Designing GUI for the User Configuration of Pervasive Awareness Applications

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ABSTRACT
In this paper we present the design of graphical user interfaces for end user tools in order for them to be able to configure pervasive awareness applications. These will help them keep in touch with close friends and family. A user-centered analysis was conducted, scenarios were developed and paper prototypes materialized in the form of storyboarding. The prototypes were evaluated by experts and proved that the interaction style and the metaphors used had specific constraints. Finally, conclusions based on this study were drawn.

Categories and Subject Descriptors
H**. [Information Systems],** H.5 **[Information Interfaces and Presentation],** H.5.2 **[User Interfaces (Graphical User Interfaces GUI)]**

General Terms
Design

Keywords
Pervasive Awareness Applications, End User Tools, Graphical User Interfaces GUI, Teenagers, Elderly People

1. INTRODUCTION
This paper describes research in supporting close family and friend relationships to keep in touch with each other. This is achieved by the mediation of pervasive awareness applications. From this perspective, the proposal is not new. It adopts the design theory/framework of the ASTRA project [1], which investigates the concept of Pervasive Awareness and the design of pervasive awareness systems for supporting social communication. The main characteristic in the previous approach is that end users individuals and communities function as designers of their own awareness systems.

We extend this investigation by developing two user models: young adolescents and fit older people. We point out the idiosyncratic needs, which are characteristic of them and are a result of their specific way of life, culture and their need to communicate. We examine the existing media, their relationship with technology and their special requirements.

Based on the user-centered approach we introduce graphical user interfaces for supporting lightweight social communication between people at home. In one such environment everyday objects are augmented with sensors and actuators to provide value added services (artifacts). Our goal is that people with the mediation of end user tools are able to programme artifacts and to easily configure their own applications according to their needs and wishes. A necessary condition is the usability of these tools so that end users are not only able to but also urged to use them.

In contrast to the majority of these end user tools that are proposed e.g. [3, 5, 8] and which very often satisfy the need for usability for specific tasks-usually the configuring of applications or even awareness applications by end users either novices or experienced-we introduce a different approach. In agreement with Robins and Webster (1999) [14] *this approach intends to go further than technical interpretation and supports that information is also a social relationship*. It is not enough for people to be able to easily manipulate technology but to integrate it into their way of life, their culture and their individuality. Technology should not put limits to people's imagination. On the contrary, it should stimulate it because *our imagination can offer us directions, hope and a sense of our place in nature and society* (Bookchin, 1982, source [14]).

Pervasive awareness systems aims at social communication and more importantly, emotions such as love, respect etc. In such a context we assume that concepts like art, creativity and entertainment can help people express themselves more efficiently. Despite the fact that previous projects have provided our investigation with a solid base we introduce for discussion new directions and aspects, via aesthetic and creative experience. These can help to better integrate pervasive awareness systems in people's everyday life.

2. CONFIGURING PERVASIVE AWARENESS APPLICATIONS

In this section we will present two GUI proposals of end user tools, which are directed at elderly users who might have had very little or no programming experience (2.1.) and young adolescents middle of the range users (2.2.). These end user tools are software. The first can be run on a PC tablet, alternatively with a touchscreen and the second on a PC.

2.1 Bee Prototype

It is fact that the elderly adopt new technologies slower than others. But if the communication methods provided are valuable to them, they may overcome their inhibitions. Older adults selectively limit their social interactions, and focus on established relationships with relatives and close friends. They value reciprocity in their social relationships and the heterogeneity, especially of age, in their social network [12]. As a result we designed interfaces, which are aimed at a wider group of elderly users. We have taken into consideration the cognitive/natural characteristics and their implications for interface design [4, 6, 9, 13] and we have emphasized the empowerment of the user.

Interface is made up of different interaction styles (wizards/form filling), which direct the user and facilitates the learning process. The main functions of the system are obvious and as little as possible. For the completion of task, progression through the interaction is basically linear: the user follows successive steps, which appear. Parallel to this, more possibilities are offered to the user when necessary. He is able to change directions by means of the correct connections and come back to complete his task. Because cognitive function of recognition is easier than recall, especially for the elderly, in most cases users choose from the available choices. It is rare for them to be asked to fill in a form according to indications given. Sometimes to avoid using many steps for the completion of a task, dialog boxes and pull down menus are used.

Figure 1. The Bee prototype: peer selection and application creation.

The layout of the graphical user interface is based on the beehive form (see Figure 1). This symbolizes social connectedness, which is one of the main motives to use pervasive awareness systems. Colour classification has taken place and this helps the user to distinguish data and to become aware of the moves needed to correctly complete the task. In addition the red/green colour is used in certain texts and images and represent active/not active. Black and white images change to colour to indicate the users choices. On every screen the user is informed by icons and in words of the steps he must follow. Each screen is divided into two basic areas, the frame (coloured) and the work area (grey). In the first, the facts are repeated on all screens at the same place. In the second there is the title of the task, explanations and the choices he has made in the previous steps, as a reminder. Finally the users' images enrich the interface and create a sense of contact for him. All the above aim not only to facilitate use but to also create a familiar and pleasant graphical user interface.

2.2 Haring's World Prototype

Adolescents are immersed in a technological world. They use a variety of technologies in their daily lives both inside and outside their homes. They especially value communication with their peers. The reasons they communicate are social, lessons, dates but mostly they are emotional. They seem to enjoy this company, sharing with them despite the interference of devices.

Teen's indicated that they appreciated it if a medium allowed them to contact others in a quick and easy way and they wished to have a more personalized control of interactive media. They prefer simple, ephemeral and expressive interaction: graphics first versus text first, play versus work, fantasy versus reality. The surprise factor is valued and they like seeing images of those they are communicating with and sharing secrets with their best friends. Especially teenage girls are primarily interested in communication, emotional contact and beautiful things. Technology for girls is an intermediary to achieve their goals [2, 7, 10, 11, 15].

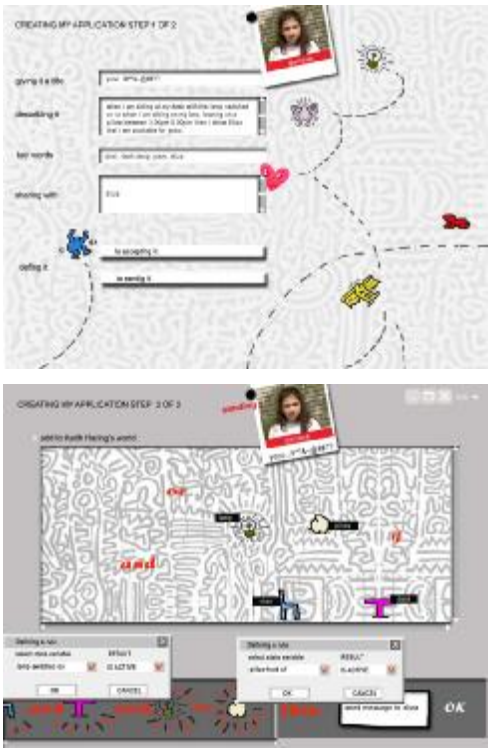

Figure 2. Application creation and rule editing in the Haring's world prototype.

The interface design should communicate the purpose with familiar, initially intuitive affordances. In our proposal we introduce a graphical interface where the teenage user will work in a creative and fun way. Haring's world (see Figures 2, 3) provides four main GUI's components and offers two choices. Users can compose applications and communicate simultaneously with friends (e.g. MSN) in order to plan their applications together. Also, they can adapt the interface according to their taste. There is a mixed interaction style (WIMP, form filling, widgets) with which potential users are familiar.

We give the user the initiative not only to device his application but to represent artifacts from his natural environment by sketching on the virtual environment. He defines associative links by playing but essentially applying logical calculations (see Figure 2). The freedom of the line gives the user the ability to represent any applications guided by his inventiveness. He is given room to question himself and to control new possibilities of augmented artifacts, which offer both social and human features. In this metaphoric way the user distances himself from the technical interpretation-something which is achieved in the project CollaborationBus [5] using the pipeline metaphor-but on the other hand the user's imagination is cultivated. We consider this more important especially in the adolescent phase. Rule editing leads him to the philosophy of programming which will slowly facilitate the composition of more complicated applications. In this way more functions are added such as entertainment, cognitive/learning and the development of skills. At the same time, the work of Keith Haring gives style to the interface environment, serving as an example of creativity.

Figure 3. Haring's world prototype is aimed at young adolescents.

3. EVALUATION/DISCUSSION

The beginning phase of the design has materialized in the form of paper prototypes using storyboarding. We have also completed formative evaluation by experts using questionnaires. These have helped us reach the conclusions that the applications and their basic social operation, although innovative, were understood and their aesthetic pleasantly accepted

More specifically the usability evaluation of prototype Bee and the interaction style that was applied showed that it was generally suitable for older users and the following problems were highlighted:

- The effectiveness of the system may be a disadvantage to its efficiency. Even though we believe that effectiveness of a system is more important than efficiency for older users it doesn't cease to be a problem because we appeal to a wider group of users.
- In the programming the users memory load is not too small (being important for older people) and there is difficulty recovering from errors and changes in the previous task. We believe that this results from the existence of many steps.
- A problem could also arise when the number of artifacts is too big.

For more complete answers other interactions styles will have to be explored (we propose speech dialogues) and comparisons made of the results.

The usability evaluation of rule editing of the Haring's world prototype showed that the application is discerned by satisfactory ease and learnability. Bad handling, if not dealt with can reduce efficiency during its use. Specifically:

- Because logical practices require familiarity on the part of the user and mistakes can be made in the rule editing, users should provided with error prevention tolerance and reversibility of actions.
- Complicated scenarios can detract from the advantages of rule editing.
- There may be difficulty in representing meanings and complicated descriptions by sketching.
- Users who don't know how to make logical calculations or formulate descriptions will face problems.

Generally the interaction style applied in the first proposal and the metaphors in the second have constraints. Some of them can be improved in a potential iterative design, but not all. We have the view that more emphasis should be placed, not only usability issues but also on social aspects, psychological issues, emotions, creativity and entertainment. All these must be examined and evaluated in the awareness system design. The end user development should not focus mainly on tools but also on the attitude that the user adopts.

4. CONCLUSIONS

In conclusion we consider reciprocity in social relationships very important, something which suggests that a system should enable bi-directional communication. Users should be able to exchange information, control what information they share with whom and manage their accessibility to others users instead of monitoring each other. Interface should also be examined to see whether it can satisfy older adults and younger users at the same time.

Finally we believe that it is more important to provide people with the ability to control tools and artifacts adapting their applications to their personal needs and wishes. At the same time they must cultivate their imagination and creativity as opposed to becoming technological professionals. Investigations must be centered around the person who should not only be able but also motivated to use new systems in order for them to be part of his everyday life and to improve the quality of his life.

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