

PROBING THE NEED FOR MOBILE TECHNOLOGIES FOR DESIGNERS

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ABSTRACT

In this paper we present a study of possible applications of mobile technology for industrial designers and architects for their daily work. We conducted two user studies with the final aim of gathering requirements for a future prototype which fulfils the aims of both industrial designers and architects in terms of mobility. The first user study consisted of using Cultural Probes which allowed us to get a first approach at the domain and showed valuable information. The specific characteristics and advantages of this method as well as the results are presented. The second study consisted of a questionnaire filled-in by designers and architects. Both studies allowed us to find some interesting answers to the following questions: what are the activities that take place outside the designers' studios/offices? What is the current use of technology among designers? What is the perception they have on technology? What kind of technology should be developed in order to satisfy their needs? Based on the findings from both studies, we propose guidelines for future mobile applications that support the work of designers.

KEY WORDS

Mobile devices, user centered design, supporting creativity, requirements capture

1. Introduction

Designers' way of working has severely changed in the last decades, mainly because of the massive use of Computer Aided Design (CAD). This kind of tools is running on desktop PCs and assists the designer in a very important part of the design process. However, the designer's job is not restricted to an office or studio, they also spend considerable time outdoors.

Although the design process has a complex and vague structure it is possible to make a four-stage division of the process [1]: sketch design stage, preliminary design stage, definitive design stage, final design stage. The first two stages are considered the early stages of design, and some new proposals try to bring computing technology to this important part of the design [1, 2, 3]. Stages 3 and 4 are

the ones in which CAD is massively used nowadays. As such, work performed throughout the design process could potentially be supported with computing tools. However, a clear distinction between work that is done inside and outside of the designers' workplaces has not yet been made. We can consider this division a complement, transversal to the other four stages and that makes them possible.

Until now, most computer applications have been created with indoor work in mind. The use of mobile technology for designers is still largely unexplored. In this paper we present a study of possible applications of mobile technologies for the daily work of designers while trying to fill-in the technological gap detected in this field. When talking about designers we are referring to industrial designers but also to architects due to identified similarities in design stages, needs, and approach to technology.

2. First User Study: Cultural Probes

2.1 Project context

The 'ID-MIX: Industrial Design in Mixed Reality' project [4] tries to assess the impact of augmented reality [5] systems in work practice. As such, the project aims at identifying if industrial designers would adopt augmented reality for their work. The first stage of this project consisted of applying the probes method [6] to study design practice in the context of the design studio and was conducted by the second author. The probes provided rich information of the designers' work not only in the context of their design studios but also when they are on the move (i.e. visiting clients, using a colleague's workshop, or finding inspiration).

The 'Mobile Technology for Designers' project tries to identify and fulfil the mobility needs of industrial designers and architects. As such, it was possible for the first author to take the probe results from the earlier study and re-interpret them for this project, now with a focus on mobile technology for designers.

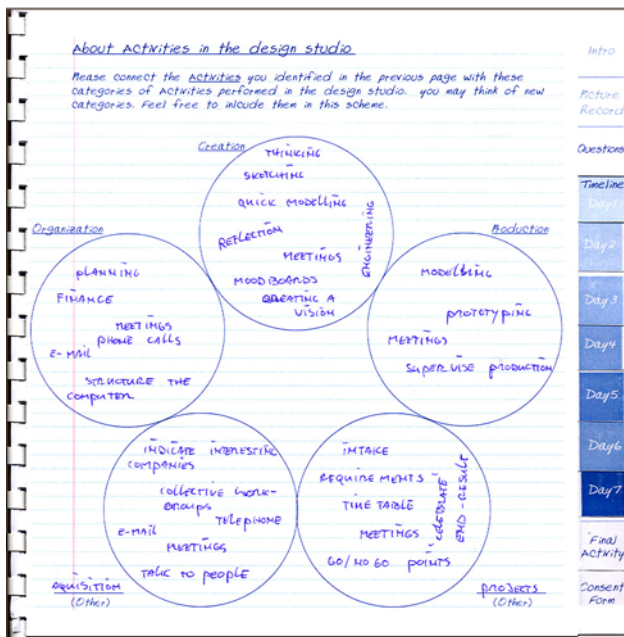


Figure 1: The 'Design Studio' diary.

2.2 An introduction to Cultural Probes

The Cultural Probes method [7, 8] allows researchers to get information on certain groups of people, collectives or environments, especially when it is difficult to observe them directly. Probes are defined as “collections of evocative tasks meant to elicit inspirational responses from people - not comprehensive information about them, but fragmentary clues about their lives and thoughts” [8].

A probe pack is given to the selected volunteers who represent the group that will be studied. The contents of the probe pack differ from one project to another, but they always try to stimulate the mind of the participants and should aim at capturing their experiences while using the probes.

The volunteers are asked to work on the probes, documenting their daily experiences by either filling-in some kind of personal diary, writing and sending postcards, or making drawings on maps, among others. Additionally, the probe packs may also contain a disposable camera so participants can take pictures of interesting things, places where they work or live, or people they deal with. This allows participants to focus in the areas of interest for the investigation with a high degree of freedom.

One of the main differences with traditional methods such as interviews is that this is a non-intrusive method, in which people feel free to explain their thoughts, activities, dreams, and desires. The main idea is to leave the pack to the volunteers and wait for them to return valuable data over time. A good design and selection of the materials included in the pack together with some suggestions and

advices on how to work with the probe are all key factors for success.

2.3 The probe pack

In the study presented in this paper, ten industrial designers were given a probe pack, which contained a diary and a disposable camera. The designers were required to fill-in a “Design Studio Diary” (Figure 1) in which they found questions, a seven-day timeline, a picture record, and drawings to answer or complete. They were also given a camera to take pictures of the environments where they work, of important things and places for them, or anything they would find interesting for their work. The idea was to obtain information from the designers on the activities that take place both inside their design studios, as well outside when designers move to other places.

With this study we were able to get a first glance at the work of designers. Although the cultural probe study was originally targeted at investigating design practice in general, some of the questions included in the diary were directly connected to the focus of this study, such as:

- Do any of your activities occur outside of your direct workplace (desk, office)? If so, please identify them.
- As a part of your work, do you meet other people outside your office? In what context? How frequently?

These two examples of questions from the ‘Design Studio Diary’ are the ones that could a priori be more interesting for our goal. However, as was previously explained, there is more to probing than simply asking participants to provide answers to closed questions. The variety of the activities included in the probe pack allowed us to obtain rich data of the domain we were studying. The seven-day timeline, the pictures taken, some of the drawings and questions, as well as comments made by participants became a very valuable source of information. Through these activities included in the probes, we also learnt on the current use of both mobile and non-mobile devices.

Through this cultural probe study we were able to have a first approach and glance into the way of thinking and special relationship designers have with technology. We obtained valuable information for our research, however, we wanted to confirm and expand the data obtained by taking a more formal approach. We were also hoping a more traditional approach to collect data from our users would allow us to complete some of the more ‘vague’ or ‘incomplete’ findings from the probe study.

We decided to develop a questionnaire that would be given to 14 industrial designers, architects, and architecture students.

3. Second User Study: Questionnaires

3.1 Questionnaires

We were able to use the cultural probe study to get in touch with the thoughts of the designers on mobile technology. We collected several ideas as well as some user requirements. However, due to the incomplete or open nature of some results from the probes we thought a further study would be necessary. We prepared a traditional questionnaire [9] to be filled-in by architects and industrial designers in order to complete and contrast the information and the designers' needs that emerged from the diaries.

The questionnaire developed consisted of twenty-two questions and was divided into four different parts:

- The first part consisted of inquiries on types of activities that take place outside the designers' and architects' offices and studios. It included closed 'yes and no' questions, scaling questions (from 1 to 7 on a Likert scale), multiple choice questions and order by frequency questions. The questions were formulated in a general way so that designers could easily see what the questionnaire was about and so it would be easier for them to answer the questions.
- The second part of the questionnaire included more specific questions on the activities mentioned in the first part, trying to get detailed information for a possible prototype. Based on activities previously identified in the cultural probes (i.e. visiting clients, visiting other designers / architects, visiting places for construction, etc.), the designers and architects were asked to specify on a 7-point Likert scale how often some actions or tasks connected to these activities occur (i.e. take notes, make sketches, make presentation, etc.). They were also asked how they perform these tasks.
- The third part included questions on their current use of technology for their jobs. Our main focus for this part was on identifying the devices they use and the use they give to them. They were also asked on the software running in these devices.
- Finally, the fourth part consisted of open questions regarding their perception of technology. We left this part for last since by then participants had already filled-in the rest of the questionnaire and were familiar with the focus of the study.

Two versions of the questionnaire were developed with slight changes in them, one for industrial designers and another for architects. The questionnaires were given to ten architecture students with no or little working experience (traineeships), and to three experienced industrial designers.



Figure 2: Cultural Probe pictures: Designers' desks with their desktop and laptop computers, and mobile phones.

4. Results

After analyzing the filled-in questionnaires, we realized there were several coincidences with the findings from the probe study. This confirms that Cultural Probes was a good method to get in touch with the designers' and architects' thoughts and needs.

4.1 Use of technology

All designers who took part in the study have a close relation with computers in their daily work (Figure 2). All of them have a computer, not only at their workplaces but also at home. Desktop computers were preferred in their offices while laptops were used at home, especially for freelance designers who work at home. The nature of their work is mobile as they have to go outdoors in order to meet their clients elsewhere.

All designers also reported owning and using mobile phones, which were mostly used for conversations, and sending and receiving SMSes. The participants did not mention other uses such as data exchange or MMS.

In the questions, they were also asked about the use of Personal Digital Assistants (PDAs) or Palm PCs. A relatively high percentage of them used such devices. Four designers owned one, and five did not (there is one who did not answer this question). The main uses given to PDAs were for keeping addresses, making notes, and keeping an agenda. Digital cameras were both given a personal and work-related use.

With these results, we were able to confirm one of the initial findings from the cultural probe study. All participants reported that they used digital cameras and mobile phones; the majority (10) used laptops, however only few (2) used PDAs, and none of them used other versions of smaller laptops such as TabletPCs.

From both studies we can say that the reported use of technological devices among designers is similar to other professional users. However, analysis of the diaries shows

some interesting conclusions about the designers' relationship with technology.

All designers accept technology and feel they can manage with it. When asked for their level of expertise with computers they declare themselves as intermediate or intermediate/expert users, especially in their fields of work. In spite of this, most of them see technology as a mean, something necessary for their work, but not as a goal, and in some cases they even seem to be suspicious of it. One designer said regarding the use of computers, "it might interfere with the creative design process". This designer was expressing his concerns on the possibility that technology may be taking away part of his creativity.

Working with their hands seems to be another important aspect for designers in their work that they do not want to lose. This can be reflected in some examples taken from the diaries. When asked about important objects for them at work a designer says, "pens and pencils because I use them so rarely to design, but it's the nicest thing to do". Another designer points out, "Pleasant work: combining hand and computer work". Finally, a third designer says, "Working with the head and the hands".

As we see, although designers are not at all against technology - they see it as necessary, useful, essential for their work in most of the cases - introducing technology in their work should carefully consider this special relationship that designers have with technology. They will use technology but only if it matches the way they like to work: technology should adapt to them, not the opposite.

This idea mentioned by one designer could be applicable for any user but is especially suited for designers. "I never thought that I would use computers when I tried a PC with DOS... It was so unnatural that I hated it. Now I love my computer..." This sentence written by a designer in her diary shows us how designers will accept technology, but only if they feel comfortable with it. Another aspect of how designers perceive technology is reflected in this comment from the questionnaire: "nothing can beat an old-fashioned hand drawing! But technology makes it much quicker".

4.2 Working outside

Participants were asked to indicate where their design activities occurred. Designers confirmed to us that some activities require them to actually go outside and leave their studios. The questionnaire showed that designers spent 30-40% of the time working outside their offices or studios. Designers also rated these activities high on importance (5.5 on 1 to 7 Likert scale).

Some designers shared with us the importance they give to mobility. When this designer was asked to imagine her 'ideal studio', she said, "it would be a perfect combination of a mobile workstation and a more fixed

one, with a good connection between both". She naturally included mobility as part of her dream studio where she could perform her work because she thinks a studio for a designer should be more than just the place where you she goes to work; it cannot be constrained to four walls as her job is not constrained in that way. The relation between both fixed and mobile working tools is also essential, and seems something that designers care about. In relation to this, communication between several devices is pointed out as a common problem designers experience quite frequently with the use of technology.

The most frequent activity that takes place outside the design studio is meeting people. They meet clients, experts, other designers, and people from other companies. When visiting (potential) clients they will usually make presentations in which they may offer their services or show the progress of their work.

Designers also reported getting together frequently with other professionals to 'have discussions' and 'work together' with them. Moreover, designers give a very big importance to these activities. Thus collaboration by means of working in groups and sharing information could be a potential desirable characteristic of technology for designers. One designer told us his 'main frustration of the day' happened when he had a verbal discussion with some colleagues without being able to visualise what they were discussing about, which only created more frustration. Taking notes and making sketches, mostly in paper, is something very common in these discussions and meetings. It seems to be potentially an important field for introducing technology.

Another important conclusion drawn from the study is that some industrial designers must develop their own models or prototypes, and therefore work in two different places: the studio, where their computers are usually located, and the workshop, where they do the building work. Although both the studio and the workshop can be in the same building, providing a simple way of connecting both seems essential to share any kind of information (Figure 3).



Figure 3: Picture from the Cultural Probe: some designers having to go to a different physical location to build a design in the workshop.

Besides being practicing designers, some of our probe participants were also involved in teaching activities at our University. Moving from their workplace to the University to supervise projects and give lectures was another regular activity performed outside their studios. There are several challenges related to working in different physical locations. Designers must work on different computers containing different information. They also must communicate with different people (i.e. students and other teachers) through face-to-face conversations as well as through email or other electronic means as reported in some of the teachers' diaries (Figure 4). These kind of electronic relations and access to information such as Intranets or VPN accesses are quite popular not only at Universities but also in some companies. The possibility of mobile access to them should also be studied.

In addition to the Cultural Probes' findings, the questionnaire showed that more than half of the participants spent time outside looking for inspiration. In the diaries, participants mentioned visiting design fairs, symposia, and libraries as examples of other activities some designers do when they are looking for inspiration.

Another idea about mobility taken from the diaries is the time used for commuting to work. Going by train (or any other kind of public transport) to work is a common thing for lots of people in the Netherlands, where this study took place. Mobile technologies could support designers to use this precious time in a productive way. Some designers already do this. One designer tells us, "I love the train as a place for working or writing". However there is still a long way to go to allow this kind of mobile work in terms of providing better support and making it more affordable. For example, in the diaries we saw that the very first activity that designers did when they arrived at the office was checking their email. This kind of activity could be done while commuting to work. Although this option is already available, designers or architects do not use it massively.



Figure 4: Picture taken by a participant of the Cultural Probe study to illustrate 'teaching at the University' as an activity outside their studios.

4.3 Conclusions from the user study

Based on the probes and the questionnaires filled-in by architects and industrial designers, we defined the following conclusions for this user study:

- Designers confirm that an important part of their jobs occurs outside their studios.
- Visiting clients and other architects or designers, visiting construction sites or places for future building, as well as places where their designs are being developed are very common activities among designers.
- When going out for those visits, important tasks for them are sketching, taking notes and discussing about the designs with clients or colleagues.
- Sketching is an activity in which the use of computer applications is very uncommon and so, a field in which development of specific software could be done.
- Taking notes seems to be evolving from the use of pen and paper to the use of computer applications. The time spent in taking notes on paper and later making them digital is the main reason given by the designers for that change. The same could be applied to sketching, but designers still feel sketching on paper is quicker.
- Taking photographs is an essential task for both industrial designers and architects; therefore any future technology developed should take good care of this.
- Groupware and collaborative design seems to be another field in which special applications for designers could be developed with success.
- Designers have a close relation with technology. Laptops and mobile phones are the most common mobile devices they use. PDAs are also used by some of them, but much less frequently.
- Designers see technology as a mean, not as a goal. Manual work is something they like and do not want to lose. They feel comfortable with present technology and seem open-minded about new technologies.
- A good and easy relation between mobile and fixed devices seems essential.

5. Discussion on Methods Used

We used two contrasting methods to gather data from our participants. We were hoping that comparing our findings from the probe study with the questionnaires would allow us to confirm and hopefully expand some of our findings. In that sense, we found several coincidences between both studies in relation to the answers participants gave.

Due to the exploratory character of probes [6], when compared with more traditional methods for data collection, its results may sometimes seem to be 'incomplete' or 'vague'. However, it is in this open nature of probe results that designers and researchers often find inspiration for their designs, prototypes or systems. The questionnaires allowed us to pin down some of that

vagueness and confirm some of the initial findings. On the other hand, we should have had more direct contact with our participants and discuss our findings with them. A follow-up interview with our probe participants to discuss specific aspects of their probes could have shed more light into the needs of users and their preferences in terms of usage of mobile technologies. These types of discussions allow researchers to complete the stories that participants initially wanted to share with us through both the notes from their diaries and the pictures they made.

6. Conclusion and Future Work

After this user study we are able to make some generic proposals to introduce mobile technology for designers. The mobile device that is thought to be more suitable for architects and designers when being outside their studios is the PDA, even in spite of not being now as popular as laptops or mobile phones. To succeed, PDAs should include specific applications for the designers, so that they will not only be used as agendas or calendars, as they are mostly used nowadays.

As we could see through the diaries, sketching is a very common activity for designers, both when they are in their studios and also outside. We could also see that sketches are still made with pen and paper [10]. Of course the ideas from the sketches on paper have to be made digital afterwards, losing time and accuracy. PDAs could be good devices to support sketching tools, especially because of the use of the digital pen, so that the designers would not lose the traditional way of sketching, while adding at the same time the advantages of “being digital”.

Another important media for designers is pictures and photographs. Considerable work has been done supporting picture management, however, again with a focus on a stationary setup. It is important to support the possibility of mobile portable devices to intuitively interact with an application running on a fixed device (for example stationary systems such as the VIP [1], Designers’ outpost [2], or the Cabinet system [11]).

The other field in which PDAs could be very useful for architects and industrial designers is collaborative working. Meetings with other designers and architects are very common and so are working together over printed plans or computer designs during these meetings. A good idea would consist on a fixed device, to which some designers could connect their PDAs and interact simultaneously with each PDA over a common design shown in the fixed computer, being able to visualize what the designer and others do. Some research projects have addressed some of these aspects [12, 13], however not directly connected with the design domain.

The results of the study showed the importance of being mobile and helped us to identify activities that take place

outside the office. It also showed that current mobile technologies are not well suited for most of these ‘mobile’ activities. Directions for future development were also identified. The next step will be to create prototypes that can be quickly developed and evaluated with designers and architects. We are considering evaluating these systems by letting the prototypes themselves act as a technology probes [14].

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