Artifacts in the design process of pervasive computing

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Abstract

In this work we want to share and discuss our approach for designing new interfaces and applications for pervasive computing. We want to outline some of the tools we are currently using and investigating. Our research aim is to create usable tools that enrich the design process while inviting a broader audience to participate. The creation of artifacts with the appropriate fidelity in each phase of the user-centered design process is an essential task as it moves the concept in iterative steps forward to a satisfying and usable result.
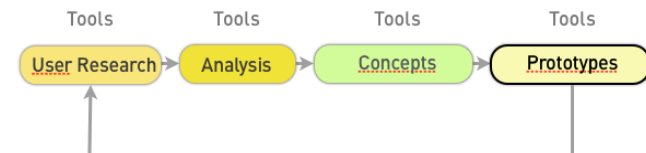
Fig.1 Appropriate tools for each phase of the User-Centered Design Process with the right fidelity

Keywords

ideation, process,ubicomp,toolkit,design,artifacts

ACM Classification Keywords

H.5.m Information Interfaces and presentation (e.g. HCI): Miscellaneous.

Introduction

On the rise of pervasive computing traditional design development methods do not stand for the design needs of tomorrows technology. While paper proto-typing [11] & guerrilla HCI [7] are appropriate for screen based interactions, if applied correctly [5], there is a demand to span the bridge to pervasive computing scenarios where we have to look at extended methods in order to get the design right. Tools that make the process accessible to a wider audience including engineers, artists, designers and businesspeople. Or as Svanæs et al. accurately described the need to *"supplement existing design methods with approaches that embrace the physical, social and bodily nature of interaction"* [12]. Artifacts can play a significant role in mediating the process and enable a bigger audience to participate in the development cycle. When designing new interfaces and services that are not necessarily equipped with a screen or have a very subtle way of interaction there are various ways to simulate the users experience, such as acting out a scenario [4], body-storming [10] and sketching [3]. As multi-disciplinary teams play a more and more important role when developing complex applications with many touch-points, a language is needed where the whole consortium is able to communicate quick and efficient. A lower fidelity in the first phases of the user centered design process is helpful because techniques such as experience prototyping [2] require time and expertise. In order to generate artifacts that include users and team members at very early stages in the ideation phase we currently investigate which tools can enrich each phase from key data collection, user research, analysis, scenarios to experience prototyping. We want to provide appropriate new tools in the form of artifacts that will especially lead to meaningful interactions in the area of pervasive computing and design handover points, when a project transfered (e.g. an executing company) and crucial information regarding the concepts and prototypes gets delivered without loss. For each phase of the user-centered design process we will apply tools with the appropriate fidelity (see Figure 1) For the *user research* and the *experience prototyping* phase we will mention some tools and techniques we are currently investigating.

Sketching with Objects

In the user research phase of the design process for a new guiding system in a museum we have incorporated the use of cardboard props that can enhance conversations and would explain a complex technology
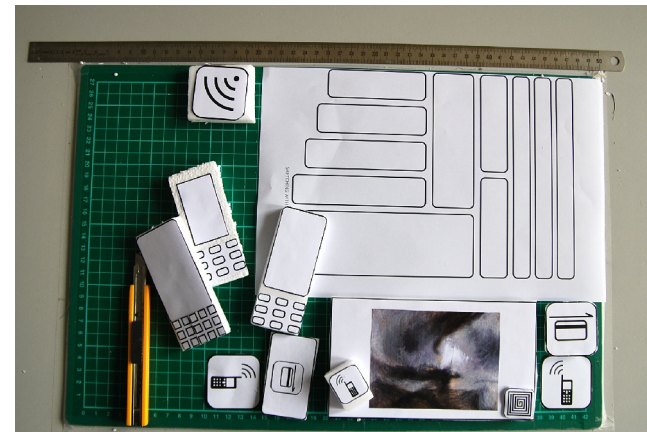

Fig.2. Sketching with Objects for a museums guide

easily, related to [1]. We have created various forms of cardboard props from interaction techniques (see Figure 2) that can be included in the conversation with a potential end user. The props serve as informal low-fidelity artifacts that can stimulate the ideation process

and help to stay focused on the topic while performing user research or judge if a technology would be potentially appropriate or not. Other team members can add their ideas on top and these artifacts can serve as a brainstorming documentation or be used in a video prototype. Simply acting out can happen on-the-fly in order to receive a first feedback and to explain a complex idea visual. In addition to Tohidi et al. [13] and to penetrate the intimidation barrier while sketching objects we have created a set of icons on A4 sheets with various interface elements which can be cut out easily and used as props so team members (engineers) and potential users do not have to worry about designing or sketching themselves.

Sketching in Hardware

Arduino [9] is a low cost & easy-to-use prototyping platform we are currently teaching and using in order to create quick and efficient experience prototypes. With this little micro-controller it is very labor-saving to create electronic sketches that emulate the look and feel of a new product or service. Some recently developed electronic sketches in a module taught to university students ranged from remote controls to learning toys. The remote for example can shuffle songs or change the volume when in an environment where tidiness is an issue (e.g. cooking). The communication cubes for public spaces can tell your mood or demands in an ambient way (see Figure 3), a sketch for an educational learning tool would teach kids if their mathematical answer was correct or incorrect by nodding or shaking the head. These early experience prototypes served as an appropriate tool to develop ideas further and make the design explorable to others. Engineers, designers and computer scientists can easily

access this environment and create their own circuits and prototypes after a short introduction.
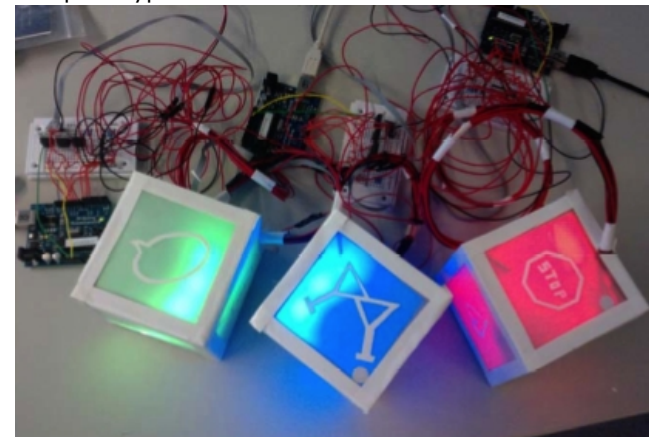
Fig.3. Communication Cubes, experience prototypes

Rapid 3D Prototyping

In order to reach a higher fidelity while sketching objects we are working with low cost & open-source 3D printing and scanning platforms [8]. These tools are used to rapidly produce variations of artifacts that have been evaluated positively in early low-fidelity user studies. Elements can be modeled with clay, scanned & printed to explore first form ideas further. While other 3D printing platforms have high production costs, the main advantage of this machine is to produce different designs very cheap. This gives us the opportunity to offer a range of forms to a potential user group, test ergonomics and filter out unwanted or irritating design elements in usability test sessions.

Ongoing Research

In our research project we want to investigate which tools are necessary to involve both, engineers and designers with equal parts in the design process. Evaluations from former research projects in the area of

pervasive computing [6] showed that team colla-boration and a common agreement on the general direction of the project could have been improved. Communication was difficult when designers and engineers had to make decisions that would lead to completely different directions. Often the opposite part had a complete different viewpoint on the design and how to achieve the common goal. While these kind of issues are often regarded when designing a screen based application together, things are not becoming easier when the task is to design an even more complex system that exists on many places in various forms. We want to establish a culture of prototyping that understands the demands and needs of many and offers the appropriate communication channels/affordances on both sides.

Conclusions

In order to develop useful pervasive applications and services we will need meaningful work-process methodologies and tools that can help engage team communication, facilitate user studies and include a wider audience in the discussion to make this technology helpful, accessible and enjoyable. Therefore many research questions have to be answered, artifacts that have been created in the design process can significantly enhance/stimulate communication patterns or spark creativity. To name some questions we want to discuss while at this CHI workshop: How might we enable a broader audience to participate in the user-centered design process easily ? How might we create appealing artifacts that enrich the team communication and serve as a discussion mediator (sketching language) ? How might we design good handover points with prototypes that convey the idea and relevant data in a precise and understandable way ?

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