Designing Tangible Interactions for Aged Users Though Interactive Technology Prototyping

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Abstract. This research aims to explore how to bring the richness of tangible interaction designs into the everyday living and working contexts of the aged users. To do so, we introduced an interactive technology design at two Chinese Universities, for the first time interactive prototyping skills become important for their undergraduate and graduate students to learn and practice. In an interactive prototyping course, a number of prototypes designed for aged users were built and experienced. From these prototypes, experiences for regularly running interaction design education based on traditional industrial design education were discussed.

Keywords: Interaction design · Interaction qualities · User experience · Interactive design technology · Context of use · Aged users

1 Introduction

Being educated as industrial designers, the design students at the Tongji University and the Beijing University of Technology are used to and are good at crafting physical car models, designing graphical illustrations and making Chinese porcelains. However, interaction design, specifically interactive prototyping will play a crucial role in their educational curriculums in the coming years. In order to improve the fit, we organized an interactive technology design course with experts from practice. The goal was to help the students learn and practice interactive prototyping skills by developing interactive and working prototypes.

Key questions for students are: how does aged users experience and use a product? What is his understanding of that product? Is it the design of the product that determines or influences these responses, the needs and abilities of the user, or the environment in which it is used and its social context? Experience design [5, 9, 23] brings a broad perspective to the design of product interaction, encompassing such traditional activities as product styling and user-centered design but additionally requiring attention for all psychological effects elicited by interaction including stimulation of the senses, meaning and value attribution to the product and the feelings and emotions that are elicited. In the traditional product design process [12, 19, 30], there are insufficient provisions to consider the design of interactive products. Alternative approaches propose a highly

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iterative design process that allow for concepts to grow by making experiential prototypes (also called sketches in the early stages of the design). Important roles of these prototypes are to allow the designer to communicate the concept to the design team and to give him insight on how well the designed features of the interactive product concept match the design brief.

2 Related Work

In aged user interaction design domain, Keller [10] designed cabinet that helps designers collect and organize their visual material for inspiration. The design makes interaction with digital material more physical by dragging digital images on a table as if they are real objects. It offers a fluent way to add physical material to the digital collection by digitizing and projecting any objects placed on the table. This type of study was followed by several other recent projects in the domain of computer supported collaborative work (CSCW), such as designing an intelligent robot worker that transports goods and samples in semi-public hospital context [13] and designing a shape-changing communication device that facilitates expressive 'knocking' communications [20]. Another example is the intelligent reading lamp, which aims to demonstrate ethics and esthetics in products and systems. By moving the hand over the lamp, a 'living light' can be directed onto an object such as a book.

3 Settings

The interactive technology design course aims to equip students with design theory while gaining practical experience in the development of interactive prototypes, which utilize potentials of embedded interactive technology in products in terms of enriching user experience [1, 6, 7, 22]. Max/MSP, Phidgets sensors and Arduino were selected as development environments. These tools make it possible to build experiential prototypes, even with students who have few electrical and programming skills [15–17]. Fifty students worked in teams of three on three design briefs concerning aged user group's styles of interaction in an office context. The concept and prototype development involved a total of five phases. The first two phases focused on exploring conceptual possibilities and building initial prototypes by hacking existing products. The third phase aimed to nut-crack the hardest technological problems and further develop the concept to a mature level. The fourth phase involved users, while the last phase targeted on integrating user comments to finalize the prototypes.

4 Approach

Our research objective has been to explore how to bring the richness of tangible interaction designs into the everyday living and working contexts of the aged users. This is an interesting challenge that presents itself to developers, designers and researchers. The course lasted for a total of seven calendar weeks. It run in parallel with others and it was

supposed to take up one and half days per week. We developed a design brief together with the brief holder who contributed some money to partially cover prototyping material and expenses. After a kick-off presentation, the students were distributed into teams, and each team received the same brief. We made sure that each team had at least one technology-focused students, although the course does not assume any technology expertise. The course consists of five iterations of increasing length, each one producing a prototype with a different focus. The five iterations can be summarized under the form of assignments given to the students.

We envisage using interaction qualities [3, 14, 21] as design guidance and a new approach that can help researchers, designers and students to integrate functional design, experiential interactions and interactive technology. Some interaction qualities (e.g., playful, collaborative and expressive) were explored and used as design guidance. The students were asked to explore IT supported user-product interactions through learning the characteristics of different sensors and actuators, how to program them, and how to employ them in realizing engaging interactions [26, 28, 29]. They had to focus on the experiential interaction qualities instead of programming details. The primary goal for the students was that it had to be a working demo and to be engaging for aged users.

5 Interactive Technology Designs

From the beginning and throughout the whole research, digital and physical prototypes that are rich in aesthetic, expressive and experiential quality are built and tested in real living and working contexts. To ensure a high flow of thoughts, ideas and knowledge, a research through design approach is taken, in which the generation of knowledge and the development of applications go hand in hand. Research through design is used as a form of research to contribute to a design activity [2, 4]. It is recognized as a form of action research, defined as systematic investigation through practical action calculated to devise or test new information, ideas, forms or procedures and to produce communicable knowledge [8, 31]. Action research is an iterative process involving researchers and practitioners acting together in a particular cycle of activities [24, 25]. The research through design approach is highly iterative, integrating theory and practice from different fields into working experiential prototypes. These prototypes can be experienced as working artefacts and can be used as research means to demonstrate and explore these theories [11, 18]. Designing and building working prototypes that are rich in experiential quality therefore plays a key role in this approach. The reflection on the action (of designing and building) creates new knowledge. The designing act of creating prototypes is in itself a potential generator of knowledge [6, 17], leading to new design insights and refinement of research issues. Below are brief descriptions of three concept interactive designs for aged users, concerning their real living and working contexts.

5.1 Glasses

Glasses is an interactive installation designed for aged users with bad eyesight. They wear glasses to read newspapers and might always forget where the glasses are put. This design helps them to allocate the glasses and to form a good habit of putting the glasses

in a box. A user swipes in the front of the box to open it. After reading, while the user folds the glasses, the box opens and lights from inside glows. This indicates the user to put back glasses in a good order. Infrared and bend sensors are embedded in the box and in the glasses. See Figs. 1 and 2 for an impression. A video scenario can be found at http://v.youku.com/v_show/id_XNTkxMDA5OTgw.html.

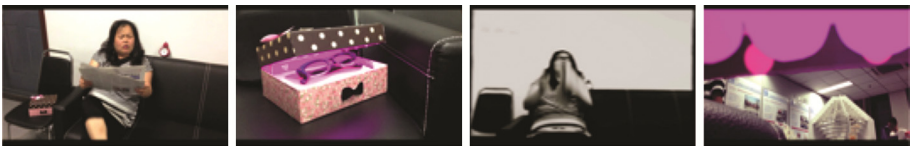

Fig. 1. The user interaction of glasses

Fig. 2. The design and development process of glasses

5.2 Toy

Toy is a pair of interactive devices designed for aged users and their family members to communicate with tangible inputs. A user touches and twists one device to trigger rotation and light effects on the other device. This indicates that a message is sent and attention is needed. Rotation and light sensors are embedded in the design. See Figs. 3 and 4 for an impression. A video scenario can be found at http://v.youku.com/v_show/id_XNTkxODEyMzI0.html.

Fig. 3. The user interaction of toy

Fig. 4. The design and development process of toy

5.3 Puppet

Puppet is an interactive device designed for aged bus drivers. This design helps them to exercise and get a quick massage after a long time driving. Every one hour, the device activates and asks the user to rest for a while. It starts vibrating and generates voice commands, which guides the user to tap and massage shoulder, arm, leg, etc. After completing the commands, the vibration stops. Vibration, touch and gravity sensors are embedded in the device. See Figs. 5 and 6 for an impression. A video scenario can be found at http://v.youku.com/v_show/id_XNTkzMjY3MTE2.html.

Fig. 5. The user interaction of puppet

Fig. 6. The design and development process of puppet

6 Discussion

All prototypes show promise by providing novel user interactions - that is the power of making experiential prototypes. From working on the design assignment, the students understand that aged users, context and action are the key elements of interaction design. They designed and tried out various ways of interacting. With skills, students can design and build more interactive prototypes in other domains.

We have mentioned that the objective of the course is to teach students how to create concepts in a group for interactive products manifested as interactive experiential prototypes. This objective places technology in a clear ancillary role. The course structure, based on group work, tends to obscure individual contributions and, in particular, makes it impossible to evaluate the degree to which students have learned prototyping technologies. Moreover, the number and complexity of the deliverables encourages the students to take on the project roles that we have already mentioned. In learning terms, the consequence is that a student may go through interactive technology design without ever writing a line of code or touching a soldering iron. While the course has a big space for techniques of all sorts, something that we personally delight in, it remains a design course in a faculty of Design.

The course was done in an educational setting but not in a practice setting of commercial product development, because in the educational setting we can take control, pay attention to design interactions and structure the course as an exercise, which does not have to have full complexity and pressures of commercial reality. The students in the course are also treated as designers.

The limitations of this course include the short amount of time, insufficient knowledge on interaction design from the students and lack of comprehensive user tests.

7 Conclusion

We have presented the model of interactive technology education. We have seen this aggressively prototyping oriented approach produce good designs that have resulted in publications and products. Our contribution to the existing body of knowledge is to draw attention to IT supported new ways of interacting that will have a great influence on aged users. Our findings have implications on the development of the future products, services and systems for aged users should utilize the power and advantages of modern, appropriate and innovative interactions and technologies. We believe that this same approach could be used for other adjacent domains that do not have a physical base like web application design or mobile application development. Designing and prototyping interactions successfully promoted the students to learn and practice interactive prototyping skills.

8 Future Work

In order to accumulate experience on interaction design education, the next step is to conduct more prototyping studies on the incoming research projects within the college, to run user tests and to set a curriculum syllabus. These prototypes will get evaluated based on how it functionally works, how its user interactions fit into context and how it can benefit future ways of living and working for the aged users.

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