Computer Game Approach for Children with Autism Spectrum Disorder: A Pilot Study

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Abstract: - Computer games are currently a significant topic in research for children with some forms of disability. Autism is one of the groups of serious development problems known as Autism Spectrum Disorder (ASD). It is a lifelong disability that prevents people from understanding what they see, hear and sense. Children with learning disability such as ASD who have serious impairments with social interaction, communication skills and in behaviour need a high degree of personalization in using computer games. In this paper we present a pilot study conducted on six ASD children of age ranging from 5 to 8. This game called find me is specially designed to teach children on improvement of social skills. Participant observation was conducted to understand their behaviour in game engagement and get feedback on their needs and learning goals, as a basis for further research on this topic.

Key-Words: - Computer Game, Autism Spectrum Disorder, Social Skills, disability

1 Introduction

Autism is one of the groups of serious development problems known as autism spectrum disorders (ASDs) that cause substantial impairments in social interaction and communication resulting in unusual behaviour and interests [1]. The signs of autism are observed in the early years of a child’s life. The causes of Autism Spectrum Disorders (ASDs) are not very clear. This neurodevelopment condition has a frequency of one in 110 children in the USA and one in 625 children in Malaysia [2]. According to the National Autism Society of Malaysia (NASOM), there has been a 30% increase in the organization’s intake of individual’s with autism for the past three years in Malaysia. It has been reported that the number of people with autism is increasing at a high rate in recent decades. It is necessary to find a new and effective way for them to develop their skills and help them to be able to contribute in the society with their limitations.

Playing is an activity that everyone has encountered more than once during his or her lifetime. Developmental scientist have underlined that playing affects cognitive processes [3]. Apart from training certain motor skills, physical interaction with computer games can further enhance the sense of presence, engaging even more deeply the player with the game and, consequently, further foster motivation [4].

There are limited tools and methods to support children with Autism in therapy sessions, the problem is that it has been seen that these conventional methods are not effective in many cases [5] because is difficult for therapist to engage an autistic child to attend in therapy sessions, sometimes children refuse to finish the sessions because they don’t feel comfortable. Since one of the main problems about children with Autism is that they cannot communicate with others, as a result it is difficult for them to talk clearly with a therapist about their problems and feelings. In some psychological methods the therapy session is paper-based, some children who do not have the reading and writing skills cannot attend into this sessions. Long time and high cost of therapy are other factors of weaknesses of traditional psychotherapies.

One of the strongly recommended approaches for teaching autistic children is to use visual aid [1]. Digital storytelling, video games and virtual reality games can use engaging multimedia formats and is proven as one of the most effective tools for the purpose [6]. Computer games provide a safe, secure, and less anxious environment for autistic users [7].

In this paper, we discuss the steps taken in conducting this pilot study on 6 children with ASD. We also discuss the outcome of this study and the overall reaction of the students.
2 Related Work
Games have evolved in the last decades, and now devices have also evolved from keyboard and mouse to touch screen and mobile.

Hassan [1] presented a computer game for children with Autism age ranging 9 to 14 years old to understand the concept of money, the game was developed on BYOB (build your own block, an advanced offshoot of the game engine scratch). The game is very simple and easy to play that has been tested on 4 girls and 5 boys with ASD to recognize the concept of money. Their results were promising.

Finkelstein et al [8] designed a game to teach emotion recognition and programming logic. They found that autistic children who were taught by a virtual human experienced higher levels of retention than those in a traditional classroom setting. Designing such programs in a manner which keeps the child engaged is very important. Apart from this, Jain et al [5] presented a game for teaching facial expression to children with Autism, the game has been designed based on the parents report in an interview that they preferred story lines with real-life scenarios. In the same manner, Aggarwal et al [9] proposed “LIFEis GAME” to improve communication skills of children with Autism with virtual characters, players play with an avatar and choose the correct facial expression of an emotion in social scenario. Chang et al [10] presented another game based on real stories to teach autistic children do their daily activity. Using real stories in a game help the children to match their experiences from the game in some situation in real life. Autistic children make mistakes when they do some activity in the authentic environment and mistakes may hurt autistic children themselves. As a result by designing a game based on the real stories or real scenarios make authentic environment safer for children with Autism. Dillon and Underwood [11] used Bubble Dialogue in his study to explore expressive writing ability. He found that the children with autism were as able as the typically developing children to engage with the task and computer games.

3 The Pilot Study: Methodology
To conduct this research we have divided our methodology to four steps as bellow:

i. Step 1: Interview and questionnaire
To find out the limitations and characteristic of children with Autism some interviews and questionnaires with parents and therapists was needed. The result of the interviews and questionnaires helped us to classify the participants based on their problems and understand their talents and skills. Children with ASD have a strong attachment to some objects, interview with their parents helped guide us to identify these objects to ease our process of experiment.

ii. Step 2: Select the game
As mentioned earlier, there are a lot of games that have been designed for children with Autism, each with special goals. Some of the games have been designed to help the child improve his/her communication skills, some to teach facial expressions, to name a few. The issue is that the game should adapt with the children’s problems and limitations. The result of the interview and questionnaire helped us in selecting the most appropriate game.

iii. Step 3: Participants play the game
We arranged four sessions with the school. On each session we asked each child to play with the device as long as they wanted and we observed their reaction and behavior throughout the process.

iv. Step 4: Analyze the information from the observation.

3.1 Step 1
To understand the problem and situation about children with ASD, some initial studying was needed. The preliminary study was conducted as following:

3.1.1 Consultation with doctors and experts
A semi-structured interview was conducted with five doctors and eleven therapists to find out some basic problems of children with ASD. Communication and social skills were highlighted as the main problems.

We asked 3 experts about types of technology devices such as touch screen devices, computers and smartphones. During the interview, experts answered several questions, and the data obtained are as follows:

i. 60% of the experts believe that children with Autism prefer to play with touch screen devices.

ii. 25% of the experts believe that children with Autism prefer to play with smart phones.
iii. 15% of the experts believe that children with Autism prefer to play with computers.

iv. 80% of the experts answered that children with Autism start a computer game on his/her initiative, voluntary, without being encouraged by someone else.

3.1.2 Interview with teachers and parents
A separate Questionnaire for parents and teachers of participants helps us to find out the participants limitations and problems. We managed to get a better insight into the likes and dislikes of our six participants.

3.2 Step 2
*Find Me* (for Autism) is designed to be appropriate for kids who are most severely affected by social and communication deficits, including kids who are completely nonverbal, who have very limited social interactions and who have limited play skills (even with toys, not just social play). The app is designed for children as young as 18 months.

The app has been designed by a combination of researchers at the University of Edinburgh, incorporating input from various people with relevant knowledge, like parents and teachers of children with Autism. The app aims to provide a forum for practicing basic social skills in a fun and motivating way. We hope that by practicing these skills, children’s real-world social behaviours will also improve. Requiring no language or reading skills, it’s accessible to the vast majority of Autistic children with access to an iPad.

3.2.1 Interface of the game: (*find me*)
Visually, the app is quite simple and the auditory input from the app is simple as well. The purpose of the app is to direct the child’s attention to a person on the screen. A character appears and asks, “Can you find me?” or “Can you play with me?” The child taps the image of the person. Successive screens show more complex scenes as more objects appear. If a child taps an object instead of the person, the app simply names the item. “Ball.” There is nothing discouraging about the app for a “wrong” answer. Repeated tapping will not result in repetitive audio from the game. So repeatedly tapping on the ball will not result in “ball-ball-ball-ball-ball-ball,” which can appeal to kids on the spectrum and distract from the purpose of the game, as well as being very annoying for parents.

When children correctly tap the person, they get a token or a visual mark of achievement. After five tokens, they are rewarded with a short animation. Parents can choose three rewards: abstract spinning shapes, trains or jumping acrobats based on the children’s interest. Some boys that are interested in cars can select train as a reward and be engaged in playing the game. The *Find Me* app is just one of many that have been developed for children with severe autism.

![Fig.1. A picture from the 1st level](image1)

![Fig.2. A picture from the 2nd level](image2)

![Fig.3. A picture from the 3rd level](image3)
3.3 Step 3
The game has been tested with six ASD children ages ranging from 5 to 8 years old, from Hua Ming School for Autism in Selangor, Malaysia. They consist of 5 boys and 1 girl, where out of these six participants, two had high-functioning ASD, two had low-functioning and two had severe ASD with difficulty in communication. The game experiment was conducted in a small room close to the children’s main classroom, in the school vicinity. The experiment was conducted in stages for a duration of a week, where each time only one student participated in the experiment. This was because, we wanted to guide each student personally and this would also help in the observation process. No time frame was given to each participant in completing the game. This was done to eliminate any pressure or stress on the student. Our objective was to find out the needs and learning goals of these students.

To perform the test one smartphone and one tablet (with 3.5” and 10” screen) were used. The researcher and child sat together and the child was given full control of the smartphone.

This experiment required us to visit the school a few times in a span of a week (4 sessions in total). Even though time frame was not given to each child, we noticed that each child played with the game for approximately 15 to 20 minutes on each visit. In each session the children were asked to play with the application from the first level to 3rd of 4th level and after they finished playing, their results were recorded. On the next session the children were asked to play the same game from the first level and they were expected to score better in the next sessions.

3.3.1 Result
In relation to behavior displayed by the children while actively being engaged in the interaction with FindMe, we particularly focused the analysis on two parameters. The first parameter concerns the moment when the child has to find the character in simple or complex environments (initial image selection). The second moment occurs if and when the child cannot find the character or tab on another object rather than character (when an error occurs). This is to understand their behavior in game engagement and try to understand their needs and preferences in learning. These findings are presented in Table 1 together with the result of evaluation of each child.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Initial image selection</th>
<th>Strategy when error occurs</th>
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<tbody>
<tr>
<td>Child A</td>
<td>He didn’t know when to put his finger on the character, for two sessions. After 2 sessions he could find the character even in complex environment without help. He was very interested in the train as a reward, for each level he knew he had to play well so that he could see the train.</td>
<td>He took the teacher’s finger and put it on the screen to help him for the first two sessions. After that, he gradually became better and more independent.</td>
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<tr>
<td>Child B</td>
<td>For the first 5 minutes from each session he tabbed the screen several times carelessly without paying attention to the character. After several times he found that he should find the character and pass one level to wait and see the train. He was interested in rewards and tried to tab any object to collect the token and see the train.</td>
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<tr>
<td>Child C</td>
<td>He was very good in finding the character without any delay. In some complex environments he was confused and tabbed on other objects but immediately found the character. In complex environments he tabbed on the others objects but immediately found the character. He was sharp and totally engaged in the game.</td>
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<tr>
<td>Child D</td>
<td>In the simple levels, he found the character easily but he tabbed on the screen repetitively and in the complex environments, he became confused among objects and characters. In complex levels he couldn't find the character and tried to tab anywhere on the 3rd level and found the character by chance.</td>
<td></td>
</tr>
</tbody>
</table>
Before she started playing she waited to find the character, only then she tabbed on it. She was not adventurous like the other boys, she didn’t try to tab on other objects or places even in complex environments. She was pretty sure about the place that she tabbed in. In some cases, she tabbed the screen slowly and couldn’t see the results, so she didn’t try another object or another place. She was very cautious and careful in making errors.

Child F

He was a very hyperactive student. He enjoyed only touching the screen and tabbing repetitively on the objects. He couldn’t continue playing the game. He could not comprehend any object or character. He was extremely hyperactive.

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Table 1. Result of evaluation of each child

3.4 Step 4

The information has been analyzed and observed.

3.4.1 Analysis

All the 6 participants, for the first minutes of the sessions, were not interested in the game; they only gained momentum after a few minutes. Their teachers helped them and sat with them to play the game for a few minutes before they became engaged in the game. As majority of the participants were boys, and based on our initial study with questionnaires we found out that they were interested in cars and vehicles, so we select train as a reward to encourage and motivate them in playing the game.

Autistic children often have trouble with generalization [1]. In this case, most of them could not really understand the concept of the character. They felt that they could tab on any object to get the reward. Some of the parents gave feedback on the aftermath of the experiment, where they played other iPad games at home and tabbed on different objects, expecting to see the same train, as seen on FindMe.

In understanding the level-wise testing, it seemed that this game was effective to teach these children to understand and recognize the characters. Child A, child C and child D were rather slow in the beginning, but once they gained momentum, they were totally motivated in completing each level to see their rewards. The levels of the game become gradually difficult, but it helped these children to adept themselves with the game.

However, while measuring performance, we noticed the children responded to the game slower than usual on the first session, but their performance improved as they played the game regularly.

4 Future Work & Conclusion

The initial success of this experiment will help us to design a game for the ASD children using touch screen device. We plan to extend our research further by including digital storytelling and animated comics to engage these special children. The concept of reward will be a focal point. Also, we plan to experiment with more children and for a longer period of time.

Children with Autism will have to live with their condition as there is no cure in today’s medical advancement. However, some practices and therapies can help improve their condition and assist in their quality of life. The computer game has been proven as a powerful device to help children with autism and teach them new skills. In our experiment, we found that the game (FindMe) helped the children learn some social skills and match their ability with the game. Children with ASD find it hard to concentrate for a long period of time, but when they are visually engaged, they are motivated and encouraged to excel. We have obtained some positive response from our pilot study and we plan to continue expanding our work to help these children in other aspects such as behavioral, problem solving, mental therapy, to name a few.

References:


