of use situation aspects while instances are variations in this category. For example a variable could be ‘clothing’ and instances of this variable could be ‘a dress’ or ‘a shirt’. Secondly the use phases were divided over different flip-over slides to make sure there would be enough space for all issues. The product column of the matrix of product use would contain different concepts instead of just product parts of a specific product type to explore if more issues would arise when not referring to only one product type. Two different types of presentation microphones (one real product, one mock-up) were available during the workshop.

Since in the previous workshop the envisioning phase was of limited value due to the lack of knowledge on technical constraints this step was not executed in this workshop. Instead, participants were explicitly asked to filter the most relevant issues from the matrix to see which issues they would use as input to design. In the second workshop one of the researchers acted as facilitator and filled the matrix of product use in the remembering and imagining phase. In this workshop participants were asked to fill the matrix themselves to test if they understood the structure.

	Use phase	Use phase
	Use situation variables	
	Use situation instances	
Product types or concepts	Use issues	

Figure 4: template of the matrix of product use of workshop 3

Results workshop 3

Compared to the second workshop it took more time to execute the remembering phase. This was caused by the fact that the participants had to fill the matrix themselves. It took them a while to learn the structure but after some feedback of the researcher they managed well. The resulting issues were comparable to the ones of the second workshop, although other issues were derived with regard to the second type of presentation microphone that was available, which was not a headset microphone but a clip-on microphone. Figure 5 shows how the participants are viewing the inspiration cards to imagine use.

Working with the variables and instances worked rather well. The instances were inspired by either a specific use situation or an inspiration card. The variables were derived from these instances. An example of the results is shown in figure 6. Prioritizing turned out to be quite difficult. Participants were asked to put green stickers on the issues that were relevant. But since they considered them all as relevant this had no added value.



Figure 5: participants of the third workshop take a look at the inspiration cards during imagining

Conclusions workshop 3

The main goal of the workshop, gathering available knowledge from design team members and constructing a frame of reference, was achieved. Moreover, participants indicated that the workshop made them more aware of the diversity of use situations a design will meet and of the accompanying consequences. Particularly involving multiple people allows for interaction and more associations. However, a number of issues could be improved which are described below.

The structuring of the matrix took the participants some time to learn. They indicated that at the start they thought it was quite complicated. They were more focused on how to fit issues in the structure than with actual remembering or imagining. They indicated that the product feature post-its did not give much added value because the product features were already clear from the descriptions of the issues (for example ‘battery capacity too low’ obviously relates to the battery). When they understood the structure of the matrix, they did find that the division in use situation aspects and use issues allowed for associating for, and evoking to other situations and issues. Finally the participants indicated that it was good to add structure, but that it would be a pity if it would interrupt the brainstorm. These comments show that we need to balance between providing structure and giving the freedom to associate and evoke experiences. Structuring elements that are irrelevant could be removed from the matrix. This includes the post-its that show the product type or part. However, clustering the issues at the end of the workshop with regard to product characteristics (instead of product parts) might be an interesting way to show the product-use relations in the matrix. Since only one independent issue was found in this workshop it might be an idea to only add a column with independent issues when they come up.

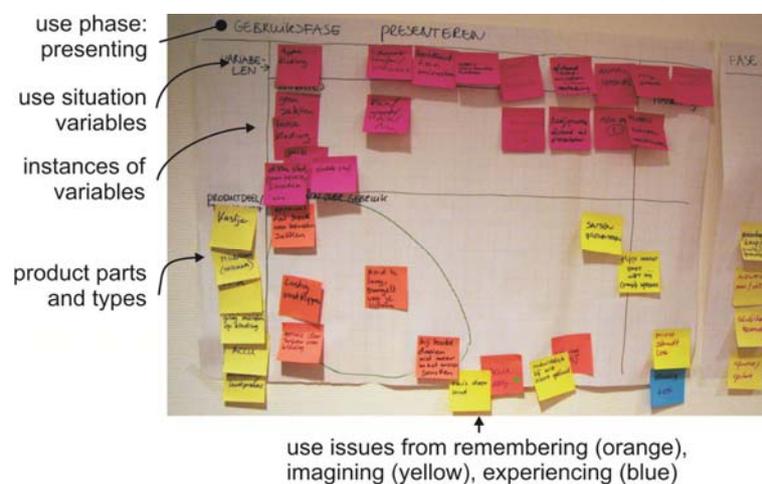


Figure 6: the filled matrix of product use for the presenting phase

With regard to prioritizing, participants suggested clustering certain issues to form groups that might give input to more abstract requirements. However they would keep the more detailed situation aspects to prevent losing the grounds of the requirements. For example ‘should fit your outfit’ includes ‘possibility to use it with a dress’, ‘preventing pulling down your trousers’ and ‘preventing showing your underwear when detaching’. They did indicate that some use situation aspects might be left out of the target design domain. For example the issue ‘the wind causes noise in the microphone’ relates to an outside use situation. They might have chosen not to include that in their design. Concluding, the prioritizing of the results needs to be executed in another way. Other means to translate the results of the workshop into a more workable frame of reference for the subsequent design process need to be explored.

In this workshop participants reasoned from a personal point of view. They suggested that it might be interesting to involve other stakeholders. For example in this case organizations that purchase this kind of presentation microphone or people that do maintenance.

As opposed to the preceding workshops there were two product types available instead of one. This resulted in other types of use issues. The question is to which extent the available product types steer the outcome of the brainstorm. In the remembering phase participants also mentioned issues that were related to a third type of

product type, so they were not completely fixed on the available products. However, particularly with experiencing use, you need some kind of product representation. Consequently the issues that arise there will relate to that specific product type. What kind of ‘reference products’ to use in the workshop should be explored further.

3. Discussion

Associating between information gathering techniques

What worked remarkably well in all the workshops was going back and forth between use situation aspects and use issues. We made this increasingly explicit after each iteration of the workshop. These relations between use issues and situation aspects and the different information sources are shown in figure 7. In the remembering phase the stories of the participants usually start with a certain experience, a certain issue of use. From these use issues they reason back to the use situation aspects that played a role in this experience. Subsequently in the imagining phase, both the assembled use situation aspects and the inspiration cards support participants in associating to scenario’s (possible use situations) that would result in corresponding use issues. Likewise, experiencing results in stories that lead to use situation aspects, and envisioning is based on use situation aspects (combined in scenario’s) that lead to use issues. In this way associating between the different sources supports revealing the issues. Moreover retrieving the stories was not restricted to the remembering phase. Both the inspiration cards and the role-play triggered new memories. While each perspective on use stimulated participants to come up with stories and scenarios, the combination of perspectives was a particularly strong stimulant to really question and investigate use.

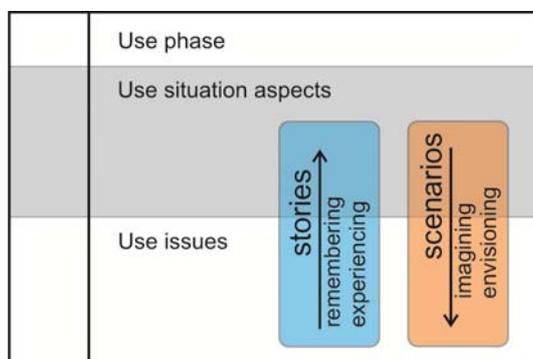


Figure 7: in stories participants reason from use issues to use situation aspects, in scenario’s they reason the other way around

In the beginning of the second and third workshop the structure of the matrix forced participants to focus on individual use situation aspects as opposed to more holistic scenarios. In the experiencing phase we added these kinds of scenarios to the matrix– which could be considered as combinations of use situation aspects - to represent a certain use situation. This combination of one dimensional and holistic use situation descriptions allows both a top down and bottom up approach.

Types of issues

The types of issues that were found in the different workshops all related to the use of products, but considered different product-user relations. As described in the introduction we can distinguish user experience issues and

usability issues. Moreover in the workshops we also found issues that could be defined as functionality or performance issues. Below we show some examples of the different types of issues.

User experience issues:

- I do not want people to see my underwear when I take off the mic
- I do not like the idea that the mic might be stained by the sweat/bodily fluids of other people
- I feel stupid when the mic is not working without me knowing it
- The battery unit is ugly, it does not fit my outfit

Usability issues:

- The headset is stuck in my hair
- Breathing directly into the microphone causes noise
- The headset wobbles on my head
- I cannot find the mute button quickly

Performance issues:

- The battery capacity is too low for a complete lecture
- The microphone causes crackling

Since the workshop technique stimulates exploring all aspects of use it is not desirable to have participants focus on just one type of product-user relation, for example usability. Moreover, many product characteristics relate to different issues. For example the size and shape of the battery have influence on the extent to which it fits your outfit, the comfort of carrying it around and the possibilities for battery capacity. However, clustering the issues with regard to the different types of product-user relations might make the matrix more appropriate as a tool to use in other parts of the design process (see also next section).

Although not explicitly asked, all gathered issues were issues that either concerned or would evoke negative emotions. Consequently envisioning new user experience will probably be aimed at removing those negative emotions instead of searching for product-user relations that would evoke positive emotions.

Value of the matrix of product use

The idea of the matrix of product use was to develop it into a frame of reference of use that can be applied throughout the design process. Several structured frames of references have been developed. For example Lim and Sato [10] propose a Design Information Framework which structures multiple aspects of use situations and Beyer and Holzblatt [11] developed five types of consolidated work models which show the common structure in the work different people do. While these formal frames of reference of use situations are aimed at giving a complete and structured overview of use, our matrix concerns a more informal frame of reference which supports informal reflection. Further research will explore if it is possible to apply our informal frame of reference to formal user testing which includes more test persons and better representations of the user and context. For example in user testing the use situation aspects can help to define the test conditions. Furthermore insight that is gathered during the design process from user analysis or field observations should be used to further complete the matrix.

Apart from completing the matrix of product use we should also reflect on the relevancy of the found issues and aspects. These depend to a large extent on the type of solution as was shown by the dependence of issues on

available products in the workshop. In this way the frame of reference evolves with the design. E.g. one participant of the third workshop indicated that if you would design a solution that you can glue directly to the skin of your cheek, you should think about use situation aspects like if the user is shaven or not.

Applying the matrix in design activities

In the workshops we received the feedback from designers that the technique needs to be applicable to the design process that they are already using. An often-described aspect of individual designers' process is that they tend to start from one or only a few guiding concepts (see for example the work of Visser [12] p194). The authors find some support for this notion in their own experience and informal observations. It needs to be investigated further how the matrix and perspectives technique presented here can fit with such preferences of designers in their daily work. In the third workshop the attempt was made to let the designers prioritize which problems they wanted to work on. To the designers such a choice did not make sense: they had identified all the problems by applying the perspectives to use, so they were all relevant and none could be dropped. For practical application, then, the matrix and perspectives technique should be extended with a means for designers to focus on separate, smaller parts of the overall matrix at different moments, thus preventing overload while at the same time retaining the acknowledgement that all problems are important.

Application domain

In the workshops only designers were involved. This can be considered sufficient as input for design projects in which it is easy to empathize with the end-user because the designer can be considered as an end-user him or herself or the designer has experiences that are similar. In later design stages testing with real end-users can then be used to confirm these results. In other cases the initial creation of the frame of reference can benefit from involvement of other stake-holders like end-users, experts, clients etc. The advantage of expert knowledge with regard to information from end-users is that experts have a broader view on potential use situations and use. Moreover the case considered a product that has been on the market for years. Consequently designers can learn from the use issues of these preceding or competitor products. In practice most projects concern these types of 'redesign' cases. Because we start from available knowledge in the workshop, the technique seems not applicable to very new types of products of which not much is known with regard to possible use situations and issues.

4. Conclusions

The paper showed the iterative development of a technique to gather use knowledge of design team members and translate it in a basis for a frame of reference of use. This technique stimulates and contextualizes informal evaluation of use. Particularly iterating between remembering, imagining and experiencing worked very well to evoke experiences of the designers. Further research includes better integration with solution generation, exploring the gathering of more positive emotions and exploring the value of the frame of reference in formal user testing.

The iterations in the workshop development were driven by designers' feedback on their experience of the workshops and by our observations of the usefulness of the workshops. For example, in the first and second workshop, a re-design exercise was included. While this was easy and enjoyable for the designers to do, they did not find it useful in getting to the bottom of use issues. In the third workshop, the complex set of concepts to be

dealt with was difficult for the designers to grasp and use, but appreciated for its comprehensive capture of the use situation and its issues.

The matrix and perspectives technique is not yet fully viable for use in a real design situation. However, to bring it closer to this aim, further research should be conducted in connection with real design situations. This will generate issues that cannot be fully anticipated using the comparatively informal simulations we have conducted so far. The design practitioners who participated in our workshops so far brought their expertise on their own life and practice to the workshops. Yet just as a simulated user test cannot replace a real user test in context, our technique needs to be tested in context.

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