
Child-Robot Interaction Workshop

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Abstract

I work with Auti, a socially assistive robot for children with autism, which I started designing during my design degree. It is designed to help encourage positive play behaviours and discourage problematic ones. My current Masters thesis in psychology is assessing the effectiveness of Auti's interactions using methodologies and procedures from psychology. I work with an at risk population, where ethics must be carefully considered. From my experience in the three fields of Design, Engineering, and Psychology, I have been able to reflect on the different methodological approaches of the disciplines.

Introduction

I work with Auti, a socially assistive robot, which I designed for children with autism. It is designed to help encourage positive play behaviours and discourage problematic behaviours (See Autitoy.com). Auti employs Applied Behaviour Analysis principles, offering reinforcement through movements in response to play

behaviours like talking or patting, and removing reinforcement by stopping and not responding when behaviours like screaming, hitting or throwing occur. Auti was designed from the start for children with autism, taking into consideration the role of the face, sensory difficulties, and difficulties with imaginative play. Auti has contrasting textures – fluffy soft fur and smooth legs – to encourage sensory exploration. Its form reflects 'cute' elements which have been shown to help engage and focus attention. To alleviate anxiety or confusion caused by facial stimuli, the toy does not have a face. Also, Auti does not look like any particular animal. These factors help remove expectations of how the toy should be played with, enabling a larger range of play to be accepted and encouraged. Auti's animal-like movements make it easy for children who understand representation to pretend it is an animal.

The design of Auti came out of my industrial design background. As part of further development of Auti, I have worked with engineers. I am currently completing a Masters thesis in psychology, working to assess the effectiveness of Auti's interactions using methodologies and procedures from psychology. The latest study



Figure 1. Furreal Friends Walkin' Puppy



Figure 2. Auti - A socially assistive robotic toy.



Figure 3. Perfect Petzzz® chocolate lab

assessed a 2 ½ - 3 hours structured play session during which children played with a walking puppy (Figure 1) to give a base line for play interactions, Auti (Figure 2), and a sleeping dog (Figure 3) to investigate generalization. The protocol was flexible to simulate how a child might play in a standard home environment. Eighteen children with an autism diagnosis between the ages of 4 years 6 months and 7 years 9 months took part. All the participants had a formal autism diagnosis from a paediatrician, and this diagnosis was confirmed with the Gilliam Autism Rating Scale Second Edition (GARS-2). Pairs of participants were matched according to their ages; their scores on the GARS-2 test, the Peabody Picture Vocabulary Test (PPVT) and the colour progressive matrices test (CPM). The pairs were split and assigned randomly to an Interactive (experimental) condition or an Active (control) condition. The first condition used a full Interactive Auti, which responds to a child's behaviours. The second condition used Auti running an Active (but not Interactive) program. Active Auti ignores all input so that no distinguishable pattern can be predicted. At the end, children in the Active condition were given Interactive Auti to see if there were any differences in their play behaviours – providing both between-subject and within-subject comparisons. In addition to looking at the effects of reinforcement delivered through a robot, the study also looked at how the children

classified the robot, whether it encouraged pretend play, and whether any of the skills were generalized. (For further information see my IDC Short paper.)

Children with autism are an at risk population, so throughout the process it was important to consider the ethical implications. We put the wellbeing of the children first in every decision we made, both in the design of the toy and the design of the experiment. We were careful how we recruited them, what kind of assessments we conducted and were careful not to push the children, but to observe their behaviors with only gentle prompting. Parents were also considered: there are so many treatments for autism which sell hope but do not deliver; we were careful to make clear Auti's limitations and that it was a prototype.

There seems to be a reasonable amount of fear around robots in society, which is particularly evident in film media. However many of these fears are based on the idea of the interaction with robots not being "true interaction" and giving a deceptive appearance of being human. I do not consider this to be a productive way of looking at robotics. Any type of interaction can have value and benefits, as well as dangers, and should be analysed within its context and purpose.

One argument for the dangers of robot interaction based on child development. Social interactions are

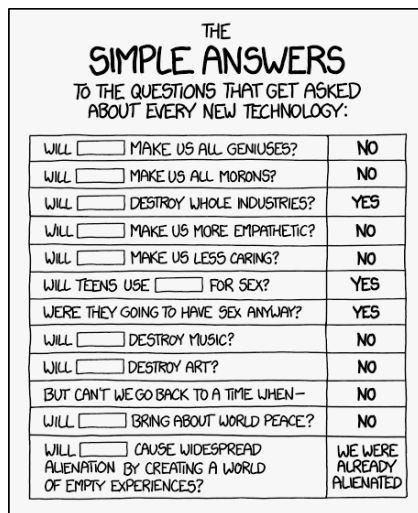


Figure 4. xkcd comic 'Simple Answers' <http://xkcd.com/1289/>

highly complex with many factors; they take a long time to learn and they are learned through practice and experience. If children primarily interacted and bonded with robots then there would be concerns they would not develop the social skills needed to interact with other humans.

This argument is particularly relevant to robotics aimed at children with autism, as they are often attempting to teach or aid social skills[3]. I have had discussions with people who argue that using robots and other technology allows children to avoid dealing with human interaction, so it in fact hinders learning. This argument is consistent with some aspects of the social motivation theory of autism[2]. However, for children not to develop human social skills I would expect that a significant proportion of all interactions would have to be one-on-one with a robot. It seems to me that this is a very unlikely occurrence, and the social nature of humans would prevent it[2].

For children with autism, who show preference for robots over humans[1], we do need to be more careful because of the reduced social drive in children with autism. At present, most robotics in autism are trying to offer an intermediate step to help children learn social interactions or offer ways to make it easier for the children to communicate. The end goal of the

robots is still human interaction and as long as it stays this way it is a positive route of inquiry.

In terms of bonding with robots, I do not see this as a problem as long as human bonding is also taking place. For children with autism, bonding with 'intermediate objects/animals' can be beneficial, as the bonding can then be shifted to people.

If robotics gets to the point where it somehow became our primary interaction then the question would need to be asked "what is it that we are missing from human experiences?" For example, for some people, online communication has replaced so much of their face-to-face communication that they miss out on needed physical contact, which appears to be important to mental health. This does not mean online communication is 'bad' but that people need to be aware of their needs and what they are not getting from their interactions.

Any new technology that changes the way we interact with the world raises fears that we will lose human intimacy or another aspect of our social dynamics. But what we see is that people just use the technology to be social in a new way. Figure 4 sums it up well.

My experience in the three fields of Design, Engineering, and Psychology has let me reflect on the

different methodological approaches of the disciplines, particularly with respect to testing and evaluation. In psychology, research is based on testing a hypothesis informed by previous research, and experiments are designed entirely around isolating this particular factor and determining whether the hypothesis is true or not. In engineering, evaluations typically measure the performance of a new design against a set of relevant factors that determine the quality of the performance. In design, a large segment of research involves exploratory investigations, which gather qualitative results to inform the design.

All three disciplines would benefit from better appreciation of each other's evaluation methodologies, and a better understanding of each other's goals and objectives. At present, explorative, qualitative research is undervalued in the psychology field, which is largely focused only on studies that will produce quantitative, statically significant results. I think that qualitative explorations give us a lot of rich and valuable information. But we do need to take care in how the gathered information is analysed. Qualitative explorations are essential to design as many of our experiments are testing things that we do not have previous studies to base our experiments on. The engineering approach is very appropriate for evaluating designs. However, when testing design interactions,

we often do not yet know what factors are important or relevant; so the engineering methodologies are not always possible. We could determine relevant factors by taking research from psychology about how people act, and then postulate what factors would be relevant. But the best way to determine what factors are actually relevant is through qualitative explorations.

Unfortunately, design research often stops after the exploration. The designer now knows what the important factors in the design are, so they can address them directly. However, to be able to tell how effective a design is, follow up experiments are needed. Design is at a point where it is developing more of its own testing protocol, which is excellent. For too long we have borrowed from other disciplines. The difficulty with borrowing is that we have different goals. In developing our methods for testing designs we need to carefully look at what methods are important to design.

References

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