Can interactive toys augment social-learnability? An intercommunication approach for preschoolers

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ABSTRACT
This report addresses our Tangible interaction project and is presenting a working prototype based on a systematic design process. The concept idea was about creating two socio-interactive devices that intercommunicates feelings wirelessly, so that the users can tangibly interact with each other on distances. The focal market is the children between 3-8 years old. This entertaining project is beneficial to create a better relationship between parents and children, possibilities to help preschoolers expressing themselves through using the devices together with the concerning 'care-taker' and general use for social communication upon desire. The final prototype was exhibited in the Interaction design Exhibition 2011 held in Kuggen.

Keywords
Tangible Interaction, Collaboration, Socio-interactive device, Preschoolers, Intercommunication, Haptic feedback

1. INTRODUCTION
Tangible interactive technology is in constant development and there are great opportunities of developing new haptic or tangible devices through using the bulk of available micro-controllers and anticipated Tangible interaction toolkits. In our case, the Arduino played a crucial role in the project.

Like many other TUI developers, we wanted to propose a project that had the potential to hit the market. By that being said, we wanted to specifically hit the child market, where there are plenty of exquisite examples of well-marketed, entertaining and educational products.

Our group wants to go beyond the creation of a "mono-social device", feeling that it would be playfully engaging to include more individuals to take part of such a functional system. Therefore, we anticipated developing a communicative system, between two devices, allowing innovative ways of expressing feelings through tangible and haptic interaction.

This interactive approach may help parents and children to enhance the understanding of each other and communicates in a fun and expressive way. Another potential user group, briefly explored, could be children with autism, since they have difficulties with social interaction. They have repetitive behaviors that restrict their expressive ability [1] and create difficulties to understand them in general.

2. PROJECT PROPOSAL
Our aim with this project was exploring possibilities to provide useful intercommunicative devices through playful approaches. This was possible through creating an interesting experience for preschoolers', filling communication gaps between parents and their children by involving touch and expressions.

3. RELATED WORKS
We investigated and analyzed related works that helped us in our project work. One example in particular that inspired us was the Microsoft's ActiMates interactive Teletubbies collection [1](See Figure 1). The toy interacts when a user pushes a LED matrix (input/output) situated on the stomach area. By doing so, the device gives various conversation feedbacks to the user, through audio (output) and the audio itself results in displaying shapes on the LED matrix. Additionally, the toy interacts with the user through encouraging pressing the LED matrix in certain ways, to trigger more sounds.

Another project that has inspired us is the in Touch system made by Scott Brave and Dahley [2]. The project suggests physical connection devices, for people that are separated at long distances through haptic touch sense. According to Scott Brave and Dahley; 'communication through touch, however, has been left largely unexplored' [2].

Moreover, the group has been looking into a newer project considering this area, named ComTouch [3]. This vibrotactile device is a sleeve that can be fit onto the back of a mobile phone. The concept is built on translating finger pressure into vibration and the device is made so that users can send and receive signals at the same time. The goal of the project delivered was to combine haptic technology with audio.

[1] More information about this toy : http://www.youtube.com/watch?v=TjPtgTXT5e8

Finally, we looked into the LumiTouch [4], which was all about communicating through pair of interactive photo frames. The photo frame lights up when a user touches the photo frame and is translated over an internet connection [4]. Each colour lighten up by the user, symbolizes a certain feeling that can create a colour combination, conveying a certain meaning.

3.1 The Concept

The overall concept was challenging and we had to design it under three weeks time, fully functional. We brainstormed and made a task list before going into further depth with the Concept.

3.1.1 Idea behind the concept

The goal with the concept was to create two socio-interactive devices [2]that communicates feelings wirelessly, so that users can interact with each other on distances (See Figure 2), i.e. being in different places. We will give three example scenarios were such a communication device might be used:

• In a fun and efficient way to create a better relationship and understanding between parents and children.

• To help children with autism to express their feelings towards their 'care-takers' as well as letting them understand the needs of the concerned child.

• General emotional communication scenarios upon desire for social and entertainment purposes.

3.1.2 Initial concept sketches

We followed a typical "form follows function" dogma (Cooper 2007), hence sketched a template for the skeleton of the system for both devices, to keep the design proportional. We also tried to sketch the expected visual feedback (feelings) given from the devices and the aesthetic appeal of the device.

Figure 1 - Microsoft's ActiMates interactive Teletubbies collection

[2] *Description and BellyBuddies in action here:* http://www.youtube.com/watch?v=I4iLxePMVig

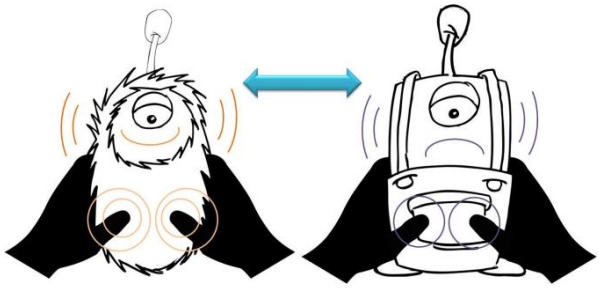

Figure 2 - Example interaction process to activate the toy in order to establish communication

3.2 Realizing the Project

We used one Arduino board connected to the two toys through wires, to visualize emotions such as happiness or sadness, through using an output LED-matrix and a pressing area functioning by using flex sensors. These flex sensors measure the pressure of the fingers and so outputting movement from the servo motors and additionally triggers the visual feedback. For example, if 'Device A' is pushed with intense force (flex sensor), 'Device B' will result in crouching and will display a sad mouth (the visual feedback).

3.2.1. Electronics and mechanisms

Although this prototype was using wires from the Arduino to connect the components of the two toys, the idea is to do a wireless toy as a final product.

Furthermore, we wanted to make a turn based system, which provides visual feedback that consists of a LED soldered with wires, put inside the designed antenna for each toy, giving better interaction feedback between users.

The antennas were made and arranged spatially by using the previously mentioned blueprint or skeleton, that was sketched on RHINO 3D.

The servomotors control the crouching movement, by rotating at opposite directions and were thoroughly reflected upon before construction. The design goal of it was to set a balanced and consistent movement, which after a lot of struggle, we succeeded to achieve. Each servomotor was carefully attached with glue, tape, metal pieces and screws and so added firmly to the material.

Like previously discussed, we wanted to add a LED matrix for visual feedback. The idea is that when the toy is happy, it should display a 'happy smile' through illuminating LEDs in a specific color of choice (See Figure 3).

3.2.2 Programming

Using the Arduino programming language, we achieved a communication structure, which allows users to control the toys. Although some programming issues with the turn based system due to the flex sensors being too sensible when applying a small movement, another majorly concerning issue was the programming of the RGB LED matrix. By this being said, creating our own custom built LED circuit board to simulate the similar effect as the RGB LED matrix, allowed us to simply switch the LEDs On or Off.

3.2.3 Outer Shell Design

Initially, we had to plan out what kind of materials we wanted to use, to give a 'childish' yet convincing look to the prototype. The chosen material was purple, blue, green and orange textile for the body, two spray-painted semi sphere Ping-Pong balls for the eye and black textile for the eyeball. Foam was stuffed inside the shell

forming a belly for the prototype, to adequately interact with the user, suggesting that 'this is the only area you can push' to communicate. The group also considered to adapt the size of the measured textile to the developed inside (mechanisms and electronics) of the toy. Buttons were added to neatly close and open the outer shell, allowing easy access for us modifying the 'inside' system whenever needed. Since we wanted to portray a variety of personas, each toy has different styles, e.g. one of the toys created have cloths as opposed to the second one being 'unclothed'.

We wanted to create a certain theme, which in this case is an adorable alien theme, to boost children's imagination and distinct it from other toys out in the market. To conclude this section, everything we added in the outer shell had a purpose connected to either the system's functions or interaction of the prototype.

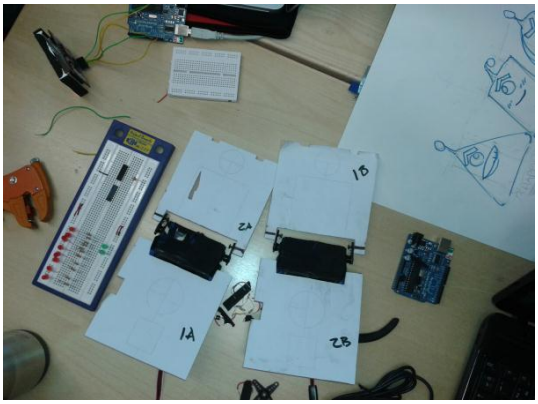

Figure 3 – Skeleton and mechanism of the toys

3.2.4 Final assembled prototype

The final prototype was a successful result of hard work and experimenting with tangible interactive system. The outcome of the carried out design process, meet our expectations as Interaction designers.

4. EVALUATION

We anticipated that the users would agree with our goals of the devices, such as if the Belly Buddies matched the purposes expected or if they liked something additional to be added. Through conducting a user evaluation method, we evaluated the users on spot, by using a questionnaire to collect feedback or suggestions from them. The enriched information collected from users, was taken during the Exhibition.

4.1 The poster

The poster was made to show an overview of the project. Moreover, simplifying the poster so that the users would understand it, i.e. by not adding to complex or technical aspects used, but rather focusing on the project itself, 'as a product'.

4.2 Users Reaction on the Exhibition

The users seemed to be happy with what we had achieved in this project. Furthermore, using the questions to get the answers from the users was an efficient way of understanding and getting feedback. All users have been kept anonymous, since most users wished for this.

4.3 End Results

We have demonstrated the viability of these kinds of systems in our proposed potential area talked about below in or discussion. However, they require a lot of development especially in a technical area, recreating a really good communication flow (See Figure 4/5).

Figure 4 – Result of the final prototype – the skin was made in soft fabric and plush hair.

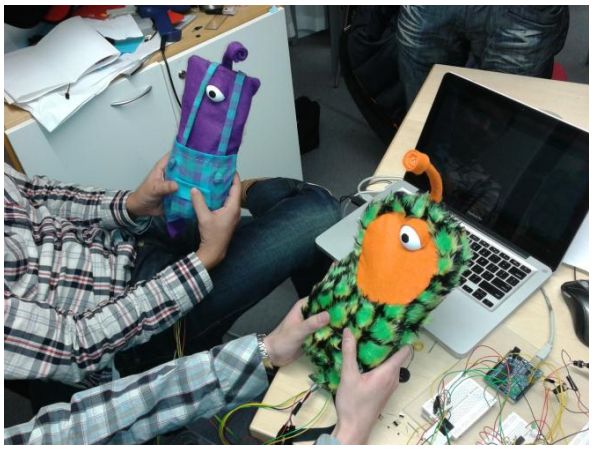

Figure 5 – User testers interacting bellybuddies each other.

5. DISCUSSION

This novel approach tries to go beyond the cold mundane communication means. In comparison to a mobile phone, the complexity of technology differs from the anticipated approach of developing a simple playful way of communicating feelings; helping to enhance the intimacy between parent and their children. Furthermore, this intimacy is important for children's development as good people in society as a whole.

We found that preschoolers are constantly demanding attention from their parents. However, from time to time they have difficulties expressing themselves. Therefore, these kinds of devices could be useful to bridge the communication gap, between the parent and the child, especially when the parent is absent at home.

6. CONCLUSION

We consider the BellyBuddies a successful project after the evaluation of the users. However, a lot of improvements are yet to be made such as increasing the amount of features and functions of the toys. We think this project as an open door for newer researches in this field; we believe the potential of this work is vast. We would like to encourage ourselves and others for further improvements in this research area in the near future.

So, Can interactive toys augment social-learnability?

The group considered interactive toys as a method to augment social-learnability, which gave us very good insights to create new means of intercommunication between preschoolers and their parents.

7. ACKNOWLEDGMENTS

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