Exploration of facilitation, materials and group composition in participatory design sessions

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ABSTRACT

Motivation – To investigate how facilitation, material and group composition influence creativity in and outcomes of participatory design sessions.

Research approach – Several participatory design workshops were held with end-users and designers. Different materials were used to trigger creativity. Analysis of effects of group facilitation, material and composition was based on observational notes, prototypes and interview data.

Findings/Design – (1) Specific allocation of time for breaks and questions are useful. Examples or prototypes tied into the explanation of the domain and design challenge support the participants' understanding. (2) Paper prototypes are useful for non-designers to trigger creativity and allow for interaction between the group members while creating new prototypes. (3) Groups should be composed to contain a domain expert, designer and end-users as well as someone taking the role of a moderator leading the group work.

Research limitations/Implications – We did not follow a strictly conditional experiment set-up with our sessions. For an in-depth and systematic analysis of influencing factors a rigid set-up is advised.

Originality/Value – The research makes a contribution to an investigation of factors influencing the process and outcome of participatory design sessions.

Take away message – To allow for creativity and collaboration, participatory design sessions need to be set-up with care. Summarizing, groups should be composed of end-users, designers, domain experts and have a designated moderator. Prototypes are useful in the briefing, and should be provided to each group as paper versions to be used in the creative process. The researcher has the crucial task of facilitating the session, allowing enough time for questions and breaks and adapt explanations to the knowledge of the participants.

Keywords
Participatory design, design methods, creativity, material.

INTRODUCTION

With technology becoming more complex and weaved into every aspect of our lives, design of new computer systems and foreseeing their impact has become a challenging task. Unlike early computer systems acting as expert systems and tools to accomplish work tasks efficiently, systems today are used by a wide variety of people– not only experts in a domain– and in many circumstances –not merely confined to a known workspace. Given the unpredictable use, characteristics and needs of end-users, it is difficult for designers to anticipate system requirements. Therefore, we believe, today's technology design is in need of end-user (and other stakeholder) involvement more than ever.

HCI methodologies aim at accounting for user needs with useful and enjoyable products. User-centred design (UCD), a term coined by Don Norman (1988), describes design processes in which end-users have an influence on the design outcome. While UCD offers diverse ways to involve users as informants or testers, cooperative or participatory design (PD) (Kensing & Blomberg, 1998) and co-design (Sanders & Westerlund, 2011) focus on making users even design partners. Since the early days of PD many methods have been developed for engagement of end-users and other stakeholders in the design process. While these are useful, one of the remaining challenges in involving end-users in design activities is that people often feel that they have insufficient knowledge or are not creative (Sanders & Westerlund, 2011). Indeed, many end-users may lack domain knowledge or design skills. Therefore, empowering people who are not experienced in technology or design to engage in creative processes is the focus of PD work and encouraging participation in design exercises remains an acknowledged problem in PD (Kensing & Blomberg, 1998).

In our work on building negotiation support systems, we continuously involve stakeholders in the design process. Besides the practical aspects of 'doing' UCD, we investigate how to conduct participatory design sessions including promoting engagement between researchers and end-users and creative outputs.

In particular, our overall research question is: "How can we support participants in PD sessions to empower them and foster creativity?" In specific, we investigate the following: (1) What role does the facilitator need to fulfil in order to engage and guide participants? (2) What materials support the creative (inter-)action of the participants? (3) How should the groups be composed in order to allow for engagement of all participants?

In this paper we present a case study of a series of PD sessions to develop a user interface for a negotiation support system. In the remainder we present more detailed background on UCD and PD. Next, we present our design challenge, followed by the set-up of the four design sessions we conducted. Last, we present our data analysis and recommendations for PD sessions.

BACKGROUND

Approaches to user-centeredness and participation

UCD approaches (Abras et al., 2004) commonly use stakeholders as informants and testers, e.g. to elicit domain knowledge and needs through interviews or observation and in usability tests. This engagement is one-directional and emphasizes the role of the designer as the sole creator of the technology that, although tested, is imposed on the user in its final form. To design human-centered systems through dialogic and creative engagement we have to turn to cooperative methods, e.g. offered by PD. Due to its historical scope PD has led mainly to methods that engage in envisioning futures, e.g. (Kensing & Madsen, 1991), involving changes in the social, technological and political environment in which they are situated. However, more recently PD has become attractive to the design of single systems as well based on the general belief that "active user involvement in the software development process leads to more useful and usable software products" (O'Neill, 2000). Co-design (Sanders & Westerlund, 2011) focuses less on the work domain and more on services and products in general. This creativity-based approach to engaging stakeholders introduces the notion of co-design spaces. This notion is three-fold referring to the physical design space a team works in, the space constituted by participant activities and the future solutions being developed. Our work focuses on the second, i.e. creative participant activities.

Aspects of participation in cooperative design

User empowerment

As PD arose from a movement towards emancipation of workers in Scandinavia during the labor union movement of the 1970s, user empowerment became the central theme in PD. However, empowerment is enunciated in current PD research in diverse ways, including, among others, empowering specific user groups, enabling direct democracy on social and political matters and strengthening the users' position in design processes (Ertner et al., 2010). Other enunciations are targeted at the role of the researcher/facilitator (see next subsection). Our work focuses on the position of the user in the design process.

Roles in cooperative design

With a shift from UCD to PD or co-design the roles of researchers, users and designers have shifted, too (Sanders and Stappers, 2008). The user who had the passive role of being studied or interviewed in UCD has become a co-designer and the researcher has become a facilitator, providing guidance and tools to the user to make her a co-designer. Although users become co-designers, professional designers are still needed to provide their expert design knowledge. The researcher and designer could be the same person.

Despite PD's democratic focus unequal roles of users and designers in PD processes occur. According to Ertner and colleagues' (2010), "the PD researcher's practice is guided by unconscious assumptions and socially specific knowledge, which become reproduced and embedded in methods, categories and interpretations. By this the practitioner poses a risk of dominating the users, if they neglect to focus explicitly on deconstructing the tacit aspects of their own practice." Due to this risk the role of the facilitator should be given special focus when setting up cooperative design sessions.

Creativity triggers

Co-design was defined by Sanders and Stappers (2008) as "the creativity of designers and people not trained in design working together in the design development process." Creativity in turn has been defined in many ways. The same authors explicate four levels of creativity, i.e. creating, making, adapting and doing. While all people are involved in some creative acts in their lives at some point becoming co-designers requires a high level of passion and knowledge in a certain domain. Sanders and Westerlund (2011) have pointed out that "it can be difficult to get people to create ideas when they feel that they have insufficient knowledge and […] people who are brought into co-designing experiences may feel that they are not creative." They suggest harnessing people's creativity with ambiguous visual artifacts. For an organization of other triggers see (Sanders et al., 2010). Examples are prototypes ranging in fidelity from sketchy paper versions to fully functional systems or scenarios used to outline specific use cases or reflect on the effects of the system on different stakeholders (Nathan et al., 2007). Marois and colleagues (2010) compared an introductory game, interactive illustrations (semi-functional prototypes) and storyboards (with static screenshots) as starting points for design activities with stakeholders. Storyboards made participants grasp the topic and supported creativity. Interactive illustrations engaged participants more, but were also more biasing. Artifacts are not only important creativity triggers for single participants, but serve as boundary objects supporting communication between participants with different backgrounds.

DESIGN PROBLEM

In the following sections we will elaborate on our design work consisting of several creative participatory

design sessions, which we will subsequently analyse according to aspects of participation described above.

Our context for developing an interactive user interface, was the negotiation domain. Negotiation is conferring with others in order to come to terms on the transfer of goods or services to be provided. Although it can be considered an essential skill, many people are not effective in negotiation (Thompson, 2005). That is why effort is committed to building software that would support people in negotiation (Kersten, 2004). A system's ability to support the end users is limited by its ability of understanding exactly what users want. This is, however, difficult. For example, if we assume that a person wants to buy a new car. Given that the person is interested in safety, it would be positive to have airbags in the car. In this example two concepts are shown. *Interests*, i.e. the underlying reasons to why a person has a preference for an *issue,* something one can negotiate on. In the example "safety" is the interest, "having airbags" is the issue and "yes" is the preference. As indicated by interest-based negotiation (Fisher et al., 2011), a negotiator should focus on the interests to reach a satisfying outcome with the other party. Unfortunately, existing negotiation support systems do not support interest-based negotiation. To allow this support, we work towards designing an interface to enable users to link their personal interests to domain-specific issues. These links can vary in strength and should be modifiable by the users.

PARTICIPATORY DESIGN SESSIONS
In the following, we describe the four PD sessions we conducted to investigate our research questions. First, we define the general set-up used in the consequent user sessions and then describe the details of the alterations. The alterations (see table 1) were aimed to (1) explore the role of the facilitator, (2) test suitable material for supporting creativity within the group and (3) investigate group composition. In total we held four sessions A, B, C and D. The sessions had four groups of four, two groups of two, two groups of two and two groups of six people respectively.

General set-up
Each session was set-up for two hours. The initial briefing was followed by a divergent and a convergent process. Breaks were included to allow people to recover from fatigue. The sessions ended with groups presenting their prototype. In three cases evaluations were done at the end of the sessions. In the following we explain each step in more detail.

Briefing
This step took 15 minutes and served multiple purposes. The participants were introduced to the design problem. They were informed on the purpose of the participatory session and what would be done later with their work. Since creativity is a hard concept to "force" into existence the briefing is also intended to set the participants at ease and engage them with a problem they can relate to.

Divergent process
Once the participants were adequately familiarized with the problem domain they were encouraged to first explore and create different solutions for 30 minutes.

Session	Facilitation		Materials	Group Composition	
	Briefing	**Evaluation**	**Extra Materials**	**Background**	**Interpersonal relationships**
A	Sef made domain	None	Simple prototype	Mixed	None
B	Sef made domain	Internal	None	Non-Designers	Allowed
C	Facilitator made domain	Internal	None	Designers	None
D	Facilitator made domain	Facilitator and participants	Elaborate prototype, interface elements	Expert Designer End Users	Allowed

Table 1: Overview of alterations in the sessions

To trigger creativity, participants were provided with colouring pens, scissors, paper in various sizes, post-its, and glue. In some sessions (see table 1) they also got prototypes and paper interface elements. The material was intended to empower participants in creating new ideas and reshape the existing ones by helping them to quickly visualize ideas and communicate them to others.

Convergent process
Then, the participants were instructed to start converging towards a GUI prototype. As stated above, this could be improvement of one of the existing prototypes or a new one. After 30 minutes the groups were expected to have created a prototype.

Presentation
Last, the prototypes that were designed by each group were presented to the other group in 20 minutes. After the presentation a discussion naturally followed, questioning the meaning of different interface elements or the reasoning behind various design decisions.

Alterations
Facilitation
Briefing and evaluation methods were modified to investigate the role of the facilitator. As part of the briefing, in session A and B, participants were asked to create their own domain examples. In contrast, in session C and D participants were given specified domain examples that were created by the facilitator. Allowing participants to come up with their own examples was expected to engage them with the problem domain early on and allow them to understand the context that they would be working in more quickly.

We experimented with evaluating the session with different groups of participants to see which evaluation strategy would reveal more insightful knowledge about the design sessions. Session B and C were evaluated by the facilitator and the observer. The evaluation of session D included a participant from each group.

In the different sessions, we provided the participants with different material to investigate the use of material for creative interaction between participants. In our previous work (Pommeranz et al., 2011) we found that when participants were provided with electronic prototypes they had difficulties creating innovative designs. That is why we used paper prototypes of different level of detail and complexity this time. Session A was provided with very simple prototypes (Fig. 1) developed beforehand by the facilitator. In session B and C we did not provide any prototypes to see how the participants with different backgrounds used simple office supplies. In session D, participants were provided with more elaborate prototypes (Fig. 2) that were created in other participatory design sessions. In addition to these complex prototypes participants were also given paper interface elements from the same prototypes (inspired by the PICTIVE technique introduced by Muller (1991)) (such as buttons, text boxes etc.) that they could use to build interface designs. Besides the prototypes all groups were provided with colouring pens, post its, papers, scissors, glue and markers to convey their ideas to other group members and create their interface designs.
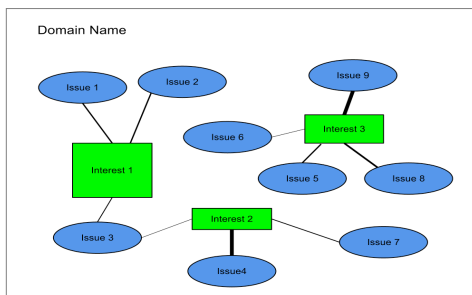

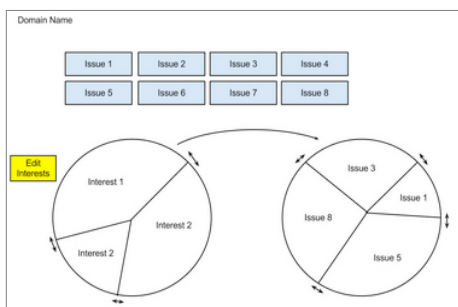Fig. 1: A simple prototype used in session A (created by the facilitator)

Fig. 2: An elaborate prototype used in session D (created by designers in session C).

Group Composition
Lastly, we used the background of the participants and their interpersonal relationships within the group as conditions for testing different group compositions. The participants in A were non-technical people aged between 26 and 82 (one with a design background). The participants in session B were selected specifically not to have a design background while the participants in session C were people who were educated in creative fields (industrial design, HCI etc.). We wanted to see how being educated in a design-related field would effect the participants approach to the design session.

With regard to personal relations, we wanted to test what effect the existence of such relations can have on the collaboration. In sessions A and C the participants that were friends or family were placed in the same groups. In session B and D the participants with such relationships were put in different groups. Also the composition of session D was more controlled. Each group had at least one person with a design background, one expert with in depth understanding of the negotiation domain and a number of end-users. We wanted to see if a mix of backgrounds would have an enriching influence on the design process.

DATA ANALYSIS
Three sources of data were gathered in the sessions, observational notes, paper prototypes and evaluation interview data (the latter was only obtained in session D). We noted down questions, remarks and reactions from the participants as well as observations that we made while the teams worked together. In session B and C there was a separate observer, while in the remaining sessions, notes were taken by the facilitator. Additionally, after each session the prototypes of each group were collected. Sessions B and C were followed by an evaluation session that was held between the observer and the facilitator. In the end of session D we held an evaluation session with a participant from each group. Once all the notes were collected, they were organized into two groups. The notes on the process (method) are separated from the notes on the outcome (user interface). Below, we give a brief summary of our observations about the facilitating the sessions, used material and group composition.

Facilitation
In session A and B, the participants were instructed to come up with their own negotiation domain examples after the briefing. Participants were asked to come up with a domain and a set of interests and issues, which led too unexpectedly long discussions (about half an hour). It also appeared to distract the participants from the real design problem. In sessions C and D, when participants were given clear and unambiguous examples we have observed that they grasped the examples quicker and more thoroughly.

In session B and C we observed that when participants were given the briefing on the whole problem domain they had trouble focusing on the specific design problem at hand. In sessions A and B breaks for questions were easily left out to save time. We noticed that participants of these sessions were not clear about the problem domain once the divergent discussion began. In the end the facilitator had to repeat the same explanation for several participants. We saw in session D that when we allocate 15 minutes of time for questions the domain became much clearer.

One interesting thing that came out of the evaluation of the session D was that some of the participants were not able to follow the conversation between the facilitator and the experts in the sessions. When the expert asked "Would it not be simpler to weight the issues?" the facilitator answered "The research indicates that interest-based negotiation yields better results for both parties, that is why the utility function should be based on the connection strength of each issue to personal interests". Although this answer satisfied the expert, it was not grasped by the other participants.

Session A was the biggest session and had 16 participants split into four groups of four participants. The session exceeded its allocated time which led the facilitator to skip breaks and an evaluation in the end. Although this did save time it resulted in decreased engagement from the participants and lowered learning benefits for the facilitator. The participants were bored towards the end and had a hard time staying focused and motivated with the session tasks. In contrast such effect of fatigue was not visible in the third and the fourth session in which breaks were strictly scheduled. This was significant especially since these sessions took longer than the first one. When an evaluation was held in the end we learned many interesting points about the design method from the perspective of the participants.

We have also seen that the presentation at the end of the sessions was beneficial for both participants and researcher to understand the groups' design rationales and mental models. In session C (designers) a lengthy (>30 minutes) discussion was triggered by the presentation revealing different perspectives on how to present the relative importance of several interests.

Material
We noticed that in session A and D, the participants asked fewer questions and demonstrated a better understanding of the problem domain in the following stages. These were sessions in which the participants were given prototypes. Although prototypes helped the participants to understand the problem domain better, they also created some misunderstanding in session D where more than two prototypes were presented. One of the prototypes assumed a model in which the "location" interest of the user was very important. In another prototype, the same interest "location" was represented with a less important interface element. This discrepancy caused confusion during the session.

In session D we expected the participants to use the paper prototypes as reference in group discussions. We were surprised to find that participants utilized them in their design process as follows. Once the convergent stage started, instead of using the paper interface elements, the participants (in both groups) preferred to use the paper prototypes. They cut out elements that they wanted to use or folded the prototype, and coloured and arranged elements on top of each other to create their prototypes. When we asked why they preferred using the prototypes directly instead of using the single interface elements, they remarked that "we were already talking about those prototypes for half an hour, so when we folded a paper prototype, or cut an element from one of the prototypes, everyone knew what it meant." Further discussion also revealed that the same interface element on the prototype itself made it much easier to find, understand and explain than the same element by itself. This effect did not occur in our previous work (Pommeranz et al., 2011), in which we followed a similar process. However, we used digital prototypes then, which did not allow for such interaction with the prototype itself. Therefore, participants in our previous work only used the single interface elements, which resulted in significantly less innovative outcomes compared to session D of the work at hand.

We saw in the comparative sessions B and C that people with different backgrounds interacted with the provided material in different ways. Interestingly, in both sessions at least one participant from each group immediately took the post-its and started placing some of them on the "screen" (a big white sheet of paper). While this behaviour seems to be afforded by the material, the non-designers kept on working with the post-its by writing interests or issues on them (using different coloured notes), rearranging them and drawing other interface elements around them until they reached a final prototype. The designers more often simply left the post-its on the sheet, but then used pens to draw other ideas while discussing many possibilities and analysing the problem in depth. After sketching many ideas, they finally agreed on one they wanted to convey in their prototype. At that stage, they cleared the "screen" again and started the final prototype from scratch. Overall, we saw that people without design background tended to create simple designs, while people with design backgrounds created complex and innovative interfaces with simple office supplies.

Group Composition
In session B the participants without the design background went straight for simple, and maybe obvious, design solutions (e.g. Fig. 3). Their prototypes were almost identical to the ones previously created by the facilitator (Fig. 1), although they had never seen them. The people with a design background took a long time analysing the problem. They started by deriving specific requirements and only after their analysis they proceeded to design the interface. The designer group came up with more complex, and novel prototypes (e.g. Fig. 2). When the same prototypes from these groups were given to the participants in session D, they expressed that the prototypes from the participants without the design background were easier to understand, but the prototypes from the designers were found more useful. When they later created their own interface prototype, using the elements from the other prototypes, they consistently selected elements and ideas from the design group prototypes (Fig. 4). Another observation with regard to differences between designers and non-designers was their focus.
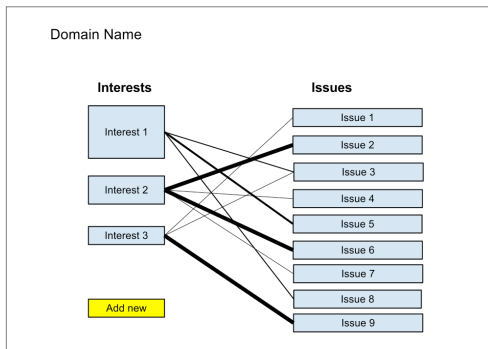
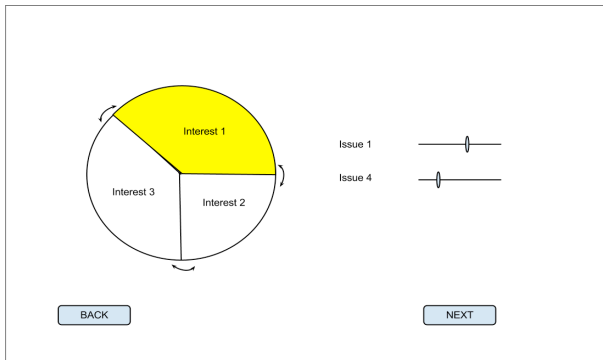Fig. 3: A prototype from session B (non-designers)

Fig. 4: Part of a prototype from session D

We observed that the non-designers focused more on the appearance of the final interface/screens, whereas the designers frequently considered and discussed the interaction with the prototype. This was apparent when they, e.g., asked the facilitator "is this for touch?" or when they made gestures while discussing what happens when users clicked a certain element.

The groups in session D consisted of six people, which was too big to be left to its own devices. However, we observed that one of the groups had a very good moderator. This unofficial moderator made sure that everybody had a chance to express their opinions. The group spent significant time imagining different solutions without constraints. Finally the group unified easier towards an interface design. In the second group in session D we saw that two of the participants dominated the conversation with their ideas. During the evaluation of the same session a participant expressed that she had "... a lot more to add to the design but she could not get time to speak and convince her design partners". Similarly, in session B we observed that one participant went on and on about the details of an algorithm and ignored several notes from the design partner that that was not the focus of the task. In the end, the group lost valuable time for designing the interface itself. A designated moderator may have been able to avoid this.

During session C, a participant interrupted his design partner by saying "You never let me talk!" As this group consisted of a romantic couple one could assume that this rather heavy handed remark was not purely motivated around the teamwork at hand. However, we also saw examples where an existing interpersonal relationship helped the design session. In session A two sisters worked smoothly together since they knew well how to communicate with each other.

RECOMMENDATIONS

Following from the presented data we compiled a set of recommendations considering several aspects of PD sessions.

Facilitation

In the following we will discuss the main aspects of facilitating PD sessions that we observed, i.e. explanations, breaks and evaluation. The facilitator has a leading responsibility to provide scaffolding and guidance in PD sessions. Besides supporting participants' creativity by providing materials, she is responsible for allowing each participant to voice herself. We suggest enforcing a limited speaking time (e.g. two minutes) for every participant between the divergent and convergent stages. This would allow everybody to speak their mind, and help limiting polarization. We have also observed that announcing the divergent and convergent stages explicitly helped the participants to stay aligned with the purposes of the different stages.

Explaining the problem domain

We have seen that the explanation of the problem domain and the design problem was an important part of the briefing. Participants should be well informed about the problem domain in order to design a useful product. Yet, once the relevant domain information is conveyed, it needs to be clarified what is expected from the participants in that day's session. We recommend that the facilitator explicitly specifies what the design problem is including an example domain instead of letting the participants come up with their own domain. The example should be relatable, simple and unambiguous. If the session involves the use of prototypes, explaining them right after the briefing allows participants to improve their understanding. Also the comprehension of the design focus was faster and better when the prototypes were integrated to the examples. However, one should be careful when there are multiple prototypes that are offered to the participants. In order to make it clear that each prototype is an alternative representation of the user interface, all the prototypes should be consistent.

Time for Questions

Depending on the complexity of problem domain, one should schedule time for questions after the briefing. While this seems obvious, it was likely to be overlooked in the spirit of keeping a schedule. Reserving a specific time interval for the questions can prevent the facilitator from rushing over the questions, give participants more confidence for asking anything that might be on their minds and also make it possible to end the questions part of the session when it exceeds a predetermined time limit. When answering questions from experts, one should still answer in plain terms as much as possible.

This would allow non-experts in the group to benefit from the answer of the question.

Evaluation and Breaks

Design sessions can easily overrun their allocated time. In such cases it can be tempting to skip breaks and evaluation. We believe that the presence of those two elements should be insisted on. A small (10 minutes) break gives people a chance to relax, recover from any fatigue. But more importantly, disengaging from the problem can open ways to approaching it from a new perspective and we have seen in session D that the results can be refreshingly good. With regard to evaluation we have seen that participant evaluation yields interesting insights that cannot easily be observed and it is, thus, suggested to include participants in evaluations. Besides benefits for the facilitator to improve follow-up sessions, this involvement can also make the participant feel more needed and make her enthusiastic for follow-up sessions.

Presentations

We have seen that presentations that are given in the end of the sessions can trigger lively discussions about the design rationales of the participants. The discussion in the end also gave every participant another chance to express their ideas. The questions that are asked by the other participants and the facilitator can reveal the underlying reasoning for different design decisions and clarify differences in mental models participants have.

Materials

We found that designers and non-designers used the given materials rather differently. While designers seemed to have their own way of approaching design problems and were comfortable to use just pen and paper to sketch many ideas in a divergent process, non-designers seemed to be more focused on the given materials (in session B post-its) and zoomed in on one interface more quickly. Thus, design material should be selected carefully. Quickly converging could be avoided by presenting several prototypes to non-designers to open up for several diverse ideas and letting participants combine them as we did in session D.

We observed in session D that the participants preferred to use paper prototypes as a whole to individually cut interface elements. Copies of paper prototypes were useful as communication tools and for supporting creativity and focusing participants. In order to benefit from the full potential of the paper prototypes, multiple copies must be provided together with scissors, glue, coloring pens and empty paper. These additional materials would allow people to modify the elements, or add personalized versions of them. In conclusion, we suggest supplying participants with multiple copies of each prototype in addition to single interface elements.

Group Composition

During the sessions we have seen that the composition of the group and the moderation of the group process influenced the results. Based on our observations we have the following recommendations for group compositions.

Group Members

When we look at the results from sessions B and C, we see that the presence of the people with the design background was beneficial to the design process. In addition, the opinion of the experts in the problem domain is an important perspective for the design. That is why we recommend that each group is assigned a designer, an expert, and a couple of end-users. Since the group size quickly increases with such participants of specific functions we recommend a moderator for groups bigger than four participants. The moderator, designer and the expert can also be seen as functions that need to be fulfilled, and can, if possible, be the same person.

Interpersonal Relationships:

We observed the pronounced effect that a personal relationship can have on the design session. However, in our case the relationships did affect the design process in unpredictable ways. As we are aiming for a consistent method we advise against putting associates in the same groups.

Leading the discussion

We have already discussed the need for a moderator in bigger groups. In this section we elaborate on the role of the moderator during the design session. The moderator should emphasize different processes in the different stages of the session. During the divergent stage the moderator should encourage people to think of different possibilities. In order to allow time for alternatives, the moderator should limit the depth of the discussions on any particular solution. During the convergent process, the moderator should focus the group on driving toward a concrete interface. In line with participant empowerment, it is important that every participant gets a chance to speak in this stage. If possible, it would be useful to train and brief the moderators in advance.

LIMITATIONS

Generalization of our results is limited due to the alterations in the different sessions and a lack of variety in domains. As we did not strictly follow a conditional experimental set-up, some combinations of factors were left out. For example, particular briefing or materials were only tested with end-users and not with designers. Thus we do not know, e.g., how homogeneous designer groups would have dealt with paper prototypes. In addition, the sessions all focused on the same design challenge. Several other domains, beside negotiation, should be tested to see if they bring up the same results. Despite these limitations, our work is a valuable exploration into different aspects influencing the process and outcome in PD sessions.

CONCLUSION

The work presented in this paper explored how to set up and conduct participatory design (PD) sessions in order to empower participants by fostering creative (inter-) activity and engagement with designers/researchers. In

particular, we investigated the facilitation of sessions, materials and group composition in several PD sessions with designers and end-users. Based on the session outcomes, observations and evaluations we compiled a list of recommendations for successful conduction of participatory design sessions.

In summary, we have seen that the facilitator should explain the problem domain using unambiguous examples, e.g. by presenting prototypes, and clearly state the session's purpose and design challenge. Allocating enough time for questions, breaks and evaluation was found to be important to allow participants to understand the challenge, shift their focus to new perspectives and provide feedback to the facilitator. The facilitator has a guiding role throughout the session to manage convergence towards concrete prototypes.

Choice of material to trigger creativity is crucial. While people with design backgrounds coped well with the absence of prototypes and produced complex interfaces, end-users were more creative when they could use existing prototypes. Furthermore, participants used prototypes directly by folding or cutting them instead of using premade interface elements, which supported understanding within the design team.

Finally, we have seen that the composition of the group is important. We observed that heterogeneous groups including a domain expert, a designer and a small number of end-users functioned well. Furthermore, a moderator within the group can steer the steps of the sessions and support equal voicing of the participants.

These results represent valuable considerations for conducting PD sessions. Our work presents a starting point to a systematic analysis of PD work and we call for more such analyses of the presented and other factors influential to the process and outcomes of these creative design sessions with stakeholders. We believe through detailed analysis and recommendations to other researchers, the use of PD sessions can be enhanced and considered as a scientifically sound research method.

One remaining challenge is how to deal with participants of very diverse backgrounds. While we have seen that different perspectives are beneficial, this may also bring along problems of understanding and power differences between the participants. As suggested a moderator can help mitigate some of the problems. However, we cannot assume the moderator to fix all problems, and thus more research is needed in this direction. We hope this work will encourage HCI researchers to follow up on.

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