

Designing Interactive Soft Toys for Children with Autism to Improve Communications Through Sensory Relaxation

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Abstract. Autism is a spectrum of neurodevelopmental disorders characterized by limited social skills. This paper explores a design process of interactive soft toys for children with autism that might enhance various ways of their communication. For local autism awareness events, two soft design prototypes were developed utilizing different sensory modalities (light, sound, and vibration). The researchers include the result of preliminary observation in the paper. The preliminary analysis suggests that interactive soft toys have potentials to engage children with autism through different features of the toys and evoke sensory relaxations and encourage them to talk about their experience.

Keywords: Interaction design · Soft toy · Children with autism · Touch · Sensory relaxation

1 Introduction

According to Center for disease control and prevention (CDC), It is estimated that 1 of 68 children born in the United States have some degree of Autism Spectrum Disorder (ASD) [1]. While symptoms can vary widely between individuals, autism symptoms begin to manifest in very early childhood and can be an emotional challenge for parents, causing extreme difficulties in the development of communication. Children with Autism suffer from severe communication deficits especially with social interaction and emotional control. One of the main reasons is that children with autism are very sensitive to external sensory information: light, touch, sound, etc. So it is important for them to always have some means of relaxation. Soft circuit or eTextile techniques provide great potentials for people with difficulties to explore touch-based interaction [4, 6]. To aid in day-to-day life and to develop necessary skills, some are given augmentative and alternative communication technologies (AAC). The relative popularity of these technologies has led to a proliferation of competing software. Over 250 AAC offerings within the Apple iTunes App Store© were observed with a cost range of free to \$250. While these technologies have met with substantial acceptance from worried families, there appears to be a dearth of evidence to specify the overall effectiveness of these technologies [11].

This paper focuses on developing interactive soft toys that respond to gentle touches and hug, encouraging alternative communication through sensory relaxation. These soft toys have been presented at various local autism awareness events.

2 Background

Prior research proves that different methods of “touch” help children with autism in various ways. In clinical research, it is known that therapeutic touch is beneficial to many populations including children with autism. Escalona et al. [2] report that children with autism who have a 15 min massage session everyday for 1 month exhibited less stereotypic behavior and showed more on-task and social relatedness behavior during play observations at school, and they experienced fewer sleep problems at home. Grandin [5] presents clinical effects of ‘deep touch pressure’ using a ‘squeeze machine’. She reports deep pressure stimulation is beneficial to calm children with autistic children. Opposed to deep touch effects, soft and slow touches haven’t been fully investigated by scientists and practitioners. Recently eTextile techniques have expanded creative opportunities in terms of soft and flexible touch interfaces.

2.1 Interactive Technology for Children with Autism

Over the past 20 years, researchers have developed interactive technologies that advance our approach to autism. According to Picard, interactive technology has contributed to these fields in at least 4 ways: (a) novel sensing technology that helps us to understand children with autism better through multimodal information; (b) new techniques to infer a person’s affective or cognitive state; (c) interactive system to respond to children with autism; and (d) self-monitoring technology [7].

Simple robot systems have been utilized to investigate how they have the potential to improve autistic children’s communication skills [8]. It is known that children with autism tend to have low interest towards other humans. However, they prefer interacting with robots than with humans [9]. Kozima et al. developed a little toy robot, Keepon and they found that Keepon attracted the attention of and caused emotional relationship in the autistic children [8].

Recently many interactive environments and wearable projects have been developed for children with autism to help them to reduce their anxiety [10] and to learn social interactions [3].

3 Soft Toys

We have designed interactive soft toys that provide sensory relaxation and playful sensory feedback including light, sound and vibration. We aim that soft interactive toys invite children and care givers (therapists or parents) to communicate through multi-sensory experience. Our design focused on two friendly objects: cloud pillow and cat pillow. We used wearable electronic components such as Lilypad arduino



Fig. 1. Cloud pillow and cat pillow

microprocessors, Lilypad vibeboards, buzzers and LEDs as well as conductive thread and conductive yarn to create our own touch sensor (Fig. 1).

3.1 Materials/Shapes

Both pillows were created by using soft fabrics and soft circuits. White microfleece fabric was chosen for the cloud pillow. Microfleece fabric is soft, synthetic wool material often made from polyester. Fleece is warm like wool and similar in appearance, but it is much softer, lighter, and easier to wash. Microfleece is also hydrophobic, or water-repellent, making it quick to dry and warm even when wet. Microfleece is also considered to be more environmentally friendly than wool. It is wonderful to touch and is mostly geared for baby and children projects. For the cat pillow, we used organic cotton fabrics. Organic cotton is grown using methods and materials that have a low impact on the environment. Organic production systems replenish and maintain soil fertility, reduce the use of toxic and persistent pesticides and fertilizers, and build biologically diverse agriculture. We chose fabrics that are safe for children to touch and easy for parents or caregivers to maintain the quality.

Our preliminary design studies led us to design friendly shapes that invite gentle touches from children and the parents. Also friendly pillow shapes and facial expression evoked emotional connection with the soft toys and the family. A smiley face on each pillow design helped children to associate personal meanings to the object. Children picked up pillows with a face more often than without a facial expression. In addition, children loved the cat pillow than the cloud pillow and parents preferred the cloud pillow.

3.2 Interactions

When the cat pillow is picked up by a child, two vibrators embedded in the pillow actuated and created nice soft tactile feeling. When it is hugged by a child, the cat pillow starts playing a song. Blue LEDs embedded in the cloud pillow glow in a slow breathing rhythm. When a child hugs it, the glow rhythm becomes faster. Lilypad

Arduino USBs were used to utilize various interactions. To create soft, comfortable as well as playful tactile experiences, all the electronic components (LEDs, vibe board, buzzer, and registers) were securely sewn on the fabric and insulated by cotton stuffing materials. Crocheted sensors using conductive yarns were also sewn on the pillows.

4 User Experiences

From multiple local autism awareness events, we observed that some children started talking to the cat pillow while they were hugging and petting it. In addition, a few kids wanted to take it home with them. They related the vibrations from the cat as ‘purring of cat’. They also sang along with the rhyme. Both (cat and cloud) pillows using soft fabrics and soft circuits invited gentle touches from children and the parents. Also friendly pillow shapes and facial expression evoked emotional connection with the soft toys and the family (Fig. 2).



Fig. 2. A child interacting with the cat pillow

5 Conclusion

Preliminary tests and research indicate that interactive soft toys may help children with autism calm down and become relaxed. Once they feel relaxed by and engaged with the interactive soft toys, they start feeling comfortable about the situation and become open to various external stimulations. Therefore this design method is considered as a useful one that may help children with autism to talk more and connect with other people in a non-invasive but a playful way.

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