How virtual reality computer programs can help three year old children with ASD communicate

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Abstract

Individuals with ASD often experience difficulties with communication which can lead to

anxiety. Ultimately, this anxiety hinders children's ability to fulfill their potential. Many virtual

reality programs have been developed the help improve communication skills for children with

ASD. However, despite the fact that early intervention is the best way to promote a successful

future,there has yet to be a virtual reality program designed specifically for children three years

old. Therefore, I propose a new interactive virtual reality program be created to improve the

socialization and communication skills for children around the age of three with ASD. The

program will be tested using the results of a one way ANOVA, which measures the child's

engagement, enjoyment and learning.

Keywords: virtual reality, ASD, Communication, children.

Virtual Reality Improving Communication For Children with ASD

Autism spectrum disorder (ASD) is defined in the American Psychiatric Association's

Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a complex neurological

disorder that affects, *inter-alia*, communication and socialization. Although, the causes of

language development difficulties in autistic children is still largely undetermined, many experts

believe that the problems result from a variety of conditions occurring prior to birth. Some

studies have shown that autism is positively correlated to the age of the father (Tsuchiya, K. J, et.

al., 2008). Other researchers have linked autism to the child's genetic disposition (Ziats, M. N.,

et. a., 2016l). The number of children who are being diagnosed with autism spectrum disorder

continues to increase. In fact, according to the Center for Disease Control and Prevention, autism

affects one out of every 68 births in the United States (Christensen DL., et. al., 2012). ASD is

defined as a spectrum because autism includes a broad range of varying symptoms and degrees

of severity, from high to low functioning. Therefore, the communication and language

difficulties experienced by children with ASD vary greatly. For example, some children with

"low functioning" autism may be unable to speak. Other children on the spectrum may be able to

speak but have trouble understanding the meanings and rhythms of words and sentences.

Furthermore, some high functioning children, with fewer verbal impairments may still have

trouble understanding social cues, such as where to look while talking to others (Mayes, S. D., et.

al., 2009).

The acquisition of communication and language skills for autistic children can be

dramatically different than those experienced by children who meet typical development

expectations. The first indicators of normal language development generally occur in the first

few days of life. Usually a newborn quickly learns that crying will result in receiving food or attention. Between the first six to eight weeks of life, babies begin to make eye contact and by 18 months of age most children can say 8 to 10 words (Hurley, A., 2006). At ages three, four, and five, a child's vocabulary rapidly increases, and they begin to master the rules of language including; phonology (speech sounds), syntax (sentence formation), semantics (word and sentence meaning), and pragmatics (effective use of language) (Fromkin, V., Rodman, R., & Hyams, N., 2010). Some indicators of autism in child development include: a child's failure to babble or coo by 12 months, gesture by 12 months, say single words by 16 months, and say two-word phrases by 24 months (Thurm, A., et. al., 2007). While these delays in language development may not always indicate that a child has autism, they are frequently the first indicators of ASD. As the child grows older, the symptoms, particularly those including eye contact, and verbal responses, often become more pronounced and lead to other difficulties with socialization.

Having a limited capacity to communicate with others can result in severe emotional distress. An individual's unsuccessful attempt to communicate verbally and/or physically may lead to an increase in their internal frustration and anger. Research has shown that 40% of children with autism also have anxiety disorder (Van Steensel &Vogels 2011). Furthermore, another study reported that rates of anxiety are higher in those children who have language disorders (Gillott et al, 2001). This is significant in that anxiety can negatively affect an individual with ASD's ability to fulfill their potential. Anxieties has the ability to impair an individual's success in education, friendships and social participation, and places an immense strain on other members of the family (Reaven, 2011). As exemplified in the video below, non

verbal autistic individuals, such as Carly, are often very smart. Thus, not being able to express

oneself creates an enormous amount of frustration. This repeated feeling of frustration and

failure to be able to express emotions can result in anxiety (Ozsivadjian, A., e.al., 2012).

Fortunately, contemporary technological advances include new ways of improving

communication skills for autistic children. These technological innovations range in function,

from teaching children to understand the implication of other people's facial expressions (i.e.,

frowning it means unhappy) to providing the means for nonverbal autistic individuals, like Carly,

to communicate. One of the most interesting innovations helping to improve communication

skills for autistic children, is the the development of virtual reality computer programs. Such

virtual reality programs, can be very beneficial to children with ASD in that, the program creates

a safe space for children with autism to practice social skills without the fear of negative

consequences. Research conducted by Nyaz Didehbani, et al., (2016) indicated that "participants

who completed the training demonstrated improved social cognition skills and reported better

relationships. Neurocognitive testing showed significant gains in emotional recognition,

understanding the perspective of others and the ability to solve problems." Their study consisted

of a sample size of 30 individual ranging in age from seven to sixteen, with high functioning

autism. The participants, who were paired into groups of two, were required to complete ten,

one-hour long sessions of virtual reality training for five weeks. During that time, the participants

learned and practiced strategies for handling social situations, such as, meeting a peer for the first

time, confronting a bully and inviting someone to a party. The following video demonstrates one

of the numerous virtual reality programs designed to help autistic children communicate:

Another study about virtual reality programs, was conducted by Fabbri *et al.* (2006).

Their study sought to determine how individuals with autism can improve their communication

skills by interacting with avatars which show facial expressions conveying emotions (happiness,

sadness, anger and fear). The children, in a sample size of 34, with an average age of ten, were

asked to choose the emotion the avatar was expressing. The children subsequently viewed the

avatar in a social situation and the participant was asked to associate the given scene with an

emotion. Lastly, the participant had to choose from a list, the cause of the emotion that the avatar

was expressing. Researchers stated that 30 of the participants understand and appropriately

identified the emotions of the avatar. The remaining four in the sample, who had a more severe

form of of autism, had trouble understand the emotions of the avatar.

As exemplified by the studies discussed above, virtual reality programs can improve

communication skills for autistic children. However, virtual reality programs designed

specifically for three year old children with ASD have not yet been developed. This is significant

because research shows that early intervention is the most effective way to promote a child's

future success. As well known autism advocate Temple Grandin stated in an interview with

Autism Live, an interactive webshow, "Kids two, three and four years old need twenty hours of

intensive early intervention…push because you've got to stretch these kids. You don't stretch

them somewhere they don't advance." (2013) Thus, the development of a virtual reality program

designed for young children can be critical to improve communication skills.

Therefore, I propose that a new interactive virtual reality program be developed to

improve the socialization and communication skills for children around the age of three with

ASD. In this new virtual reality program the child will be represented by an avatar of their

choice. As the avatar, they will have the option of taking part in a daily adventure such as a

virtual visit to the zoo, or participating in an interactive story of their choice. Their choice of

activity will be represented by a symbol which they would choose by the use of a gesture. An

example of an interactive story in which a child could participate could be a well known fairy

tale like Goldilocks and the Three Bears. While listening to the story, the narrator would ask the

child to help Goldilocks find simple objects, by asking questions such as "where is the bed."

Another example of a story, could be the creation of a completely new tale involving a group of

colorful animated animals that would frequently use the child's name in songs. While telling a

story, the characters would encourage a child to interact. For example, if one of the animals

mentions a ball, they would ask the child to gesture to a picture or say the word ball, depending

on the severity of their autism. If the child chooses to visit a virtual zoo, they would similarly be

required, after a computer prompt, to say the name of a given animal, or point to a symbol of the

animal. Throughout the activity, the child would randomly be required to interact with other

avatars. The computer program would indicate the emotion of the other avatar (sad, happy,

angry, etc.) and the child would indicate which facial expression, from a sample list of simplistic

symbols, expresses the given emotion. The goal of this program would be to help a child

improve their communication skills.

Methods

Participants

   The study would consist of a minimum sample size of 36 children with ASD around the age

of three. Their parent or caregiver would also be available in the same room to ensure the child is

calm and provide positive feedback to the child. The researcher would not be in the room

because this may be a cause of anxiety for the child.

Material

       There would be a computer available in a quiet isolated room with the virtual reality

program already installed. There would also be a camera for the researcher to record the child's

progress.

Procedure

Every day for at least an hour for ten weeks, the child with ASD will play the games and practice interacting with the virtual reality program in the lab with their parent or trusted caregiver.

Results

The results would be measured using a one way ANOVA test. The test would measure enjoyment which would be indicated by how much fun the child seemed to be having while using the virtual reality program. The test would also measure the child's engagement which would be indicated by how interested they were in the activity. Lastly, the test would measure whether the child is learning from the program, by comparing their communication skills prior and subsequent to the study.

Discussion

Research shows that early intervention is the most effective way to promote a child's future success. Accordingly, intervening in a child's development at the age of three, by the use of a virtual reality program may be critical for improved communication. This is important because not being able to express oneself can lead to frustration and anxiety which can further hinder the child's ability to communicate. As research clinician Dr. Nyaz Didehbani states, "[I]ndividuals with autism may become overwhelmed and anxious in social situations…The virtual reality training platform creates a safe place for participants to practice social situations without the intense fear of consequence,"(Nyaz Didehbani, et al., 2016)).

Each element of the virtual reality program that I purpose has a unique purpose. The use of the colorful animated, animals is intended to keep the child interested in order to encourage their desire to learn. The narrator's frequent repetition of the child's name is intended to help the

child practice responding to their name. For non verbal ASD children, the use of gestures to

respond to questions is meant to demonstrate their capability of communicating to others and

themselves. It also encourages the child to practice ways that they could communicate since they

cannot speak. For high functioning children with ASD who are verbal, answering the questions is

practice with direct communication and speech. Moreover, the requirement to practice using

simplistic symbols which express emotions is important to help a child understand which

expressions are associated with specific emotions.

There are certain limitations to this study. One of the limitations is that the virtual reality

program might only be beneficial to high functioning autistic children. Children with low

functioning autism may not be able to be engaged in the activities because they might be too

challenging. Furthermore, measuring some of the test results may be subjective. For example, it

it may be difficult to measure how much fun a child is having or how engaged they are in the

program. However, an experienced researcher should be able to make these determinations.

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