How Does User Feedback to Video Prototypes Compare to that Obtained in a Home Simulation Laboratory?

Prina Bajracharya, Thelxi Mamagkaki, Alexandra Pozdnyakova, Mariana Viera da Fonseca Serras Pereira, Tetiana Zavialova, Tin de Zeeuw, Pavan Dadlani, and Panos Markopoulos

Eindhoven University of Technology, Department of Industrial Design, 5600 MB Eindhoven, The Netherlands
{prina.bajracharya,thelxi,tanya.zavyalova,mserraspereira, t.dezeeuw}@gmail.com, alexpozdnyakova@yandex.ru, pavan.dadlani@philips.com, p.markopoulos@tue.nl

Abstract. This paper compares the user feedback obtained from viewing a video prototype of a domestic Ambient Intelligence application called MatchMaker to that obtained by evaluating the user experience in a home simulation laboratory. The video was reverse engineered, from the final application to ensure that it provides a valid representation of the system tested in the lab. The comparison indicates that video prototypes give results consistent with the laboratory evaluation. It seems to be harder to uncover issues of appropriation of the technology as only a narrow and typically normative use of it is shown on a video prototype. Given the ease with which feedback from many people can be collected, video prototyping seems better able to identify variety of contextual factors that may influence acceptance and use of the intended system.

1 Introduction

Video scenarios alias video prototypes are a very commonly used technique for representing design concepts during early phases of interaction design. Video prototypes are created using a range of simple or more complex techniques like stop motion animation, video editing, narrative voice-overs, computer animations, etc. These common techniques for the video medium help create audio-visual narratives illustrating a design concept, placing it in context, and conveying an impression of the intended interaction and user experience. The video can be shared with stakeholders in a design process to inspire developments but also, very importantly, to obtain feedback regarding their attitudes and expectations regarding the design concept shown.

Video prototyping was adopted by the HCI community during the eighties as a way of obtaining early feedback from users during a user centered design process, though it was discussed explicitly as a method for interaction design slightly later, see for example [12]. The method was originally used for the standard design problems of the era, e.g., prototyping graphical and multimodal interfaces, for which software prototypes were at the time expensive and time consuming to create, thus not lending themselves as well for iterative user centered design. While over the years software

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prototyping techniques have become more efficient, video prototyping still remains attractive especially for systems that are harder to implement, such as ambient intelligence / ubicomp applications. For such cases video prototypes are particularly appropriate as they make it easy to embed the envisioned interaction in different living and working contexts, to show dynamic aspects of interaction, to bridge time spans, and explain with narration or video effects the workings behind the scenes (e.g., adaptation, profiling, and communication).

For some time now, a range of well known vision videos capitalized on the ability of the technique to illustrate futuristic technologies, e.g., see the STARFIRE video by Sun Microsystems [11], or the seminal Knowledge Navigator video by Apple [8], which have managed to visualize interactive technologies that are now part of current technological habitat long before they were feasible to build. Over time the research field has become very much accustomed to such videos and there is quite some expertise available as to how best to use video as a medium, see for example [13].

Much of the knowledge on video prototyping reported in related literature is best described as anecdotal or craft knowledge. There has been little attempt to provide empirical evidence for the advice given and to consider the applicability, validity and generalisability of related methodology. This study is part of an investigation that attempts to address this omission.

In earlier work, we have examined the impact of fidelity in representations used in video prototypes. The generally perceived wisdom that low fidelity prototypes lead test participants to be more critical and to focus on higher level detail was not confirmed in the case of video prototypes [3]. Different filming techniques were compared, e.g., one using actors and one using cut-out animations, showing that the added realism of context and of the protagonists also did not result in different feedback to be obtained by viewers. [6].

Batalas et al [1] examine how video prototyping impacts the overall design process, focusing on the domain of ambient intelligence. Note that video is particularly attractive as a prototyping technique in this domain as it makes it easier to prototype and solicit user feedback, liberating non technology savvy designers from implementation concerns and even democratizing the design process enabling user participation and feedback. The embedding of a video on the design process is interesting for several reasons. A concise and vivid video representation can have communicative and persuasive uses towards managers, a development team, but also, can serve as a common ground within a design team. On the other hand, as [1] found it might draw attention to issues captured well with the medium, while ignoring other important aspects that simply do not lend themselves for filming. Further they argue how a slick presentation may conceal serious usability and user experience limitations of the envisioned design.

2 Aims of This Study

In the last 15 years, the field of human computer interaction has been paying increasing attention to the importance of context for the emerging user experience. Field

testing of fully functional prototypes is often considered the golden standard for evaluating with users. Evaluating user experiences in a realistic physical and social context is accepted as a key aspect of iterative interaction design and user oriented research. Still for many systems that are experimental and at early phases of development, field testing may be too expensive or even infeasible, and the logistics of observation and experimentation in the field may be prohibitive. For these reasons, several research institutes around the world have established what we could call *context simulation laboratories* with the aim to create in a lab context much of the appearance and experiential aspects of real life contexts like homes, schools, hospitals, or even restaurants. Context simulation laboratories serve for the implementation of experimental technologies, the facilitation of observation and data collection. A typical example is the home simulation laboratory used in the present research study.

Given the considerations above which point towards functional prototypes and real world deployments, one should question how valid is the feedback obtained during early design phases from representative users viewing video prototypes. Can we consider their attitudes regarding a system, the design of the interaction and their expectations regarding the user experience intended by the designer as representative of what would be found by evaluating actual use?

This paper aims to address this issue by comparing feedback obtained from video prototypes to that obtained by evaluating a working system in a home simulation laboratory. We describe a case study concerning MatchMaker, an ambient intelligence application that notifies people in different households that a connected other is engaging in a similar activity at that very moment. To evaluate how feedback obtained from a video prototype evaluation compares to that obtained from testing, we reverse engineered a video prototype to represent the exact same concept. The original system had been evaluated in a home simulation environment with 46 participants spread over the role of the parent and the child. For this study we showed the video prototype to 11 participants fitting the demographics of the initial experiment. Qualitative interviews were conducted, gauging the value this system could bring for participants and issues relating to acceptance. Interviews were analyzed qualitatively using an inductive approach and the results were compared to the findings of the experimental evaluation. In the following sections, we report the study and its results in more detail.

3 The MatchMaker System

MatchMaker is an experimental ambient intelligence system that was designed to support peripheral awareness between inhabitants in two connected households so as to increase connectedness between elderly parents and their adult children living remotely. The system provides cues of when the connected individuals are engaging in a similar activity assuming that awareness of this similarity would enhance feelings of closeness and connectedness. MatchMaker was developed in an iterative design process and a feasibility prototype was installed in a home simulation laboratory. The design, implementation, and evaluation of MatchMaker are reported elsewhere [5].

Experimental context sensing technology was developed to a) identify moments when connected parties are engaged in similar activities, and b) do so only for selected types of activity that do not compromise the autonomy and privacy of the connected parties. Two Internet connected picture frames at each location light up when the system detects matching activities, e.g., both parties cooking, both watching television, tidying up, etc. The activity recognition technology enabling this function is still experimental which makes the home simulation laboratory particularly suitable for supporting experimental evaluations.

Fig. 1. Snapshots from the evaluation of MatchMaker in a home simulation laboratory, showing two participants tidying up after dinner at different locations, with their frame indicating the similarity of the activities identified by the system.

The potential affective benefits of similarity awareness were evaluated in a laboratory experiment involving 23 pairs of a parent and a child; this experiment reported in [5] shows that similarity awareness can significantly enhance social connectedness. During the evaluation each participant was given a set of tasks that they should carry out, e.g., tidying up, preparing dinner, etc. As they were carrying out these tasks the frame would indicate to them whether their relation who was present at a different location in the same campus, was engaging in the same activity at that same time. That experiment (described in [5]) is outside the scope of this paper; suffice it to say that the quantitative analysis confirmed the overall concept while a wealth of comments and reactions were recorded regarding the system, its potential to enhance connectedness, concerns regarding privacy, expectations regarding its value, etc. For the purposes of the present study, we compare related findings to those obtained by interviewing people who viewed the video prototype of Match Maker discussed below.

In creating the video prototype of MatchMaker we did not seek a persuasive and promotional video but one that would be a reasonable and low cost representation of the design concept, such as those used during early phases of interaction (see [12]).

The first step of creating the video prototype was a storyboard based on the core use cases of the MatchMaker. The scenario consists of two stories taking place in

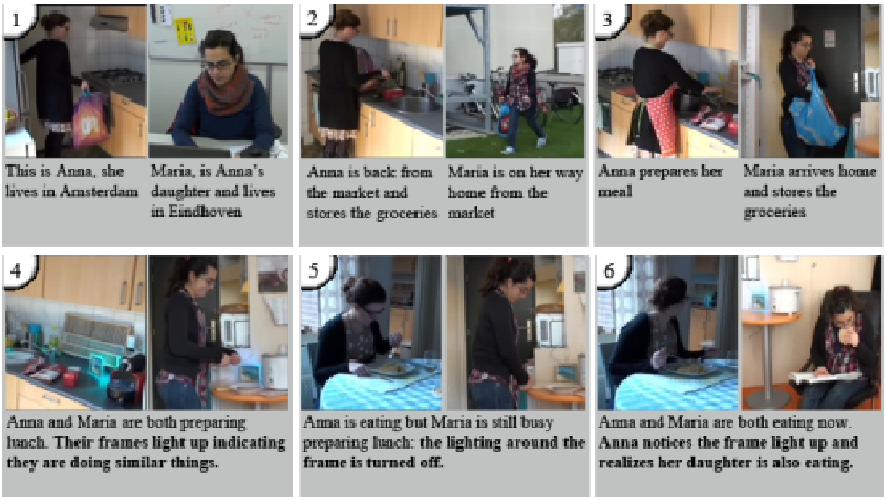

Fig. 2. Snapshots from the reverse engineered video prototype of the MatchMaker concept

different settings. The first scenario narrates the story of a mother, an empty nester, coming back home after groceries and then preparing a meal, having dinner, doing the dishes, having a drink and then vacuum cleaning. The second is about the daughter, who now lives on her own and does some of the same activities in her own place.

The video was shot at two different locations, a house and a student studio, to achieve more realism. The photo frame was placed on the counter in the kitchen at the mother's house and on a table at the daughter's studio, and it remained visible during the whole video. The activities that are synchronized (matched) in the video are: the preparation of the meal, having dinner, vacuum cleaning and having a drink. The frame lights up when there is a match between the activities that mother and daughter do. At appropriate times the scene is split in two parts to emphasize that mother and daughter are doing the same activity. Narration is used to provide some context to the story and call attention for the moment where the frame was lighting up.

4 Evaluating the MatchMaker Video Prototype

A different set of participants was recruited to view and comment on the video prototype. During the recruiting they were briefed that the study was about communication between parents and children. Participants were invited for the interview that was held at the Eindhoven University of Technology. They were first shown the video after which, they were interviewed regarding the concept as a whole, and more specifically regarding its potential to support feelings of social connectedness.

Participants. Two groups of participants took part. The first group was made up of empty nesters, parents (2 men, age 54 and 58 respectively and 3 women, aged

between 50 and 58) whose children moved out of the house for studies. The second group were children (young adults; 3 men, aged between 20-21 and 3 women, aged between 23-25) that left the family house to live on their own. All the recruited participants were employees or students from Eindhoven University of Technology.

Compared to the user test of [5] some differences can be noted. In case of the video prototype, all the recruited participants were academics or students whereas for the user test a more representative mix of backgrounds was achieved and a larger number of participants (N=46). The user test participants were all recruited as pairs of parents and their children who were really connected through their parentage. This has resulted in better understanding of their bond, while in case of video prototyping the participants were recruited apart and could only comment on their own situation in relation to the child that moved out or their parents that they had left.

Measures. Since this study only aimed for a qualitative comparison of reactions between the present study and the laboratory evaluation of MatchMaker [5], quantitative measures from the original test were not used, but relevant questions were put in an interview format.

The resulting interview consisted of questions about social connectedness [2] and Social Presence [10]. Measuring social connectedness and social presence with questionnaires when showing a video prototype would retrieve only hypothetical results, since participants did not experience a real and direct interaction with the MatchMaker. In addition, a short questionnaire concerning demographics and background, motivation, and feelings of intimacy was used for each participant. This questionnaire was the same used on the original research [5].

The script of the semi-structured interview was similar to that of the laboratory evaluation and had three parts. In the first part, the questions regarded the MatchMaker concept and were the same as in the original research. The second part of the interview was designed to gather information on social connectedness loosely based on the Social Connectedness Questionnaire (SCQ). Finally, the third part was based on the Social Presence Questionnaire [10] to gather information concerning differences in feelings of social presence.

5 Comparing the Evaluation of Matchmaker in Lab and from Video Prototype Viewings

Interview sessions were recorded, transcribed, and open coded to identify inductively different categories of responses that characterize the reaction of viewers of the video. These are discussed below comparing them directly to the results of the user test.

Closeness and Social Connectedness. Viewers thought that closeness would be enhanced by using MatchMaker and that using the photo frame would evoke feelings of belonging, being more in touch and together - “feeling that you’re not doing it alone but together with your parents in different places”. Some negative aspects of the

closeness that the frame creates were also expressed in the present research - "might feel a bit like as if parents are present, that's the part I might not like" - while they were not mentioned in the user test, where participants did not actually experience such feelings in the short and inevitably de-contextualized usage they had in the laboratory. Regarding connectedness, the feedback from viewers suggests that the quality of the relationship will not change because of the photo frame, in particular it will not help to understand more what the other thinks and feels, neither will help to talk about difficult topics. However, potential positive changes were also mentioned, such as feeling more connected to each other or that it might trigger more contact.
These results are congruent with the results of the MatchMaker user study [5].

About Similarity Matching. In general the concept was perceived as a new and indirect way of communication and easily comprehended by viewers of the video prototype. However, for some it was difficult to predict if using this system in daily life would be enjoyable. Several concerns about the frame were expressed; parents and children with different schedules and routines wondered how frequently and when the system would match an activity – "the probability that my eating happens at the same time as my son's eating is not that big". The same problem was referred when considering that the two parties live in different countries with different time zones.
Similar results were not found in the user test of [5].

Tricking the System. Considering the synchronization and matching of activities, users expressed sometimes that they would try to trick the system to find out what the other party is doing at a specific moment, by trying different activities. This is consistent with the user test where participants suggested that at home they would try different activities until the frame would lights up in order to find what the other party is doing.

Triggering Communication. Matching activities was considered to trigger contact in most of the cases – "Could be an occasion to establish contact" – but the possibility of having automatic calls when there is a match was not appreciated and was rejected as an option by the majority of viewers – "If a phone line opens automatically it will be privacy invading". Moreover, it was stated that they would use the information that the frame offers to know when the other party is busy or not so that they do not disturb with a call.

Although the system triggers contact, worries about the obligations and expectations that the system might create were also expressed. Especially children were worried that their parents would expect a phone call when there is a match and in case they did not call they would feel guilty. It was also suggested that if activities never match, this could also bring disappointment. Moreover, children are worried that they may have to give explanations about what they were doing at a specific moment – "Bossy parents would say you are not doing your work properly".

These comments are fully in line with the reactions of participants in the user test.

Privacy. Privacy concerns were one of the main topics discussed during the interviews. In general the concept was not considered as privacy invading as long as the activities matching were between parents and children and were regular daily activities (cooking, having dinner, watching TV etc.) – "It's your parents, it's not like a stranger" (sic). Nevertheless, users were clear about the privacy matters that they worried about. Personal and intimate moments should not be taken into account when matching activities – "When my son invites his girlfriend perhaps he doesn't want me to interfere in his love life" (sic). Another worry concerned the feeling of being watched and controlled through the frame – "I moved out for a reason" (sic).

The users of the MatchMaker system expressed analogous opinions concerning these privacy matters.

Control System and Preferences. Users want to have control over the system, which means being able to switch off the device when they want. As a consequence of having control over the system, a need for different settings and preferences emerges. Participants would want to be able to choose which activities match and to have control settings for the color and intensity of the light. The possibility to have additional communication channels, such as videoconference, calls, chat or messages would also be appreciated. A need for messages that illustrate the user's mood and feelings was also suggested. The same results regarding the system's control and preferences were also found in the MatchMaker user studies.

On Matching Activities vs. Matching Location. One question that concerned the evaluation was whether activity recognition as such is useful: could it be replaced by the technologically simpler matching of location within the house? E.g., lighting up the frame in the kitchen, when the remote party is in the kitchen too. When asked about matching location instead of matching activities, users were not as positive. They thought that matching activities would be more meaningful while matching locations would not add more value. In addition matching location can be a problem when one party lives in a small apartment, studio or shared apartment and the other party lives in a house with several rooms. A consequence of this problem would be the frame lighting up permanently, which would make the device lose its spontaneity and meaning.

Relaxation or individual chores were also suggested by viewers of the video as good options for matching, such as reading or doing the dishes. Although similar consensus regarding the preference of matching activities was found in both studies, the concern about the size of each party's house and its consequences was not mentioned by the MatchMaker user test participants, perhaps because the whole experience and the interview were very much focused on the actual usage in the test session.

6 Conclusion

User feedback obtained from viewers of a video prototype was very comparable to the findings from testing in a context simulation laboratory, particularly with respect to the main questions of the study regarding closeness and social connectedness, privacy issues, control and preference settings, tricking the system and triggering communication.

However, some differences were remarked that were unexpected. Viewers of the video prototype were more forthcoming regarding practical considerations and fitting the application in their lives and context than participants in the test. For example, the difficulty of using the system over different time zone was missed by participants in the laboratory test who arrived together at the laboratory and live in nearby locations. Also, remarks concerning the configuration of the participants' own home did not arise in the home simulation laboratory that is bigger than the apartment of some of the participants. Conversely, video viewers did not envision explorative and playful usage of the system that was observed in the MatchMaker test and their responses were more normative and aligned with the designer's intent than was the case in the test. So the two methods are complimentary and by their nature will shed light to different aspects of the user experience.

This study is encouraging regarding the validity of feedback obtained by video prototyping, but also regarding its efficacy. As one would expect video prototyping appears to be blind to issues of appropriation, but it did trigger the imagination of viewers who could compare the proposed usage and user experience to their own lives and contexts. Given that it is easier to involve larger number of users, it appears that it helps bring into consideration a large variety of contextual factors relevant to viewers, that would be practically difficult to capture in a user test: one can only test in a limited number of locations and contexts, and when one is testing in an experience laboratory (e.g., home simulation), many of these contextual factors become contrived.

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