THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF COMMUNICATION SCIENCES AND DISORDERS

AN ANALYSIS OF THE EYE GAZE PATTERNS OF INDIVIDUALS WITH ASD DURING PASSIVE VIEWING OF SOCIAL STIMULI IN VIDEO GAME CONTEXTS

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SPRING 2015

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Communication Sciences and Disorders
with honors in Communication Sciences and Disorders

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ABSTRACT

The overall purpose of this line of research is to determine if stable friendships can be cultivated between children with autism spectrum disorder (ASD) and their typically developing peers through engagement in mutually motivating activities, specifically while playing video games. The goal of the current research project is to better understand the eye gaze patterns of children with ASD when passively watching a dynamic video game stimulus. To answer this research question, eye-tracking technology (i.e., Tobii T60) was used to gather data from children with ASD and their peers. A coding scheme was developed to determine how often the children with ASD visually attended to various elements of the video game. This is an important step in this line of research as it is critical to determine if children with and without ASD attend to and play video games similarly prior to designing interventions with the objective of promoting friendship in this context.

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ACKNOWLEDGEMENTS

There are so many people that have helped me to make this thesis possible. I would like to extend my complete gratitude to Dr. Erinn Finke, who was always available to me and went above and beyond in her role as my Thesis Supervisor to make this thesis possible. Her time and effort on this project was completely unparalleled and I am so grateful to her for all of her guidance throughout this process. I would also like to thank Dr. Krista Wilkinson for all of her assistance throughout this project. Her persistence and incredible teaching abilities were what made the results section of this paper possible. She was also always available whenever help was needed. Next, I want to thank Dr. Ingrid Blood for her help within her role as my Honors Adviser and her continued support through my undergraduate honors experience. Lastly, I want to show my appreciation for all of the members of the video game research team, without whom I would have been unable to complete this thesis. They helped me and encouraged me throughout this entire process.

Chapter 1

Introduction

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is currently one of the fastest growing developmental disorders. The Centers for Disease Control and Prevention has reported that 1 out of every 68 children will be diagnosed with ASD (CDC, 2014). This statistic is higher than the number of children with diabetes, AIDS, cancer, and Down syndrome combined (Autism Speaks, 2012). According to the CDC, "ASD has been reported in all racial, ethnic and socioeconomic groups" (p. 1), but is diagnosed more frequently (1 in 42) in males than in females (1 in 189) (CDC, 2014).

Autism spectrum disorder is different from other disorders because those with ASD fall somewhere on a scale of severity. Depending on where a child falls on this scale it can indicate their skill level in different aspects of learning and socialization capabilities. Individuals diagnosed with this disorder may have differing levels of cognition and verbal abilities. One example of this is in language development. Some individuals with ASD can develop language at a typical rate and display language skills at a very high level. However, some individuals develop very little language and others never even become verbal at all (Wilkinson, 1998).

Autism spectrum disorder is classified by a clear deficit in social skills and abilities displayed by the individual. The current *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (American Psychiatric Association [APA], 2013) describes the main characteristics

that children with ASD present typically. The first establishes the concept that children with ASD display deficits in areas of social communication and interaction. This criterion includes when children with ASD have trouble initiating social interactions and struggle with conversation. They also often are unable to share their interests and emotions with others. This heading of the DSM-5's criteria for a diagnosis of autism spectrum disorder also includes the common deficits that children with ASD display with using nonverbal forms of communication (APA, 2013)

Many individuals with ASD display weaknesses in areas such as eye contact, facial expressions, gestures, and body language. They also may display a disconnect between what they are saying and the nonverbal communication they are using. For example, their facial expression may not match the emotion they are attempting to convey. They may also show a lack of interest in others and struggle to create stable friendships (APA, 2013). This can be seen when many individuals with ASD have difficulties understanding the viewpoints of those they are interacting with or have problems maintaining a social interaction. They are also more likely to participate in behaviors that could be considered off-putting by others. These behaviors include dominating a conversation or talking in an inappropriate way (Bellini & Hopf, 2007).

Children with ASD and Friendship

One of the main symptoms associated with ASD is a deficit in social interaction and communication (APA, 2013). This means many children with ASD struggle creating and maintaining friendships with others and often become isolated (Locke, Ishijima, Kasari, & London, 2010). Due to this deficit it is sometimes incorrectly assumed that individuals with ASD

do not desire the acquisition or maintenance of friendships (Locke, et al., 2010).

It is challenging to create a definitive definition for friendship. Most professionals consider friendship to be a close and intimate relationship between two people that involves social interactions and positive feelings towards another, where the feelings are reciprocated (Bauminger & Shulman, 2003). It is extremely important for children to have the necessary social skills to create stable friendships, but these relationships also help to foster these skills. Therefore, it is important for all children to have friendships so that they can cultivate these important social skills and develop a caring attitude, empathy and sharing abilities (Bauminger & Shulman, 2003). Friendships can also help individuals to develop important skills such as linguistic capabilities and cognitive thinking.

Oftentimes, individuals with ASD have difficulty establishing stable friendships. Their deficits in social interaction can lead others to have a pessimistic view concerning the abilities of these individuals to create friendships (Bauminger & Shulman, 2003). One of the main reasons for this concept is that it is a commonly accepted idea that those with ASD struggle with Theory of Mind. Theory of Mind is the way that humans relate to one another and comprehend the fact that other people see things and feel things differently than they, themselves, do (Bauminger & Shulman, 2003).

There have been studies done to determine how loneliness can be seen and can affect individuals with ASD. One study found that children and young adults with ASD were lonelier and had less satisfaction in their friendships than their typically developing peers of the same age (Locke et al., 2010). Bauminger and Kasari (2000) examined the concept of the different types of loneliness that exist. Emotional loneliness stems from not having a sense of bonding or attachment to others. Social-cognitive loneliness is when a person does not view their

relationships as satisfactory and feel excluded from others (Bauminger & Kasari, 2000). By looking at whether or not individuals with ASD experience these types of loneliness it is easier to determine if children with ASD understand and have emotions towards friendships (Bauminger & Kasari, 2000).

The results of the loneliness study revealed that the participants with ASD did experience more loneliness than the typically developing (TD) participants. Individuals with ASD defined loneliness as being alone and rejected by peers more often than they associated it with emotions. However, the study displays that a lack of friendships does affect those with ASD and causes them to feel loneliness. This is contrasting to the idea that children with ASD do not experience loneliness because they do not desire social interaction. The results support the idea that children with ASD do have a desire to be social and create relationships with others (Bauminger & Kasari, 2000).

It is important to consider ways to help individuals with ASD learn how to better create these relationships. Research has shown that the most common way to create friendships for adolescents is through common interests (Locke et al., 2010). When individuals are able to participate in activities together it can help to foster friendships. By helping provide opportunities for children with ASD to create relationships with others that share their interests it is possible to help them to create friendships.

At this point in time a growing interest for almost all teenage individuals is video games. These games can be played on the Internet, computers, hand-held gaming systems and larger systems such as an Xbox or Wii. In a research study done by the Pew Research Center they concluded that 97% of American teenagers play games on at least one of these consoles. 56% of these teenagers played video games on an Xbox, PlayStation or Wii console (Lenhart, 2008).

It is not just typically developing children, but also those with ASD have begun to play these games on a regular basis. A report done by Autism Asperger's Digest concluded that 64.2% of individuals with ASD spent their free time either watching television or playing video games (Temple Grandin, 2012). Furthermore, Medical Daily reports that children with ASD play video games for twice as long as their TD peers (Anthony Rivas, 2013). It can be seen that video games are enjoyed by a majority of individuals with and without autism spectrum disorder.

Eye-Gaze patterns of Children with ASD

Due to the findings listed above the conclusion can be drawn that both individuals with and without ASD enjoy playing video games. Using this information it can be determined that video games may be a common interest that could be used to help those with ASD foster friendships. However, it is extremely important to first look at the visual attention of those with ASD. This information can provide significant insights into whether or not children with ASD orient towards social stimuli within the game in the same way that their typically developing peers do.

The past decade has made way for an explosion of research investigating the visual attention patterns of individuals with ASD. This is most likely due to recent developments in technology that allow for collection and analysis of more reliable eye-tracking data (Guillon, Hadjikhani, Baduel, & Rogé, 2014). Eye gaze patterns are particularly interesting to study in individuals with ASD due to their core deficits in social interaction (APA, 2013). Determining how individuals with ASD attend to various social stimuli may help to better understand their strengths and needs. Through the use of eye tracking it is possible to determine whether children

with ASD attend to people and follow conversations similarly to individuals without ASD (Guillon et al., 2014).

In most analyses of young children who are later diagnosed with ASD, eye gaze patterns that might be expected of an individual with ASD are observed. These young children did not frequently orient to people or social situations (Guillon et al., 2014). When studies were directed at older individuals with ASD, many of the same conclusions were drawn. It was also taken into account in these early studies that compared to their typically developing peers, individuals with ASD attended more often to mouths in social scenarios (Guillon et al., 2014).

The first notable study done helped promote this idea because it concluded that eye gaze patterns of those with ASD did display the expected preferential orientation towards mouths. This study focused on eye gaze patterns when viewing a social situation. For coding purposes they separated the screen displaying the videotape clip into four different sections: mouth, eyes, body and objects (Klin, Jones, Schultz, Volkmar, & Cohen, 2002). Due to the previous research done on the subject at the time, the researchers hypothesized that children with ASD would attend most frequently to mouths. They also believed that how often the eye gaze patterns of children with ASD followed the eyes of characters would be an indication of their level of severity of ASD. If an individual followed character's eyes more frequently it was expected that they would display better social skills and abilities than individuals with ASD that did not do look at the character's eyes (Klin et al., 2002).

The study recruited 15 adolescent males with ASD and 15 adolescents from within the community that were screened and determined to be neurotypical and free of any psychiatric illness. Using ISCAN Inc. technology, the participants all watched a series of 5 clips chosen from Edward Albee's 1967 film "Who's Afraid of Virginia Wolf?" It was determined that these

clips displayed complicated social situations that resembled real-life social scenarios as well as background objects (Klin et al., 2002).

The results of the study were somewhat concurrent with the researcher's hypothesis and also slightly different. The study did help to verify the idea that individual's with ASD looked more frequently at the mouth of conversation partners and less frequently on the eyes. The participants with ASD were twice as likely to look at mouths and to not the eyes as the group of typically developing participants (Klin et al., 2002). However, the second part of the hypothesis, which concluded that looking more at eyes would indicate higher social functioning, did not prove to be correct. The results displayed that fixation time on the eyes was not a predictor of social competence or incompetence (Klin et al., 2002).

However, an individual's fixation time on the mouth and object sections of the coding scheme did follow patterns of social adaptation. Looking at character mouths equated with higher social abilities. Contrastingly, the more attention that individual's gave to objects indicated lower social adaptation skills (Klin et al., 2002).

The next study that explored eye gaze in individuals with ASD looked at how children with Williams syndrome and ASD viewed movies and cartoons. These two disorders are neuro-developmental and have common stereotypes concerning social tendencies associated with them. Individuals with Williams syndrome are often thought to be particularly interested in social interaction, whereas individuals with ASD are thought to feel the opposite (Riby & Hancock, 2009).

The study used clips including both human actors and cartoon characters from the movie *The Adventures of Tin-Tin*. The clips containing human actors were recorded on a Sony digital camera and displayed normal social interactions between the individuals. The clips containing

cartoon characters chatting over coffee were captured using Adobe. The researchers tracked the eye movements of their participants using a Tobii 1750 eye-tracker (Riby & Hancock, 2009).

The participants of the study included 20 individuals with ASD that ranged in age from 6 years old to 18 years old. The results of the study concluded that the participants with ASD spent more time looking at background objects and the bodies of characters and less time looking at faces. The study used both cartoons and humans to determine if the atypical eye gaze patterns seen in individuals with ASD were consistent even with non-human characters. The study determined that those with ASD still do not look at faces as much as those with Williams syndrome or typically developing individuals. When looking at just the regions of the face participants with ASD looked more at the mouth regions of the characters and less at the eyes, which was also seen in the previous studies (Riby & Hancock, 2009).

Hypothesis

The current research project examines how children with ASD view social situations in video game contexts. The long-term goal of this research was to determine if children with ASD can create stable friendships with their typically developing peers by playing video games together. The current project focused on the question of how children with ASD viewed the social aspects displayed within the game. The video game used was particularly interesting due to the fact that it involved LEGO characters. These characters are very human-like but are still computer animated.

Due to the previous research that has been completed, the hypothesis for the current project was that children with ASD would attend to background elements and other aspects of

the game an equal amount of time as social aspects. This is because previous studies have found those with ASD less likely to orient to social aspects of videos.

Research Question and Importance

The research question for this project was; what is the proportion of visual fixations towards human-like video game characters by young adults with ASD during passive viewing of a dynamic video game stimulus? By looking into how individuals with ASD view these social elements it is possible to compare the data to how they might view real-life human interactions. If individuals with ASD prove they are capable of viewing the social aspects in a more typical way than expected it may prove that they are more capable in their own social skills than was initially thought. Overall, having an idea of how individuals with ASD give out their attention to social situations creates a better understanding of how they participate in and view their own daily social interactions.

Chapter 2

Method

Experimental Design

The design of the experiment involved using a dynamic stimulus and tracking the eye gaze patterns of individuals with ASD. The stimuli were videos of gameplay recorded from an Xbox One gaming device. The videos consisted of 3 different clips and were approximately 2 and a half minutes long. The clips were taken from *LEGO Marvel Superheroes*, a video game created to follow the concept of a popular film within the adolescent age group, *The Avengers*. The goal of using this stimulus was to catch the attention of the participants because the game is geared towards their age group.

Participants

For our participants we sought out individuals with official ASD diagnoses. We found participants by collecting data from a school in central Pennsylvania established specifically for individuals with ASD. We wanted to have participants between the ages of about 6 and 20 because this is a population that is most likely to play video games. It was important that we received consent from the children's parents, verbal consent from the participant if they were under 18, or written consent from the participant if they were over 18.

Materials

The materials used in the experiment were video game clips. These clips were recorded using an Xbox One. The Xbox One has a feature that allowed for recording of gameplay on the gaming console. The stimuli were three different video clips taken from the *LEGO Marvel Superheroes* video game. All of the characters displayed in the clips had human-like features and behaved in humanistic ways. The first clip involved two characters working together to get through a passage that is blocked by a fallen truck. The second clip displays one character saving another two 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). The social characteristics of the game clips included: *The Avengers* characters, the sand creatures that act as enemies, Sandman (the giant made of LEGO sand) and the tornado.

The instrument used to track the eye movements of the participants was the Tobii T60 and the software Tobii Eye Tracking Studio. Tobii is a device that is able to determine the movements of the eye and what they are fixating on at any given time. Tobii determines these movements by using light to create reflections from of the pupil and cornea of the eye. The machine 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. The Tobii was connected to a Dell laptop where all of the data was stored within the Tobii software on the computer.

To review the recoding the Replay within the software attached to the Tobii screen was used. From the Replay section we could view the data of the participants eye gaze and were able watch each individual fixation as a red dot on the screen. Small cycads displayed the eyes' movement and when the red dot grew in size it meant that the participant's gaze was remaining in one location.

Data Collection

The data for the study were gathered by taking multiple trips to a school in central Pennsylvania specifically designed for children with an ASD diagnosis. The school gave the research team access to a small room with just a table and chairs. The only thing on the table was the Tobii machine and the attached Dell laptop. This set-up allowed for minimal distractions for the participants because the only thing for them to focus on was the Tobii screen. Participants were brought in within 15-minute slots to watch the video clips.

Each participant sat in a chair facing the screen. The researchers sat behind the screen to start the video and monitor the participants. First the participants were calibrated with the Tobii T-60 technology. This was done by ensuring each participant was positioned appropriately for the Tobii T-60 to recognize his or her eyes. After this the researcher would use a two-point calibration. The participants were directed to look at the top left and then the bottom right corner by the presence of a familiar cartoon character in these spots. After calibration the desktop would display how well the participant was calibrated and the researcher would determine if the individual needed to be calibrated again. The participant would be re-calibrated if necessary until the calibration was sufficient.

Next, the participant would watch the video in its entirety on the Tobii screen. The only sound in the room came from the laptop and coincided with the video clip being played on the Tobii screen. The participant would sit for the entire time that the video was being shown. At the end of the showing the teacher who had accompanied the participant would usually give them a reward consistent with the school's policies.

Data Analysis

For data analysis the research team used data from participants for whom the Tobii had captured 50% or more of their fixations. The data from these participants was analyzed through a coding scheme created within the Tobii program that focused on the social aspects of the clips that were chosen. These social aspects included all of the characters. For the three clips the characters included: Hulk, Spiderman, Ironman, animates, Sandman and the tornado. Each of these characters had their own code to identify that the participant looked at them. Then, codes were created for all of the other aspects of the game. These objects included: background elements, key elements, and parts of the game such as words on the screen.

After the codes were established, the data from each participant was coded by assigning a code to each individual fixation. This was done by pausing the video and slowly forwarding through and watching for when the participant looked at something new. Their eye gaze was displayed by a red dot and then a cycad would indicate the gaze movement. Each new fixation would be assigned the appropriate code using a coding scheme embedded within the Tobii software. For example, when the F1 button was pressed it signaled to the Tobii program that Hulk was the focus of the visual fixation.

After the coding was complete for all of the videos the data were exported from the Tobii Studio into an excel spreadsheet. Using a SUM formula in excel the amount of time each participant spent looking at each of the elements of the game was determined. These elements included all of the characters and objects in the game.

The next step in the data analysis process involved determining how much space each of the elements took up on screen. This was accomplished by taking multiple screenshots of the clips and then putting each picture into a PowerPoint presentation. In PowerPoint, rectangular

boxes were placed over top of each element to determine the size of the element. If an element changed shaped throughout the clip, an average size was calculated through the use of multiple rectangular boxes. Finally, the size of each element was divided by the total size of the screen. This percentage indicated what percent of the screen an element took up.

After this, it was important to determine how much time each element was on screen and available to be fixated on. This was accomplished by going through each clip individually. For each second of the clips it was determined whether or not each element was on screen. Then, the number of seconds that 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 looked at.

The next step was to calculate each of the element's presence on screen. By calculating the presence of an element the likelihood of that element being looked at based on its size and how often it is on screen could be determined. To determine the presence the percent of the screen each element took up was multiplied by the percent of time that it was on screen. This provided the presence statistic of the element in percent form.

After this, the mean ratio of the presence of each element compared to the amount that it was actually looked at by the participants on average was calculated. This mean ratio displayed if the social aspects of the game were being looked at more than, less than, or equal to what would be expected from their presence.

Finally, in order to determine the validity of the results the sign and binomial test was used. This 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 that the results we found were 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

Testing for Reliability was important to determine if the coding scheme could be generalized. To check for reliability two people coding each coded one out of the three clips from 5 different participants each. Then, the two testers coded 10 seconds from each of the 5 clips that the other reliability checker coded. They did so without looking at the other person's codes. The two researchers then met in person to compare what each one had coded to see if the codes they had chosen were the same. The two researchers that checked reliability 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

The participants that we collected data from ranged in age from 7 years and 6 months old up to 20 years and 2 months old. These ages can all be seen below in Table 1. Our participants included 13 boys and only 1 girl. They were all on the ASD spectrum and considered to be low functioning. The participants were nonverbal and required a large amount of daily support.

Table 1, Participant Ages

Participant¤	Age¤
AKC-·A¤	15;2¤
PFT-A2¤	14;·7¤
NFH-A¤	15;11¤
KSL-A¤	11;6¤
GWB-A¤	9;5¤
ZLN-A¤	14;6¤
JJM-A¤	14;2¤
CNL-A¤	20;2¤
NSH-A¤	15;4¤
ZBH-A¤	14;6¤
NMC-A¤	15;8¤
JSY-A¤	17;4¤
JHK-A¤	7;6¤
JMC-A2¤	13;5¤

When analyzing the results of these participants it was important to look at how individuals with ASD focused their attention while watching the video game stimuli. The coding scheme was used to calculate the locations of visual fixations during their viewing. It was important to determine if individuals with ASD were focusing their attention on social aspects of the video game.

The results are displayed using the mean ratios. Figure 1 displays the average mean ratio for each of the social aspects of the game. The 1 on the y-axis indicates the presence, or how much it was predicted that this character would be looked at. Anything above this level indicates the character was looked at more than expected. For example, animate characters were looked at twice as much as would be expected, as indicated by their bar reaching the 2 on the y-axis. It can be seen that the Spiderman, Animate, Hulk and Ironman were looked at more than would be expected by their size and time on screen. However, Sandman and tornado were looked at less that would be expected given these same factors.

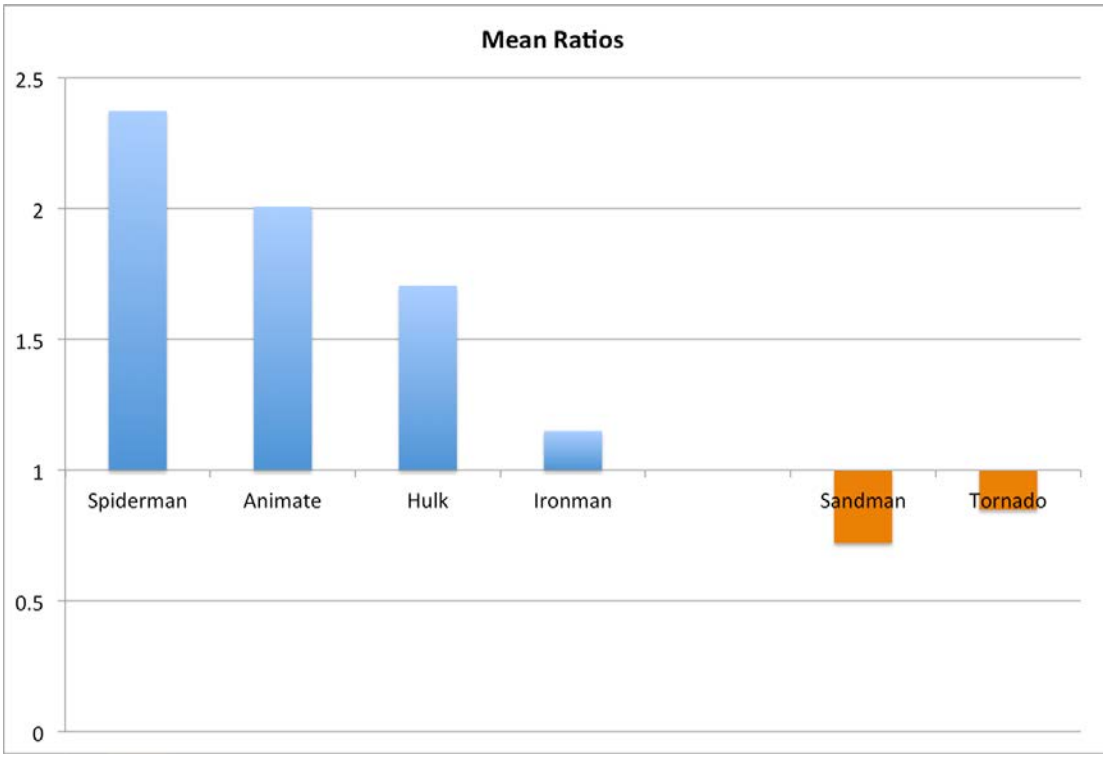

Figure 1, Mean Ratios

Data were also analyzed relative to how much each participant looked at the different elements. The data from almost all of the participants reflected the average mean ratio seen in Figure 1. Figure 2, Figure 3 and Figure 4 display three of the main social elements and how each individual participant viewed them. Every participant except one looked at Hulk and Spiderman more than would be expected. Also, over half of the participants looked at the tornado less than would be expected.

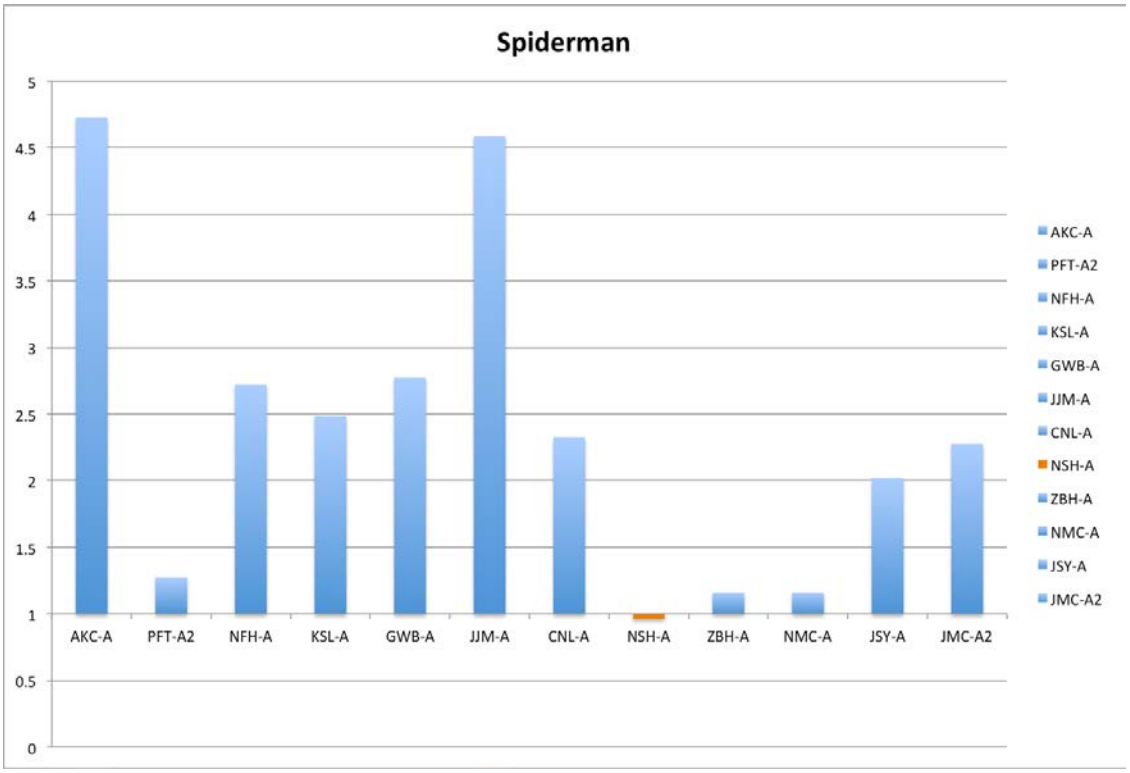

Figure 2, Spiderman Viewing Patterns

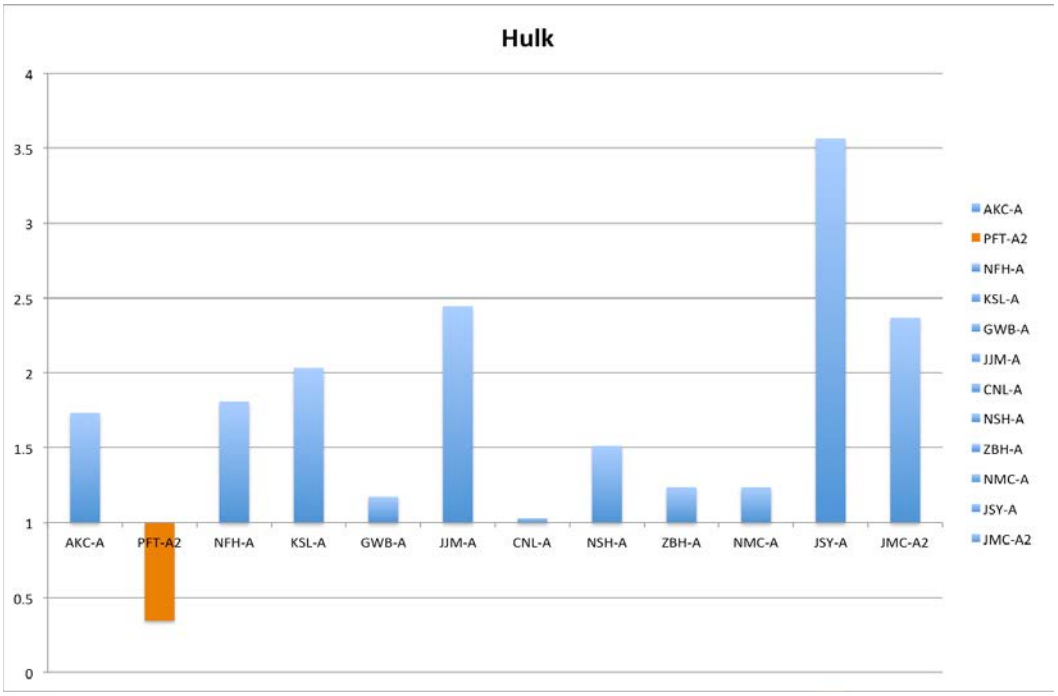

Figure 3, Hulk Viewing Patterns

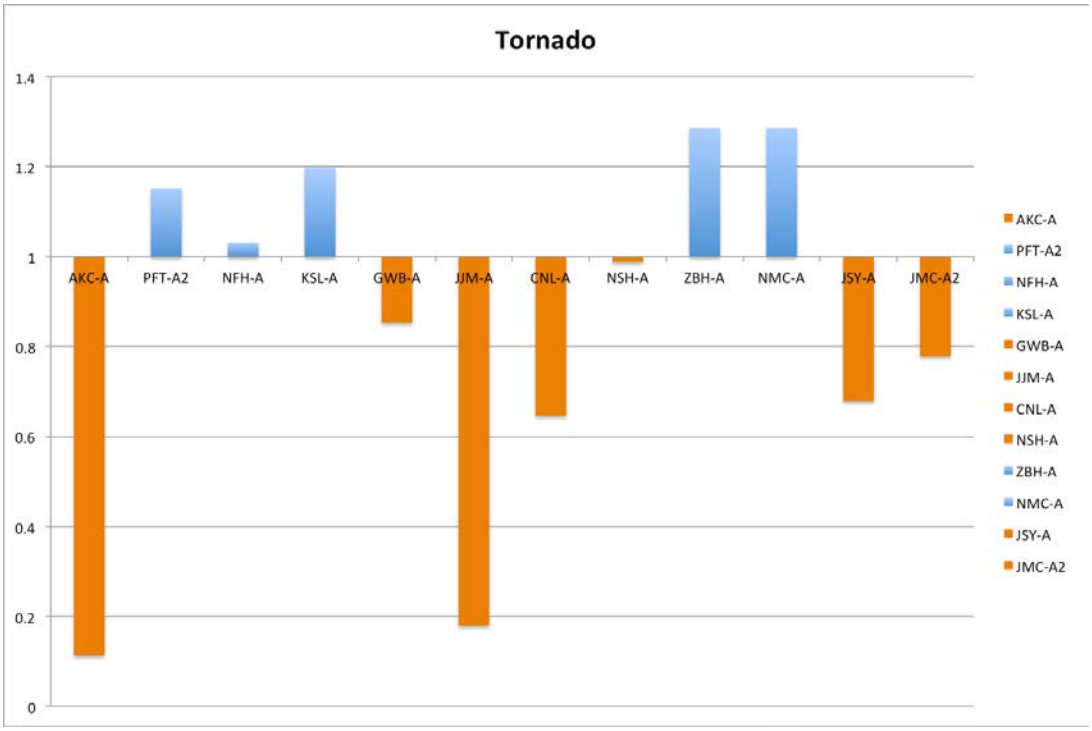

Figure 4, Tornado Viewing Patterns

Chapter 4

Discussion

The data collected from the 12 participants in the study clearly illustrated how the individuals with ASD viewed the social elements within a video game. This information is extremely important due to the fact that it is a stepping-stone for continued research within this field. By learning how individuals with ASD view these social stimuli it is possible explanations for the pattern of results observed can be explored.

Fixation Patterns

Spiderman, Animate, Hulk and Ironman were looked at significantly more than Sandman and tornado even though all were considered social characters. There are many possibilities for these differences. The characters have different attributes and act in certain ways that may be the cause of how often the participants fixated on them.

Spiderman is a character that was viewed a substantial amount of the time and these results could be caused by many different factors. Within the clips Spiderman acts as the leader a large amount of the time and is often the main speaking character on screen. Therefore, he is a very prominent social aspect of the game. It is likely that these are the reasons why Spiderman is a game feature that is looked at often.

The next most frequently looked at aspects of the game were the animate characters. These are small sand creatures that come on screen and attack the main characters. It is likely these characters were looked at often due to the fact that whenever they are on screen they are

always interacting with other characters. These social interactions likely draw the attention of the participants.

Hulk and Ironman are also fixated on a higher amount than would be expected, though not as often as Spiderman and Animate. This is likely because they are main social characters and do interact with the other social aspects of the game a great deal. However, there are also many times when they are on screen and are not interacting with anything at all, therefore, they would not draw a participants attention. Overall, the more likely a character is to be social and interact with other characters positively correlates with being looked at more often and for a longer amount of time by the participants.

There are two social aspects that are viewed less often than their presence would indicate. These characters are Sandman and tornado. Both of these elements take up a large amount of the screen and are visible on screen for a majority of the time. However, the participants were much less likely to fixate on these elements than the smaller and more social characters. These two social aspects differ from the others due to the fact that they are the least human-like characters. Both are made up of sand and debris and do not contain a face. They also do not interact directly with any other characters, so there are no social interactions to draw participant's attention to them.

It can clearly be seen through these results that children with ASD do attend more to human-like and social characters. This can be seen in their preference for clear social, human-like characters instead of the less human social aspects. This information is extremely interesting due to the fact that it is not what most would expect from children with ASD. One of the main diagnostic criteria for children with ASD is that they struggle with social interactions and communication. However, from the results of this study it can be concluded that children with

ASD prefer to watch social interaction occur compared to other stimuli. It can also be seen that they often look at the human-like characters most often, even though they are a small percentage of the screen. Therefore, the conclusion can be drawn that children with ASD, even low-functioning, have a natural tendency to orient to social and human-like characters in video games.

Relation to Previous Research

The data from the current project conflict with the data reported in the previous eye gaze research involving individuals with ASD. Riby and Hancock (2009) determined that individuals with ASD were likely to look at background objects, a finding that the results of the current project directly contradicts. The results from the current project indicates the individuals with ASD to follow characters far more than was expected compared to background elements.

The conclusions made by Guillon (2014) that individuals with ASD do not orient to people or social interactions also did not hold true within our research. Our data indicated that the more a social aspect of the game participates in social interaction, the more likely they are to be looked at. For example, Spiderman is always participating in social interactions when on screen and is the most frequently looked at part of the game. In fact, for all characters, their likelihood of being looked at increases the more that they participate in social interaction. For example, Sandman rarely ever interacts with other characters and is, therefore, looked at a great deal less than his presence on screen would indicate.

Future Research

This research and the conclusions that can be drawn from it are stepping-stones for more research into how individuals with ASD view dynamic video game stimuli. Now that it has been determined that children with ASD do, in fact, attend frequently to social aspects of video games it is possible to compare this data to how often individuals with TD view these aspects. If individuals with ASD and TD children view social aspects in the same way then we can look in depth into how they view the video game as a whole. This can lead to the conclusion of whether or not video games are an appropriate approach to helping children with ASD create friendships with their peers.

Another area of research that could be explored would be how the participants oriented to faces. The current data only displays whether or not they looked at any part of a social aspect of the game. By going further and determining whether or not children with ASD are looking at the eyes and mouths of the characters a better comparison with the data from previous studies may be possible. Most of these studies concluded that children with ASD viewed eyes less than would be expected and mouths more. By figuring out how our participants viewed the eyes and mouths of the characters it would be possible to determine if our research has corroborated the previous studies done or not.

Further research has already begun for this research project. The current project is being expanded and data are being collected and coded for TD adolescents that are the same age and gender as the participants with ASD. This will help create the best comparison for the data from the children with ASD and the TD individuals. By determining if they are viewing the stimuli in the same way conclusions may be drawn regarding the possibility for children with and without ASD to play video games together. This mutually enjoyed activity could be an excellent way to

help combat the loneliness that many individuals with ASD feel by helping them create stable friendships.

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ACADEMIC VITA

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Education:

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Bachelor of Science Degree in Communication Sciences and Disorders, Spring 2015
Minor in Special Education
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Honors and Awards:

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Association Memberships/Activities

- Member of Alpha Xi Delta Sorority
- Rules and Regulations Committee Member, Penn State's IFC and Panhellenic Dance Marathon, 2013
- Morale Committee Member, Penn State's IFC and Panhellenic Dance Marathon, 2014
- Dancer Relations Committee Member, Penn State's IFC and Panhellenic Dance Marathon, 2015
- Member of National Student Speech Language and Hearing Association

Professional Experience:

- Research Assistant within Communication Sciences and Disorders Lab
- Teaching Assistant for Communication Sciences and Disorders 311: Phonetics
- Head Counselor at Summer Sensations Day Camp for children with special needs