Social Mobile Interaction using Tangible User Interfaces and Mobile Phones

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Abstract: This 'work in progress' paper presents an investigation of mobile input devices and interaction techniques on their effects on social engagement for children when interacting with virtual characters. We call interactions *social mobile interactions* if they increase social involvements. *Social mobile interactions* are collaborative interactions to create social experiences between children in a group as well as social engagement with the virtual characters. We describe our first findings of adequate input devices and interaction techniques which might support social and emotional learning for children. The tangible user interface (TUI) called *Display Cube* and a mobile phone interaction technique called *touching* are discussed on their efficiency creating social interactions and engagement. Finally, we describe our future work including planned user tests.

1 Introduction

Children use a special way to interact with things surrounding them. These things imply both objects of the real world and objects of the virtual world. Children's mental model of how things works as well as their physical skills and social engagement are often different from adult's ones. These aspects must be considered when developing children-computer systems. Current input devices such as a keyboard and a mouse do not consider children's special needs. Smets describes in [9] that children encounter difficulties when interacting with traditional input devices and a 2D screen, because action and perception are spatially separated.

Children want to use technologies which support their curiosities, their love of repetition and their need for control as Druin points out in [1]. One way to find appropriate devices and interaction techniques is developing systems which are hands-on but which supports interesting and innovative interactions which enables social interactions and engagement. In the following, we present first ideas on interactive technologies for children in the interdisciplinary EU project e-Circus [2]. The project investigates how social learning may be enhanced through interactive role play with virtual characters that establish empathetic relationships with the learners. It creates interactive stories in a virtual school with embodied conversational agents in the role of bullies, helpers victims etc. The children run through various bullying episodes, interact with the virtual characters after each episode and provide advice to them. By taking on the perspective of the virtual characters, the children should come up with a better understanding of how to cope with such situations. Our objective is to investigate how different input devices and interaction techniques affect social learning. We suppose arranging collaborative interactions in a group increases social interactions between children and fosters social skills.

2 Social mobile interaction

The most challenging part of our work is finding new and innovative interaction techniques and devices building social skills for children. If an interaction device is used in a mobile fashion, collaboratively, hands-on and creates social skills, we call this interaction *social mobile interaction*.

*Social mobile interaction*s should address the human-human-interaction between children within a group as well as the human-computer-interaction between children and the computer system. The question is how to build social interactions. We suppose that collaborative interactions increase social experiences between children in a group as well as a social engagement to a virtual character of a role-playing game. Collaborative decisions force children to discuss about the scenario and the virtual characters to know about the attitude of the other children. Furthermore, they have to talk about pro and contras to arrive at a decision about an appropriate advice for virtual characters.

To enable collaboration and communication between children, the input device should support arrangements enabling discussions and a collaborative decision. Moreover, input devices should support mobility and display functionalities. Mobility allows children to hand around the device and to walk around while interacting with the computer system. Mobility means a more natural and immersive interaction. Display functionalities allow children to receive more and detailed information which might enrich their discussion.

Finally, we suppose that interactions with real world objects can increase the immersion of the children and increase the social engagement to virtual characters. For our project, children can interact with two kinds of physical objects of the real world. Physical objects can even represent different suggestions or the virtual characters of the role-playing game. The representations of all suggestions give children a mnemonic of possible advices. Once they have decided to advice one of the suggestions they can easily interact with the real world object to perform their selection.

The other kind of physical objects of the real world are representations of virtual characters. A representation of the virtual characters in the physical world might be a way to provide annotations. In this way they can get background information about the respective virtual character, e.g. more information about the bully to understand his behavior. Thus, we suppose interactions with the real world can enrich the scenario and increase the immersion.

3 Input devices for social and emotional learning

Elementary, we need input devices and interaction techniques to support a selection of children's suggestions for a virtual character. However, to achieve a social engagement, devices and techniques are required to support collaborative interactions to increase interpersonal communication and social interaction between children. Stanton describes in [4] an evaluation between children's collaborative work. Her results show that using only one input device per group might increase communication between members of a group whereas one device per child increases the effectiveness to perform a certain task but normally decreases the social contact between the children. Moreover, Stanton points out that one child might dominate the decision making when using only one input device. We decided to use a single input device per group to investigate the children's behavior. We want to see if it implies collaborative decisions and increase children's attendance to communicate. We introduce and compare two different input devices which are aimed on the children's needs. We suppose that the introduced *Display Cube* particularly considers needs of younger children with reading impairments in an age of 7 up to 9 years because it is more easy and intuitive to use whereas mobile phones are addressed to older children who are used to a mobile phones usage. In contrast to TUIs, mobile phones offer a wider range of interactions and more detailed annotations to characters or the episode. The mobile phone can be used as selection and information device. It can display information on the mobile phone regarding any real or virtual object. The information functionality might enrich the experiences for the children which could increase their social engagement for the virtual character.

3.1 Tangible User Interface (TUI)

Tangible user interfaces (TUIs) seem to be appropriate for a usage as interaction device in context of *social mobile interactions*. Generally, TUIs are physical objects of children's everyday life. They aim to provide direct manipulations by mapping between behaviour of the tool and usage of such a tool and between semantics of the representing world (the control device) and represented world. Normally, they are mobile and not restricted to a single user. Moreover, their manipulations are familiar and intuitive. Holleis and colleagues developed a tangible learning appliance, the so-called *Display Cube* [3] as displayed in Figure 1. First experiments have shown that the shaking and turning of the cube helped to engage children in learning tasks and fostered interaction between them. We therefore consider the *Display Cube* as a promising interaction device for e-Circus. However, in our case, the objective is not to teach vocabulary or math. Instead, we use the cube as a collaborative input device in an interactive story telling environment that should increase social skills and affective engagement of children.

On the different cube sides the *Display Cube* visualizes suggestions, such as tell an adult, children can propose to a virtual character. Children in a group can hand around the cube, switch the sides and discuss about the different options. Finally they can collaboratively decide for an advice to the virtual character and perform the selection by shaking the cube when the preferred suggestion is lying on the top. The children do not only interact with each other, but also with the virtual characters that are displayed on a large screen and may express, for example, doubts regarding the feasibility of the advice given by the children and ask for another tip or repeat their request for help if the decision-making process takes too long.

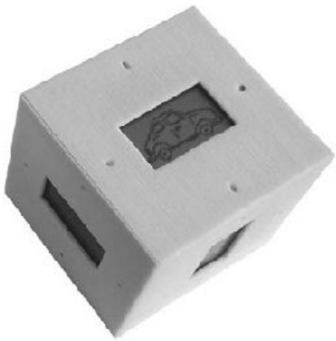

Figure 1: Display Cube

Using the *Display Cube* as a means to select among several options, the children may decide collaboratively how the story evolves (even though it is not guaranteed the character always follows their advice). Thus, in our point of view the *Display Cube* might be an appropriate device for *social mobile interactions*.

3.2 Mobile Phones

Another useful input device in context of *social mobile interactions* might be mobile phones. Mobile phones and their sensors offer a range for new and easy to use interaction techniques. A NFC [5] reader as provided for the Nokia 3220 [6] can be used to implement the mobile interaction technique called *touching*. Figure 2 shows the Nokia 3220.

Touching requires real world objects which are augmented with RFID tags. A child performs a selection by simply touching a physical world object with the mobile phone. Afterwards the mobile phone can display hints and background information, e.g. more detailed information about the respective virtual character. In this way the mobile phone becomes a guide and selection device in a social interaction context. The combination of the virtual and the real world enrich the interaction experience which addresses children needs for control and curiosity. Almost every physical object of the real world might be used as representation of the virtual world.

We are currently developing several prototypes. For the first prototype we decided to use the so-called *circle of decision* which is displayed in figure 3. This circle is split in different parts representing different suggestions children can advice to the virtual character. During the scenario children can sit around a table and discuss about the suggestions of the circle. The can turn around the circle to discuss advantages and disadvantages of each option. This arrangement can increase the social interactions between the children and their social engagement. Once they have collaboratively decided, a child selects the respective part of the circle by touching it with the mobile phone. This interaction is quite easy to use.

Figure 2: Mobile Phone as Interaction Device

For another mobile phone prototype we extended the first prototype by using physical objects as representations of the virtual characters. Each of the virtual physical objects is augmented with a RFID tag. Once a child wants to receive annotations to a character it simply touches the physical objects and gets information on the mobile phone.

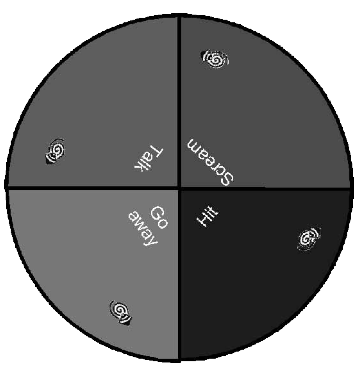

Figure3: Circle of Decision

The combination of the virtual and the physical world might enrich the experience of the children. It should enable interesting and innovative interactions for the children. In our point of view these interactions enable playful and hands-on interactions for children which increase collaborations.

Apart from *touching* we are planning to investigate more aspects of the mobile phone interaction. Currently, we are investigating other mobile phone sensors and their usage. The Nokia 3220 supports access to a 2D accelerometer. This information can be used to implement a tilt sensitive user interface. We are planning to implement such a user interface for our work.

4 Related Work

Until now, research in areas of TUIs and mobile phone interactions has mainly addressed the usability of the system and economical aspects but not the social part of the interaction. However, several of these works is related to our research. Välkkynen describes in [7] the mobile interaction technique called *touching*. He firstly used this technique to interact with physical objects. Lampe [8] is also working in areas of real world interactions using mobile devices. He built an augmented knight's castle. Children can receive annotations to physical objects when touching them using a mobile phone. In this way he enriched a traditional toy environment with additional information. Sheridan [10] investigated the cube as TUI. She found affordances of the cube as 3D object and possible manipulations, based on action, description and events.

5 Conclusion and Future Work

In this paper we introduced our first findings of input devices and interaction techniques on their efficiency in creating social experiences and engagements. We called this kind of interaction *social mobile interaction.* We described requirements for a social interaction between the human-human-interaction as well as the human-computer-interaction. An appropriate interaction device and technique must support mobility and collaborative decisions of children in a group. Moreover, we suppose that interactions with the real world can help to increase the social engagement to virtual characters.

Input devices and interaction techniques depend on the children's age and skills. Therefore, we introduced the Tangible User Interface *Display Cube* for children in an age of up to 10 years with reading impairments and the mobile interaction technique *touching* for children older than 10 years. Both input devices supports mobility, display functionalities, collaboration, communication and real world interactions which are quite necessary for *social mobile interactions* in our point of view.

We are planning to evaluate prototypes of the introduced input devices and interaction techniques on their effects on social engagement for children. Thereby, we want to discover if children feel more engaged when using new forms of interaction devices and interaction techniques instead of using traditional input devices. Thus, our evaluation is going to compare social interactions provoked by traditional input devices with social interactions provoked by new forms of interaction devices and techniques. Apart from the evaluation of the two introduced devices, we are currently trying to find other social input devices, interaction techniques and interaction scenarios to increase a social engagement for children when interacting with virtual role playing games.

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