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DO TYPICAL DEVELOPING PARTICIPANTS AND PARTICIPANTS WITH ASD FIXATE SIMILARLY DURING HIGH SOCIAL GAME PLAY?

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ABSTRACT

The purpose of this research was to determine if typically developing children and children with autism spectrum disorder (ASD) fixate similarly while passively viewing a video game play stimulus. The goal is to better understand the visual social attention of children through their eye gaze patterns when passively watching video game stimulus. To answer this research question, eye-tracking technology (i.e., Tobii T60) was used to gather data from typically developing children as well as children with ASD. A coding scheme was developed to determine how often all participants visually attended to various elements of the video game. Areas of interest were then identified to determine where each child fixated during the viewing task. This task is the first step in determining if children with and without ASD attend to and play video games similarly in order to determine if video game play may be an appropriate context for providing opportunities for friendship formation.

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Chapter 1
Introduction

It is important for all individuals to have true friends in their life (Parker et al. 1995). Friendship is something that cannot be forced; it is a reciprocal bond between two individuals that is mutually recognized and valued. Children with autism spectrum disorder (ASD) have poor social relationships that lead to a lack of friendships (American Psychiatric Association, 2016) which can lead to loneliness and isolation (Bauminger, & Kasari, 2000). By investigating whether children with ASD and typically developing children fixate similarly to video game stimuli, it may be determined whether video games can be a context in which opportunities for friendship between typically developing children and children with ASD can be created.

The current study specifically investigated how the participants visually attend to video games, and the similarities and differences between the visual attention patterns of children with and without ASD. This problem is significant because it will identify potential barriers to using video games as a context for intervention targeting friendship-based outcomes. Video games are played by individuals of all ages (ESA, 2013), so determining whether people can become friends while playing video games would be significant. Because of the poor friendship-based outcomes for individuals with ASD to date, it is critical to determine better ways to promote friendships for this population. Interventions involving video games could improve social outcomes and increase quality of life for individuals with ASD.

Literature Review

Autism spectrum disorder (ASD) is a developmental disorder that results in significant social, communication, and behavioral challenges (American Psychiatric Association, 2013). Autism spectrum disorder is one of the fastest growing developmental disorders. The Centers for Disease Control and Prevention (CDC) Autism and Developmental Disabilities Monitoring (ADDM) Network estimates about 1 in 68 children are identified with ASD. Autism spectrum disorder has been identified in all racial, ethnic, and socioeconomic groups, but has a higher prevalence in boys (1 in 42) than girls (1 in 189; CDC 2015).

There is no known cause of ASD. Unlike Down Syndrome where there is a specific genetically-based cause, the presence of all or part of a third copy of chromosome 21 (Rafii, 2015), ASD is not that simple. There is no objective test, which results in the diagnosis being based on behavioral evaluation of development. Researchers believe both genes and environment are involved (Kotsopoulos, 2015).

Although it cannot be traced to a specific gene, genetics clearly plays a part in ASD (Hansen et al., 2016). Autism spectrum disorder tends to run in families, especially in identical twins who share the same genes (Kotsopoulos , 2015). Researchers also believe the environment plays a part in the diagnosis of ASD. Environment in medicine refers to anything outside of the body that can affect health. This can be anything from the mother's health while the baby was in the womb, to the medicine the child takes, to environmental toxins the child is exposed to, and everything in-between, however the specific environmental factors that play a role in ASD are currently unknown (Kotsopoulos , 2015).

Autism spectrum disorder is considered a spectrum because of its broad range of symptoms, skills, and levels of impairment experienced by children with ASD. While some

children are only mildly impaired, other children are severely impaired and face bigger challenges in their daily lives (Hansen et al., 2016). Most children with ASD have trouble engaging in everyday social interactions, and seem to be disconnected from the social world. Children with ASD may have difficulty showing interest in others, making eye contact, responding to other people, and establishing joint attention (Hansen et al., 2016). Because of the impairments in social interaction, often times individuals with ASD experience difficulties in establishing friendships (Guralnick et al, 2007; Petrina, Carter & Stephenson, 2014).

This is an unacceptable outcome for individuals with ASD as friendship plays a big role in development and quality of life (Gerine et al. 2015). Friendships have been shown to enhance overall well-being by affecting not only social outcomes, but also emotional and cognitive outcomes (Petrina, 2015). Because of this, the failure to create friendships can lead to difficulties in everyday life. Due to participation in social environments such as school and extra curricular activities, individuals with ASD often establish friendships, but these friendships are frequently lower in number and quality than the friendships experienced by other children (Qualter et al., 2015). Reduced friendship quantity typically results in a sense of loneliness for the individuals with ASD (Gerine, 2015). Many individuals with ASD want to make friends but are unsure how due to their deficits in communication, social interaction, and joint attention. Individuals usually build friendships because of shared interests and likes (Rossetti, 2011). If shared interests can be found between two individuals who have ASD, it is believed that true friendships can be formed, similar to the process of typically developing individuals (Locke et al., 2010).

Electronics are pervasive in American culture, and are extremely popular with kids and adults alike (ESA, 2013). Durkin (2010) suggested that between computers, hand-held devices, cell phones, tablets, and gaming systems, people of all ages are playing games on an electronic

device. According to a study done at the Pew Research Center, 97% of teens without disabilities ages 12-17 play computer, web, portable, or console games. Additionally, 86% of teens play on a console like the Xbox, PlayStation, or Wii (Lenhart, 2008).

Recent research has also indicated individuals with ASD are interested in and play video games. Finke, Hickerson, and McLaughlin (2015) reported school-age children with ASD spent twice as much time playing video games per week than did their typically developing peers. Further, research has suggested when children and adolescents with ASD do have a friend, they spend the majority of their time with this friend playing games, primarily video games and board games (Bauminger & Kasari, 2000; Bauminger & Schulman, 2003; Kuo et al., 2013). In fact, adolescents with ASD reported greater overall companionship with the friends they spent time playing video games with, compared to those who did not play video games with their friends (Kuo et al., 2013). This may be significant as this perceived increased companionship could translate to an overall higher quality friendship in general for these children with ASD, but this is not known for certain. Patterns of friend-based after school activity for typically developing children mirrored this pattern of friendship activity. Adolescents without disabilities also frequently use video game play as a context for interacting with their friends (Olson, 2010).

Though video games appear to have potential as an activity that individuals with and without ASD could play and enjoy together, there is no way of knowing what barriers might exist and prevent this collaboration during game play. It is still unknown whether individuals with and without ASD play and process video games in the same way. Without understanding this factor, it is not possible to determine if video game play may be a context where children with and without ASD may engage with each other in positive ways. One way to better understand this potential barrier to using video games as a context for building friendships is to

examine the visual attention patterns of individuals with and without ASD as they attend to this media.

Due to recent developments in technology, visual attention has become something measureable (Klin et al., 2002). This allows for the collection and analysis of more reliable eye-tracking data (Guillon, Hadjikhani, Baduel, & Rogé, 2014). By studying visual processing and visual attention, researchers have been able to learn more about how individuals with ASD process and interact with the world around them (Guillon, Hadjikhani, Baduel, & Rogé, 2014).

Hypothesis

The current research project examined the visual attention patterns of children with and without ASD as they passively viewed a video game stimuli. The long-term goal of this research is to determine if children with ASD play video games similarly to better understand whether video game play can be used as a context for creating opportunities for children with ASD to establish reciprocal friendships with their typically developing peers. The current project focused on the question, do typically developing participants and participants with ASD visually attend similarly during a passive viewing activity involving a video game play stimulus? Due to previous research on this project, the hypothesis for the current project was that typically developing participants, and participants with ASD would fixate similarly.

Chapter 2

Method

Participants

Participants were 16 individuals with ASD and 9 with typical development. Participants with ASD were recruited from a local non-public school for children with ASD. Participants without ASD were recruited through personal contacts. Only children whose parents provided signed informed consent and who also provided assent to participate and who met the inclusion criteria were included. Inclusion criteria for the participants with ASD included: 1) having a documented diagnosis of an autism spectrum disorder from a medical professional; 2) being between the ages of 6 and 21, inclusive; 3) having parental (or primary caregivers) permission to participate in the investigation; and 4) providing their own assent to participate (if under the age of 18) or written consent to participate (if over the age of 18). Inclusion criteria for the participants with typical development included: 1) having no reported and/or documented history of any type of disability; 2) having their parental (or primary caregivers) permission to participate in the investigation; and 3) giving their own assent to participate (if under the age of 18) or written consent to participate (if over the age of 18).

Diagnosis of ASD was obtained through parental and/or school record report and documentation. Matching across the two groups of participants was done based on chronological age. Matching of participants was not one-to-one as there were more participants with ASD than participants without ASD included in the sample. There is one participant without ASD for every age (in years) of the participants with ASD.

Materials and Stimuli Development

Three different video game play clips from *LEGO Marvel Superheroes* video game were

captured using a Microsoft Xbox One. The Xbox One has a feature that allowed for recording of gameplay on the gaming console. All characters in the videogame were LEGO figures, with human-like features (e.g., faces, legs, arms, bodies). In the first clip, two characters (i.e., Ironman and Hulk) are working together to get through a passage that is blocked by a fallen truck. The second clip displays one character (i.e., Spiderman) saving another two (i.e., Hulk and Ironman) from being swept away in a tornado. The third clip displays the same three characters working together to fight a common enemy (a giant creature created from LEGO sand).

General Procedure

Each participant took part in one eye tracking data collection session. During this session the participant was calibrated with the eye tracking equipment using a two-point gaze fixation procedure in which the participant was directed to look to the top left and then the bottom right corner of the screen by the presence of a familiar cartoon character in these locations. After the calibration was complete, the computer displayed how well the participant was calibrated and the research team determined if the individual was okay, or needed to recalibrate. Recalibration would take place, and continue until the calibration was sufficient. Once proper calibration was achieved, each participant watched each recorded video game play clip one time. There were no additional sessions and no repeated viewings of the videos allowed while data were being collected.

The Tobii T60 and the software Tobii Eye Tracking Studio were used to track the eye movements and visual attention of the participants in this study. The Tobii T60 is an eye-tracking device that captures the movements of the eye and the participant's point of focus or fixation at any given time. Infrared light is used to create reflections from of the pupil and cornea of the eye. The eye tracker uses the geometric features of this reflection to determine where the eye is

looking on the device's screen. The Tobii captures six fixations per second by using the information from reflections to capture how the eye is continuously moving. During data collection session, the Tobii was connected to a Dell laptop where all of the data were stored within the Tobii software on the computer.

The "replay" feature of the software attached to the Tobii screen was used to review the recorded data. This feature allowed the researchers to view the captured data of the participants eye gaze. The visual fixations of the participants were captured as dots or circles on the screen. The longer the participant looked at something, the larger the fixation circle became. Small lines between these fixations noted the visual saccades, or path of eye movement.

Data collection setting

To gather the data for this study, multiple trips we taken to a school in central Pennsylvania designed specifically for children with and ASD diagnosis. At the school, the research team was provided a small room for their data collection sessions. The small room contained a table, the Tobii machine, the Dell laptop, and chairs. Participants were scheduled for 15-minute sessions, which was sufficient for watching all of the clips. Each participant sat in a chair facing the Tobii T60 screen located on top of the table. The researchers sat to the side of the participant in front of the Dell computer in order to start the video, as well as observe and monitor the participant.

Data Analysis

Only participants for whom the Tobii system had captured 50% or more of their fixations were used for the data analysis. A coding scheme was created within the Tobii program that informed the computer software of the "areas of interest" for analysis of visual attention data. This coding scheme focused on all the specific aspects of the clips and included: Hulk,

Spiderman, Ironman, Sandman, animates, and the tornado. Each individual character had their own code to identify when each participant looked at that character. After the characters, codes were created for other aspects of the game which included: background elements, key elements, lives, dialogue, etc.

After all the areas of interest were created, data from each participant was coded by documenting the focus each individual fixation for each participant. Coding was done by hand by pausing the video, and slowly clicking forward through the video sample by sample. Every fixation and saccade was coded in this manner. For example, when the participant looked at Hulk, the F1 button was pressed. Because of the coding scheme that had been created by the research team, the Tobii system knew F1 was coordinated with Hulk and that he was the focus of the visual fixation at that moment.

Once the coding was complete for every video, the data were exported from the Tobii into Microsoft Excel. Using a SUM formula, the amount of time each participant spent looking at each specific element, both characters, and objects throughout the game was determined. Next, the amount of space each element took up on the screen was calculated. To do this, multiple screenshots of the clips were captured and placed into a PowerPoint presentation. When in PowerPoint, rectangular boxes were positioned over each element to determine the size of the element. If an element changed shape throughout the clip, an average size was calculated with the help of multiple rectangular boxes. Lastly, the size of each element was divided by the total size of the screen to determine the percentage of the screen an element occupied.

After the relative size of each element was determined, the amount of time each element was on screen was calculated. This provided a measure of the availability of each item for fixation during each game play clip. Then, for each sample of the recording, it was documented

whether or not each element was on screen. Then the number of seconds each element was present on screen was divided by the total amount of seconds in the clips. This gave the percentage of time that each element was on screen and available to possibly be fixated on.

Next, each element's presence on screen was calculated. By completing this step, the probability of that element being looked at based on its size and how often it appears on screen could be determined. The percent of the screen each element took up was multiplied by the percent of time the element was on screen. This provided the presence statistic of the element in percent form.

The mean ratio of the presence of each element compared to the amount it was fixated on by the participants was calculated. This mean ratio displayed whether the social aspects of the game were being looked at more than, less than, or equal to what would be expected based on their presence on the screen.

Finally, in order to determine the validity of the results, the sign and binomial test was used. The sign and binomial test used the number of participants that displayed the majority result shown and the number of participants total. By inserting these two numbers into the formula it was possible to determine how likely it was for results to occur at random. For all of the results the sign and binomial test displayed that it was less than a 0.001% chance that the results occurred randomly.

Reliability

Reliability was an important factor in this project in order to determine if the coding scheme could be generalized. In order to check the reliability, two people coded the fixations in 33% of the video clips from five different participants. Each coder did this without looking at, or discussing with the other coder. After that process was complete, the two researchers met in

person to discuss their findings, and compare their codes. The results of this comparison indicated 98% reliability between the coders, specifically they had 100% of the same codes for 8/10 of the clips and 90% for the two remaining clips. This reliability proved the coding scheme was reliable.

Chapter 3

Results

A total of 25 participants, 16 with ASD, and 9 typically developing participated in the current investigation. The participants ranged in age from 7 years, 6 months old to 20 years, 2 months old. Participants included 13 boys and 1 girl. A summary of this demographic information can be found in Table 1.

Table 1. Gender and Age of Participants in Samples

	Male (Percent %)	Female (Percent%)	Mean Age (years)
Individuals with ASD (n=16)	94	6	13.19
Individuals who are NT (n=9)	78	22	11.31

To answer the research question, two sets of data were analyzed. Visual attention data were examined relative to determining the participant's time on task as well as their specific visual attention patterns. The specific visual attention patterns were analyzed to determine the similarities and differences between the two samples.

Total fixation time was calculated by determining the total time each participant spent fixating somewhere on the screen. Time on task was calculated as the proportion of time spent attending to an area defined as an area of interest (AOI). For example, if the eye tracker recorded 25 seconds of fixation by the participant, then 25 seconds represents the total fixation time for that participant. After the total fixation time was determined for each participant, the quantity of time spent looking at an AOI (five AOI -- action, dialog, Hulk, Ironman, and life

were designated for this study) was calculated and compared to the total fixation time for that participant. As an example, perhaps a participant spent 8 seconds looking at action, 1 second on dialog, 5 seconds on Hulk, 5 seconds on Ironman, and 1 second on life. For this participant, then, total time on task was 20 seconds out of the total 25 seconds spent fixated somewhere. This would indicate, then, that 5 seconds were spent fixated on something not identified as an AOI. So the percent time on task for this participant would be 80% (20/25 seconds). For this study, the total on task percent for individuals with ASD on any AOI was 63.02% while their percent on an area other than an AOI was 36.98%. Meanwhile for typically developing individuals 81.21% of their overall time was spent focusing on an AOI, while 18.79% was spent looking elsewhere on the screen.

Next the distribution of the participants' visual attention was examined. This is similar to the above analysis, but was more specific in that this calculation included only fixations on an AOI, and excluded "other". These data were based on the distribution looks when the participants were fixated on the AOI. The purpose of this analysis was to determine if the participants with and without ASD distributed their visual attention similarly across the AOI. As can be determined from the data presented in Figure 1, the results of these analyses across the groups were very similar. The largest difference between the groups was for the AOI "action". Individuals with ASD fixated on "action" 33.40% of their time while typically developing individuals spent 28.87% fixating on "action", a 4.53% difference. The smallest between groups difference was observed for fixations on "Ironman", with 17.05% time spent by typically developing individuals, and 16.53% time spent by individuals with ASD, leaving only a 0.52% difference between the two groups of participants. It is also apparent from the data presented in Figure 1, that it was not always the same group of participants that fixated "more" on each of the

AOI. For example, for fixations on “action” and “dialogue”, individuals with ASD had the higher percent of fixations, while typically developing individuals had the higher percent fixation rate for the remaining three AOIs: “Hulk”, “Ironman”, and “life”.

As you can see from Figure 1, there is a small difference between the individuals with ASD, and those who are typically developing for their percent time spent in each area of game play. For each AOI, the participants with ASD did have a lower fixation percent than did the typically developing counterparts, but the main difference between the two groups came with areas other than AOIs. Individuals with ASD spent an average of 36.98% of their time on areas other than those defined as an AOI, while the typically developing individuals spent an average of 18.79% of their time looking at something other than an AOI.

Figure 1: Percent Time Spent in Each Area

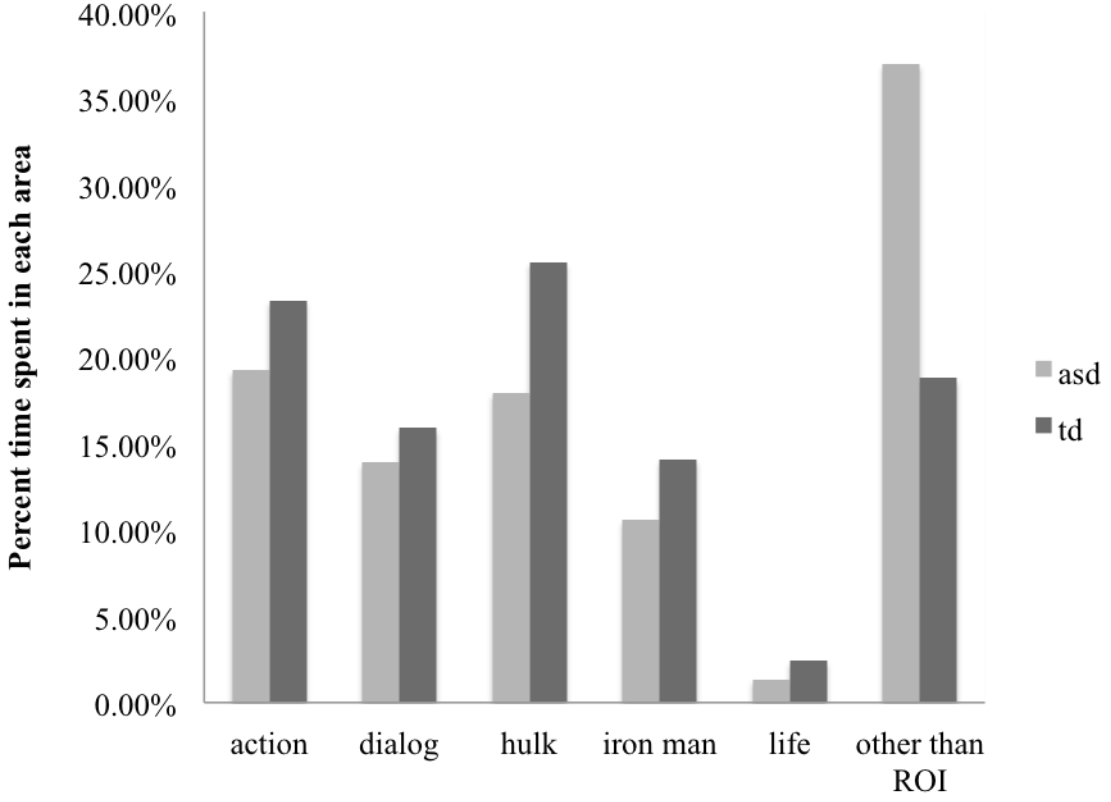
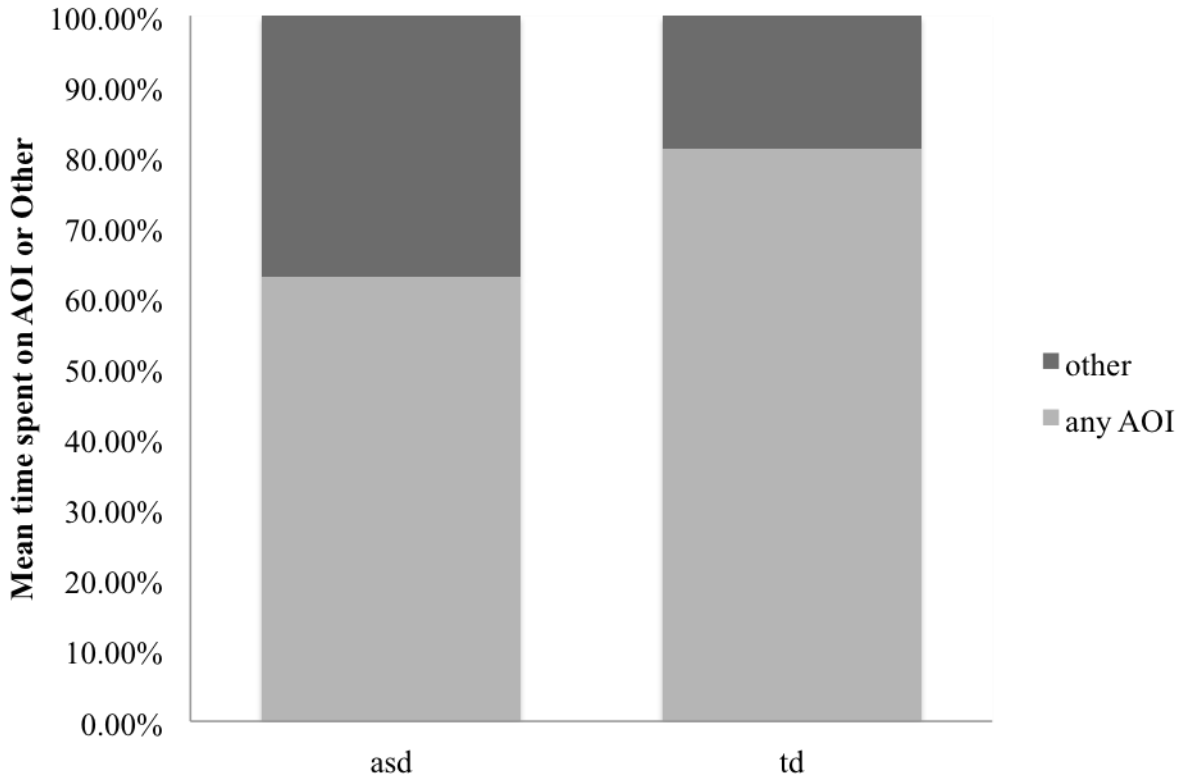


Figure 2 provides an example of a heat map from the video game clips from *LEGO Marvel Superheroes* video game used for data collection for the current project. The heat map represents the intensity of fixations to the AOIs throughout the video clip. Comparing this data to the data presented in Figure 1, it is clear "Hulk" has the highest percent of fixations throughout the videogame, as the heat index is most intense over this AOI. It can be observed that all the participants fixated on "Hulk" during this portion of the video game clip viewing.

Figure 2: Heat Map of Hulk during high social game play with both the fixations of participants with ASD as well as typically developing participants

Figure 3 illustrates the overall mean time spent on AOIs and areas other than AOIs. From this graph, one can clearly see both individuals with ASD as well as their typically developing counterparts spent the majority of their time fixated on AOI, but again the participants with ASD spent more time looking elsewhere than did the typically developing participants. Overall, the majority of each group's time was spent looking at AOIs.

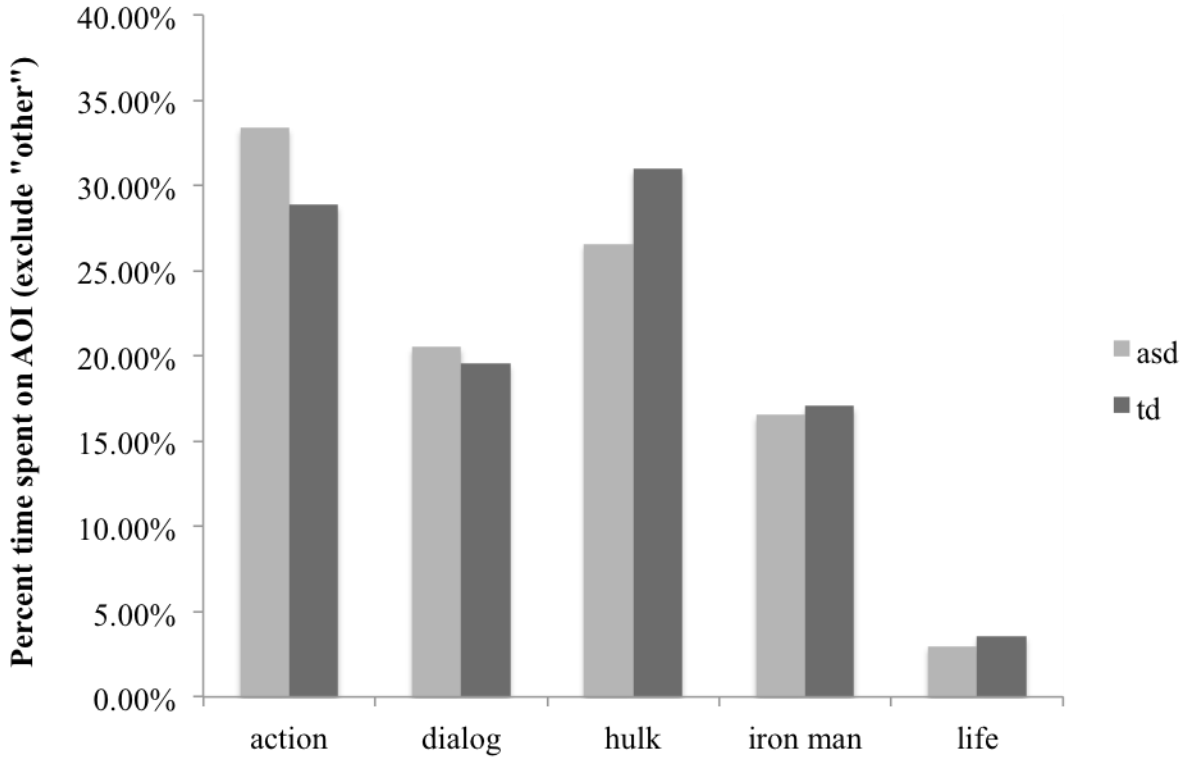
Figure 3: Mean Time Spent on AOI or Other



And lastly, Figure 4 displays the percent of fixations within the AOIs only, this answers the question of whether the fixations of the two groups were distributed similarly across the AOI. Although it was seen in the above figures that the participants with ASD and the typically

developing participants fixated similarly on AOIs, it is very clear here how alike their fixations are when you remove the “other” category.

Figure 4: Percent of Fixations within the AOIs Only



This slight percent of a difference shows there is overall only a small difference in fixations between those with ASD and typically developing individuals. This could indicate video games could be a great way for individuals with ASD to build true friendships with other individuals through the use of playing video games.

Chapter 4

Discussion

The goal of this research was to determine if individuals with ASD and individuals who are typically developing fixate similarly during video game play passive viewing task. The long-tem goal of the project is to identify any potential barriers that may exist to using video games as a context for providing opportunities for friendship formation and maintenance for children with ASD and their peers. The data collected in the study revealed both individuals with ASD, and typically developing participants viewed elements of video games in the same way during the viewing task in the current investigation.

Fixation Patterns

Fixation patterns were analyzed based on five main AOI that included: “action scene”, “dialogue”, “Hulk”, “Ironman”, and “life”. As seen in Figure 4, “action scene” and “Hulk” were fixated on the most, followed by “dialogue”, “Ironman”, and then “life”. Each AOI possessed different elements and attributes. Therefore there may be many potential explanations for the similarities and differences observed in the fixation patterns of the participants.

Action scenes were fixated on the greatest amount of the time, which could be the result of many different factors. Action scenes occurred during the clip for a substantial amount of time. Action scenes could range from moving objects on the ground, to the train being ripped apart and thrown. It is not surprising that “action scene” was the fixated on most frequently and for the largest amount of time due to the fact that an action scene AOI was present for the majority of the clip viewed by the participants. In addition to the quantity of time on screen,

"action scene" AOIs generally included events happening to the characters. These events were interesting to observe and were also critical to the storyline of the game. Game players would need to attend to these events to be able to determine what they (as the player) should do next, and to be able to predict the next events in the story for the characters.

The AOI that received attention for the second largest quantity of time was Hulk. Hulk was a main character, and played a major role in the clip by being the center of attention for a good portion of the video. Hulk participated in many of the action scenes, and is also a large sized character, who takes up more room on the screen than other characters. It may be because he is such a prominent social aspect in the clip that he received such a large proportion of the participants' visual attention during the viewing task.

Dialogue was the next most frequently looked at aspect of the game. The dialogue would appear towards the bottom of the screen when a character would speak, and then would disappear when the conversation was over. Because of the inconsistent nature of this AOI on the screen, it is understandable why "dialogue" was not fixated on as frequently as other AOIs. When "dialogue" was on the screen, the participants did visually attend to it briefly and then return their attention to another part of the screen, either the character or the action taking place. This seemed to be an appropriate pattern of visual fixation to dialogue during game play. Players should attend to dialogue when present, as it often gives information about the story, characters, or how to play within the game, but should also return their attention to the task at hand in the game fairly rapidly after gleaning the information put forth in the message.

Although Ironman was the other main character in the video game clip, he didn't appear on the screen as much as Hulk did, and was also a much smaller character than Hulk. Because of

the size difference, and lack of on screen time, the "Ironman" AOI was not as prominent of a focus point for the participants. Finally, "life" was the least viewed AOI of the game clip. Life was a constant on the screen, in the top left corner. Because it rarely changed, it did not attract attention to the participants, which may explain why it was the least fixated on AOI.

The data from the video clip show how most participants focused the majority of their attention on relevant aspects of the video game for successful game play. The conclusion of the analysis of this data conveys that both the participants with ASD, and the typically developing participants fixated very similarly during this passive video game viewing task.

Relation to Previous Research

The data from this research contradicts the previously reported research conducted by Guillon, Quentin, Hadjikhani, Baduel, and Roge (2014), which stated "overall, the majority of eye tracking studies indicate individuals with ASD demonstrate decreased visual attention to social stimuli relative to TD individuals." The results from the current project indicate individuals with ASD and individuals who are typically developing displayed equal visual attention to the video game stimuli in the current study.

In 2015, an eye-tracking study published by Shi, Zhou, Ou, Gong, Wang, Cui, Lyu, Zhao and Luo reported results that corroborated those reported for the current study. The results of this investigation indicated there were no statistical differences in total fixation duration between the ASD and TDC groups of the experiment, exactly as this data shows.

Clinical Implications

Because the data from the current study indicate children with ASD fixate the same as

typically developing children when watching clips of video game play, speech language pathologists should consider implementing video game play into their therapy sessions. As stated above from Finke, Hickerson, and McLaughlin (2015), children with ASD love to play video games and by implementing game play into speech therapy, you could truly engage the child in therapy, thus the child would actually enjoy therapy, and which may result in more efficient improvement. Video games could also be a way to bring children together and provide them with an opportunity to interact with each other. Bringing video games into a clinical setting would be a novel practice, but the growing body of literature suggests it may be a novel practice worth serious consideration.

Limitations

The current study has several recognized limitations. This study was limited to twenty-five individuals, sixteen with ASD and nine typically developing. This study only recruited participants with ASD from one school in central Pennsylvania, leaving very similar demographic profiles, which may limit generalizations across populations. Individuals were only between the ages of 6 and 21, which did not permit the study of young children, or older adults. The participants only watched one video game (*LEGO Marvel Superheroes)*, not allowing researchers to see how they do when watching another type of video game. Participants only watched the video game for fifteen minutes, leaving questions of how well they would do if they had to pay attention for a longer period of time. All participants sat in a chair facing the Tobii T60 screen located on top of the table while researchers sat to the side of the participant to reduce distractions. And lastly, only participants for whom the Tobii system had captured 50% or more of their fixations were used for the data analysis, removing some individuals from the study.

Future Research

Since it is now determined that individuals with ASD can fixate the same way as typically developing individuals during passive viewing of a video game play clip, this research can be expanded to better determine whether or not video games are played similarly by children with and without ASD. This will continue the line of inquiry to understand the utility of video gaming as a context where children with ASD may create friendships with their peers. This study was about visual attention, but future studies should investigate how children with and without ASD physically play the video games, alone and with a play partner. Attending to, and playing video games are two completely different tasks and need to be studied separately. A longitudinal study that observes how children with ASD play video games together as well as interact as they play could be helpful in providing insight as to how the nature of friendship is affected by ASD.

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Bachelor of Science Degree in Communication Sciences and Disorders, Spring 2016
Minor in Special Education
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Honors and Awards

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Association Memberships/Activities

- Member of National Student Speech Language and Hearing Association
- Health and Human Development Honor Society
- Health and Human Development Honor Society Executive Liaison, 2015, 2016
- Health and Human Development Student Council
- Rules and Regulations Committee Member, Penn State's IFC and Panhellenic Dance Marathon, 2014, 2015, 2016
- Rules and Regulations Security Leader, Penn State's IFC and Panhellenic Dance Marathon, 2015, 2016

Professional Experience

- Research Assistant within Communication Sciences and Disorders
- Teaching Assistant for Communication Sciences and Disorders 300: Developmental Considerations in the Assessment and Treatment of Language Disorders
- Penn Highlands Healthcare, Volunteer in Therapy Department
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