Original Research

A Comparative Study of Social Scene Parsing Strategies between Children with and without Autism Spectrum Disorder

Chen Song;[1] Aosen Wang;[1] Kathy Ralabate Doody, PhD;[2] Michelle Hartley-McAndrew, MD;[3]* Jana Mertz, MBA;[4] Feng Lin, PhD;[1] Wenyao Xu, PhD[1]

[1] *Computer Science and Engineering, SUNY, University at Buffalo, Buffalo NY*
[2] *Exceptional Education, SUNY, Buffalo State, Buffalo, NY*
[3] *Jacobs School of Medicine and Biomedical Sciences, SUNY, University at Buffalo Women and Children's Hospital of Buffalo, Buffalo, NY*
[4] *Children's Guild Foundation Autism Spectrum Disorder Center, Women and Children's Hospital of Buffalo, Buffalo, NY*

Autism spectrum disorder (ASD) is a complex developmental disability characterized by deficits in social interaction. Gaze behavior is of great interest because it reveals the parsing strategy the participant uses to achieve social content. The legacy features in gaze fixation, such as time and area-of-interest, however, cannot comprehensively reveal the way the participant may cognize the social scene. In this work, we investigate the dynamic components within the gaze behavior of children with ASD upon the carefully-selected social scene. A cohort of child participants (n = 51) were recruited between 2 and 10 years. The results suggest significant differences in the social scene parsing strategies of children with ASD, giving added insight into the way they may decode and interpret the social scenarios.

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Key Words: *gaze dynamics, autism spectrum disorder (ASD), autism, social scene*

INTRODUCTION

Children with autism spectrum disorder (ASD) have impairments in social interaction, communication as well as atypical behaviors that include restricted interests and repetitive behaviors.[1] Impairments in the social domain include challenges in decoding and processing socially relevant information from faces and facial expressions. Studies have shown that in children with typical development, the ability to parse and process facial information is a vital part of appropriate social development.[2] Findings indicate that children with ASD respond atypically when compared to same-aged peers with typical development, with respect to attention to faces, facial recognition and identification of different emotional expressions.[2-5]

For decades, researchers have been studying eye gaze behavior and how one cognizes or perceives information from a given scene. According to a study by Buswell in 1935, who was the first to study the visual fixation position in a scene found that among 200 participants studied, fixation positions were found to be highly regular and related to the information in the pictures. Viewers would concentrate on people rather than the background regions. This provides information that eye movement patterns during complex scene perception are related to the information in the scene. Buswell stated, "Eye movements are unconscious adjustments to the demands of attention during a visual experience."[6] In 1967, Mackworth and Morandi found that viewers were as likely to place their visual fixation on informative regions in the first two seconds of scene viewing.[7]

With the development of advanced eye-tracking technology, people have utilized it to differentiate between the eye gaze patterns of individuals with ASD versus those with typical development. Advances in ability to track eye gaze have led to the hypothesis that facial scanning strategies are abnormal in autism spectrum disorders.[8] Reports have suggested that individuals with ASD spend less time examining the eye area of the face compared to typical controls.[9,10] Also, individuals with ASD appear to show decreased attention to the internal features of the face that include the eyes, nose and mouth.[9,11,12]

As early as the 1970s, several studies found that individuals with typical development demonstrated a specific eye gaze pattern when viewing photographs of faces. Besides the core areas of an interest of an individual's face such as the mouth

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***Corresponding Author:** Jacobs School of Medicine and Biomedical Sciences, SUNY, University at Buffalo Women and Children's Hospital of Buffalo, 219 Bryant Street, Buffalo, NY 14222. Tel: 716-878-7600. (Email: hartley4@buffalo.edu)

and nose, the gaze points of individuals without ASD are mainly focused on the eyes.[13,14] In contrast, individuals with ASD tend to avoid eye contact.[15] For example, among five adults with high-functioning ASD and five adult controls, significant differences were found in the scan paths of the two groups.[9] The participants with ASD gazed more frequently upon non-feature areas of faces rather than the core areas, such as the eyes, mouth and nose. A similar phenomenon is also noted in another study by Dalton.[16] After displaying images of faces to the participants with ASD and controls without ASD, results indicated that the participants with ASD spent significantly less time fixating on the eyes in the photograph than did the control group.

There is also growing popularity in assessing the eye gaze of children with ASD in performing various tasks. These studies have suggested that the eye gaze patterns of children with ASD are different than children without ASD when exposed to a familiar face versus inanimate objects.[17] In a study that observed the autonomic response of children with ASD compared to children with typical development while viewing videos containing individuals demonstrating facial expression, it was found that children who had less severe symptoms of ASD along with increased gaze to the eye region of the stimulus resulted in a more accurate or typical emotion recognition. Moreover, a few recent studies have begun to explore the possibility of using eye gaze to predict the risk of ASD for infants.[18,19]

As referenced above, most of the previous research has made use of two major aspects of study: 1) exploring the fixation areas where gaze points are located and 2) calculating the corresponding fixation time that is spent in specific areas. However, one limitation of applying fixation patterns is that they cannot indicate how the brain actually combines all the visual information it receives and processes the visual scene it is observing. For example, even if an individual with ASD has a similar fixation pattern while gazing upon an image when compared to people without ASD, it does not necessarily mean that the individual has the correct and accurate perception of the image. Aside from the recognition of key objects in a visual scene, deficits in social interaction of the participants with ASD may occur due to the lack of ability to understand the relationship between the key objects within the social scene. The corresponding dynamic connection information among the key objects is what the traditional fixation features such as time and area-of-interest ("AOI") cannot reveal.

In this work, we hypothesized that children with ASD demonstrate noteworthy differences in eye gaze patterns when parsing social scenes compared to controls with typical development. We further hypothesized that children with ASD processed the facial features of others and salient stimuli in photographs differently when compared to peers without ASD.

METHODS

Participants

The material preparation in this study was approved individually by the Institutional Review Boards at the Women and Children's Hospital of Buffalo, University at Buffalo, and SUNY, Buffalo State.

All participants were recruited via existing research programs. Inclusionary criteria included falling between the ages of 2 and 10, with or without ASD. Informed parental consents were also required and were obtained at the time of the study by one of the authors. Children who had the ability to provide informed assent did so after listening to a description of the study's requirements by one of the authors. One hundred percent of all children and parents who arrived at the study site opted to participate after receiving a thorough and comprehensive description of the study and its requirements. Children and families were reminded that their participation was voluntary. Participants were not provided any compensation for their involvement in the study.

Participants were recruited following the inclusion criteria discussed above. A general discussion of the study was held at monthly parent group meetings, so that family members had an idea of the requirements of the study before committing to the project. Questions were answered at this point and the researchers had the ability to assess parents' overall interest in participation.

Next, photographs for use in the study were created or obtained. The authors established guidelines for attributes of the photographs which met the needs of our study and directly pertained to our research questions. To wit, we sought photographs of more than one individual engaging in some type of social interaction, against a background which was visually "quiet" or uncluttered, so as not to unnecessarily draw the eye gaze away from relevant and targeted features of the photograph.

With the designated visual stimuli set, a small pilot study was implemented at the computer lab of SUNY University at Buffalo's Computer Science Department. Four children with ASD participated in this pilot, along with six children with typical development. This was performed for calibration of the equipment, spacing and eye level of the monitor and determining which portions of the images were AOI or "key areas." The researchers learned a great deal through the implementation of the pilot study: namely, that the computer lab of a university was not an ideal environment for conducting the study, due to the agitation and anxiety it provoked in the children with ASD.

The study also enabled us to test the durability of our equipment which is an important consideration when working with children.

A total of 51 participants were enrolled in this study. Of the participants, 16 were female (31%) and 35 (69%) were male. All children enrolled were between the ages of 2 and 10. Of the 51 children enrolled, 25 had a diagnosis of ASD (5 of the females and 20 of the males) and 26 had typical development (11 of the females and 15 of the males). In total, 8 of the children had received a diagnosis of ASD through assessment by administering the Autism Diagnostic Observation Schedule ("ADOS");[20] the remainder received a diagnosis via direct observation, parent report, and physician judgment closely following the criteria set forth in the Diagnostic Statistical Manual ("DSM") for autistic disorder.

The age range of the study group was 2.5 years to 10.6 years with an average age of 6.4 years and a median age of 6.7 years. The age range of the control group was 2.2 years to 9.1 years with an average of 5.3 years and a median age of 6.3 years.

IQ scores of participants are not included in the materials because the focus group cross from 2 to 10, and not all child participants are eligible for IQ test. Considering formal IQ testing was not administered to the participants (see discussion in Limitations), the children in both the control and study group were only matched by age. As to the severity of autism, of the 25 children in the study group, 12 were severely impacted by autism. We defined "severely impacted" as meeting one or more of the following inclusive criteria: lacking verbal speech, demonstrating aggressive or self-injurious behaviors, or receiving their educational services in special classes housed in special schools, which is the most restrictive end of the educational continuum as per the 2013 US Department of Education's Special Education program description. The remaining 13 participants in the study were moderately impacted by autism, meaning: they possessed verbal speech, did not demonstrate aggressive or self-injurious behaviors, and received their educational services in public school settings in inclusive settings with peers with typical development.

Materials

Following is a listing and description of the materials used in this study.

Furniture. A child's sized wooden, collapsible table with chairs was employed for use during this study. The table and chairs were adjustable to accommodate the varying heights of the participants and afforded them the choice to sit or stand.

Monitor. A Dell P2214H monitor (476.64mm x 267.78mm/ 18.77" x 10.54") was placed upon the table, and adjusted to be at eye level for each individual participant.

Reinforcers. Small items were available for the children upon completion of the study. Some children selected their preferred reinforcer prior to beginning the study, while others selected their chosen item at the conclusion. Reinforcers included items such as stickers, juice boxes, small snacks (granola bars or bags of chips), and sensory-friendly manipulatives, such as koosh balls.

Eye-tracking Device. A Tobii EyeX Controller 21 was used to measure the gaze behavior of participants in response to presented visual stimulus. The Tobii EyeX Controller is an eye tracking device which uses near-infrared light to track the eye movements and gaze point of an individual. With the advanced eye tracking technology, the Tobii EyeX Controller is able to record the participant's gaze point on the screen at the frequency of 120Hz. The X and Y coordinates of the gaze point, Px and Py, are pre-processed into the range of the current screen resolution. The recommended operating distance is from 45 to 75 cm (17.7 to 29.5″). Figure 1 shows that a participant was sitting in front of the monitor and watching, while the Tobii EyeX Controller was tracking the eye gaze simultaneously.

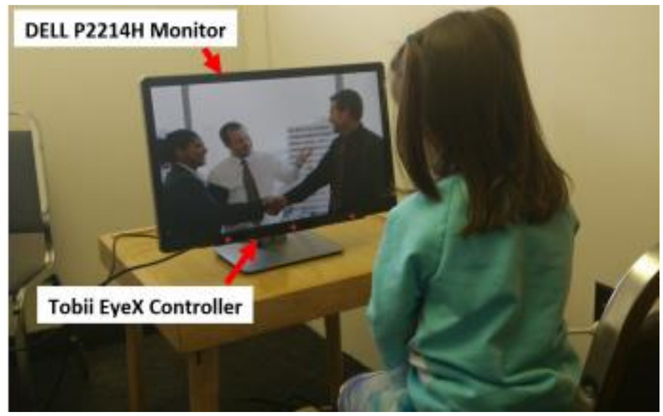

Figure 1. A child participant is watching the visual stimulus.

Visual Stimulus. The preparation of the visual stimuli used in this study was carefully considered. They were static images displaying daily social scenes. Specifically, both adults and children can be involved depending on the social scene. We also adhered to the following three principles. First, each image contained a set of pre-defined key areas. For the sake of screening efficiency, there were no more than five key areas (such as faces and hands) on the stimulus in case the participant is distracted by too much information. Second, the key areas of the photograph maintained a certain distance from each other to avoid the condition that the participant's eye gaze inadvertently lingered and coincidently hit two or more key areas in a sequence. Third, the background needed to be visually "clean" to discourage the participant from being unintentionally distracted by colorful or irrelevant stimuli. The visual stimuli did not always have the same resolution as the screen and they were scaled to fill in the entire screen. In these cases, to correctly visualize the gaze points on the original image, the recorded coordinates of the gaze point could not be directly applied and specific calibration was required. Therefore, let I_{width} and I_{height} be the image resolution. We further calibrated the recorded coordinates from the screen resolution to the image resolution:

$$P_x' = \frac{I_{width}}{R_{width}} * P_x,\ P_y' = \frac{I_{height}}{R_{height}} * P_y.$$

Following the parameters above, **Figure 2** demonstrates one such example of visual stimulus employed in our study. The blue circles are the gaze distribution from a child participant with typical development.

PROCEDURE

The participants were then ushered into a small room containing the table and computer equipment. Parents were invited to observe or were able to remain in the small waiting area directly adjacent to the study's location. One of the researchers accompanied the participants into the study area, while the graduate assistants calibrated the computer equipment for the appropriate eye level of the child.

Eighteen photographs in total were displayed to the child. Each photo was shown for 5 seconds and the whole process took 90 seconds. One of the researchers, well-trained in behavior management and experienced in working with children with intensive behaviors, was next to the participant at all times, ready to intervene as necessary.

Figure 2. An example of the gaze distribution on the visual stimulus.

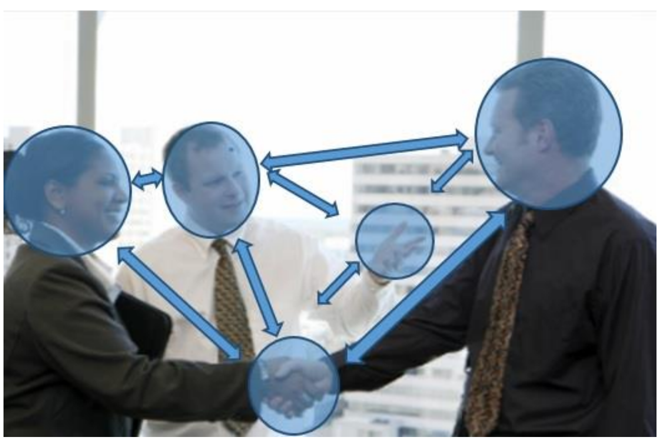

Figure 3. Key-area connecting graph.

DYNAMIC COMPONENT ANALYSIS

Key-area Connecting Graph. This study examined the sequential information found in a participant's gaze behavior. A Key-area Connecting Graph (KCG) was introduced before the specific data were analyzed. In this work, we define KCG as a connected graph containing pre-defined key areas in regard to the social scene within the photograph. As shown in **Figure 3**, there are three people engaged in a conversation; two of those three people are shaking hands with each other, while the third watches. The position of their bodies, coupled with the gesture of a handshake, indicates a social interaction. Therefore, we defined the corresponding key areas that can reflect the social information, and represented them by the blue circles in the photo below. The inner connection of the key areas forms KCG.

Sequential Analysis - Symbolic Representation. This is a method used to symbolize the gaze path with a symbol sequence for the convenience of eventual processing. The five key areas are labeled from A to E, as shown in **Figure 4**. Additionally, the background was defined as any area other than the key areas and was labeled as X.

In practice, it is possible for an individual with ASD to scan the visual stimulus without purpose. Therefore, it is important to only extract the meaningful gaze point in the whole gaze sequence. Fixation threshold is the minimum fixation time of a gaze point that we applied to determine whether a gaze point was a real fixation or a saccade, which is a rapid eye movement that occurs when eyes fixate on one point after another while taking in visual stimulus.

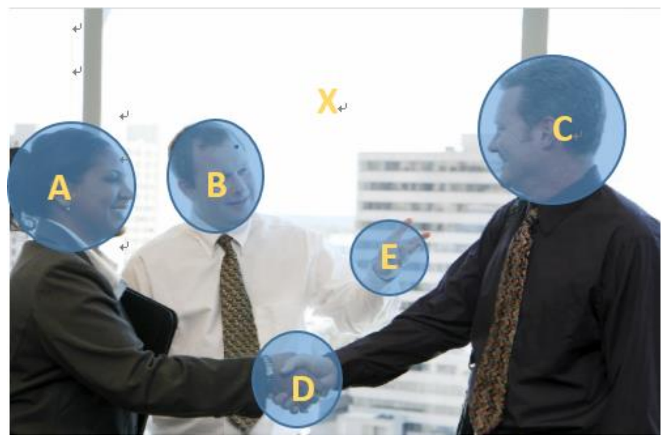

Figure 4. Symbolic representation.

Dynamic Component. We proposed four unique components from the participant's gaze pattern in the dynamic domain. The components are highly related to the way the gaze behavior performs on the KCG; additionally, they will supplement our understanding of the participant's perception of the visual stimulus. The following are the four components and detailed descriptions:

The length of the symbolic sequence. This component infers the way the participant processes the social scene. Within the limited display time, the length of the symbolic sequence should not be too long or too short. An extremely long length of symbolic sequence is most likely caused by the repetitive local gaze between certain areas. An extremely short length can be the result of long-time staring.

The number of covered key areas with 5 seconds. This component is highly related to the ability of the participant to grasp the global content on the scene. Normally, participants without ASD are expected to quickly gaze upon all the key areas regardless of the order of presentation on the image.

The number of the key-area pair. The cognitive ability lies in the understanding of relationship between the key areas. Individuals with typical development will tend to consecutively look at two areas if they are related. Therefore, the total amount of times the participant switched fixation between two key areas was counted on each image. Participants without ASD are expected to have more fixation switches between the key areas than participants with ASD.

Effective gaze coefficient. This coefficient is denoted as the effective gaze behavior in the gaze sequence. It is calculated as the percentage of key-area pairs in the total gaze sequence (Feature3/Feature1), inferring how many gaze fixations are involved to scan one key-area pair. If the participant frequently watches the areas other than the key areas (such as the background), the number of key-area pairs will be relatively small even if the whole symbolic sequence is long.

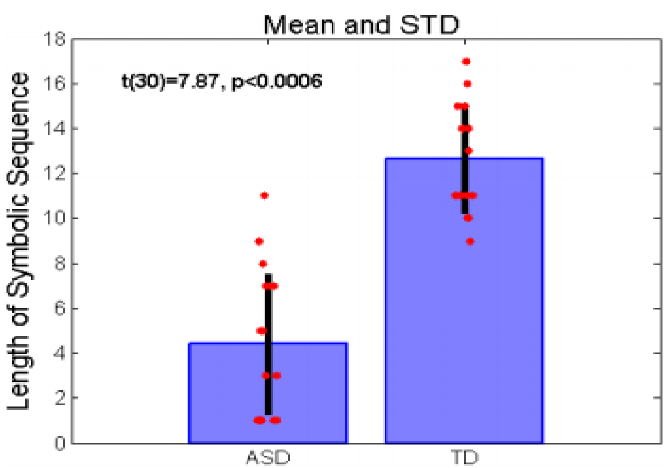

Figure 5. The length of the symbolic sequence.

RESULTS

Our goal was to differentiate the eye gaze pattern of ASD children from typically developing children. The null hypothesis for each component is expressed as the corresponding observed result cannot distinguish the ASD children ($H_0\colon\{Se \leq Se_0\}$).[22] We first assume the null hypothesis were true. Then we adopt the *P*-value approach to determine the probability of observing a more extreme test statistic in the direction of the alternative hypothesis than the one observed.[23,24] Specifically, given the dataset x of size n, we conduct the hypothesis test for the population mean μ and standard deviation s, using the *t*-statistic $t^* = \frac{\bar{x}-\mu}{s/\sqrt{n}}$ which follows a *t*-distribution with $n-1$ degrees of freedom. The P-value is then calculated based on the known distribution. If the P-value is less than or equal to the chosen significance level (traditionally 1%), then the null hypothesis is rejected. In this section, we will analyze the P-value results associated with the four unique components from the participant's gaze pattern in the dynamic domain.

A: The length of the symbolic sequence (after removing the gaze points which have a fixation time less than a *Threshold*). As shown in **Figure 5**, the length of the symbolic sequence was much shorter in participants with ASD than in the participants with typical development (t(30) = 7.87, P < 0.0006). Specifically, the participants with ASD had an average length of 4.44 (std. = 3.38), while the participants with typical development have a significantly larger average length of 12.63 (std. = 2.42). The short symbolic sequence was caused by the limited areas through which the gaze passes, inferring that the participants with ASD tend to keep focusing on a limited local part of the visual stimulus and ignore the global information. This is in coherence with the findings where participants with ASD have been hypothesized to have a bias or default preference to focus more on local than global information.[25-27]

B: The number of covered key areas within five seconds.

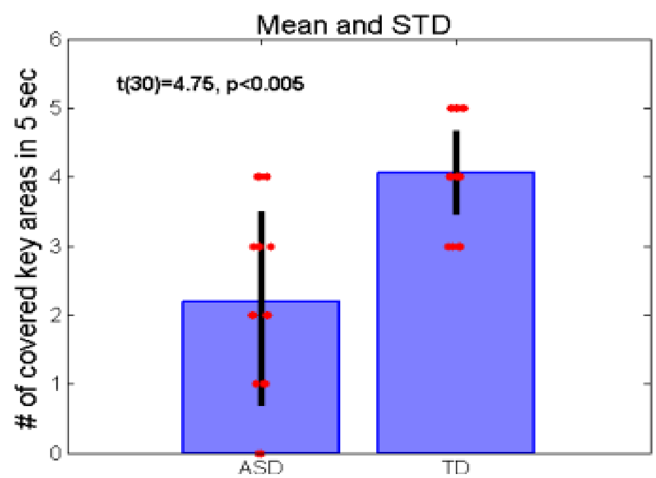

Figure 6. The number of covered key areas within five seconds.

We analyzed the number of covered key areas within *five* seconds. Our hypothesis was that the participants with typical development can scan most of the key areas (such as the individual's face and shaking hands) of visual stimulus in 5 seconds. As shown in **Figure 6**, we observed the corresponding difference between the participants with and without ASD (t(30) = 4.75, P < 0.005). All the participants with typical development gazed more than 3 key areas. In contrast, only half the participants with ASD were able to do so. The typical perception strategy the participants with typical development applied on the visual stimulus was to quickly browse the key areas in order to grasp general information regarding the stimulus, before focusing on the specific interesting areas. However, the participants with ASD lacked the global strategy over visual stimulus and were more likely to focus on local areas.

C: The number of the consecutive key-area pair.

Perception is essentially the ability to understand the relationship between the key areas in the scene. For example, eye gaze from a handshake to a face, might indicate an understanding of the meaning, while the gaze from handshake to the sky in the image, might show that the meaning of that handshake is lost. We investigated the number of consecutive key-area pairs in the gaze sequence and hypothesized that the participants with ASD would notice far fewer key-area connection relationships compared to the participants with typical development. As shown in **Figure 7**, the significant difference has been revealed in this aspect ($t(30) = 6.5$, $p < 0.001$). By investigating the number of consecutive key-area pairs in the gaze sequence, we found that the way participants with ASD processed the visual stimulus was much more "detached" than that of the participants with typical development. The participants with ASD tended to discretely perceive the area instead of noticing the relationship between the key areas. This result is in coherence with the findings that individuals with autism have limited attention or intentions to explore social and human-interactive information.[28,29]

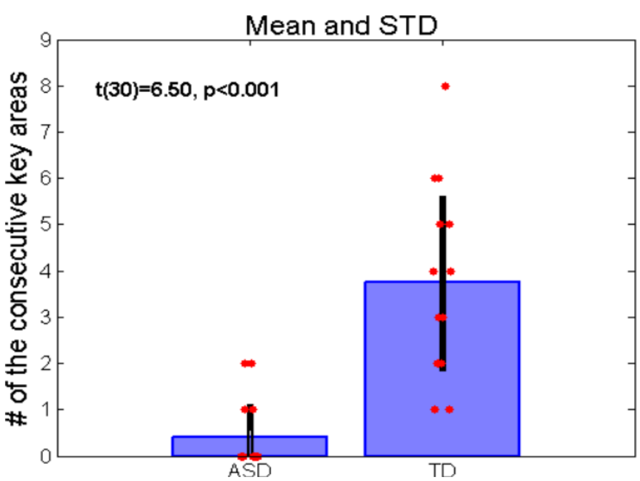

Figure 7. The number of the consecutive key-area pair.

D: Effective gaze coefficient

As described above, the number of key-area pair provides information regarding how the participant perceived the visual stimulus. However, if the participant only looked at two key areas, the results would show a large number of key-area pairs. Therefore, to further analyse the gaze dynamic pattern, we introduced an effective gaze coefficient, which represented the percentage of key-area pairs in the total gaze sequence. As demonstrated in Figure 8, the coefficient differed quite a bit between two groups ($t(30) = 5.43$, $P < 0.0007$). On average, the participants with typical development used 38.6% (std. = 18.8%) of the total time in processing the connecting relationship between the key areas. However, this percentage dramatically dropped to 7.9% (std. = 12.5%) in the participants with ASD, inferring that the perception strategy used by individuals with ASD was not area-connection based.

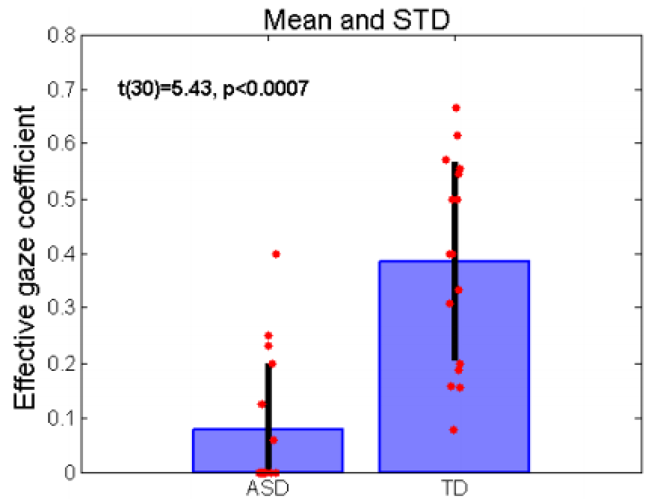

Figure 8. Effective gaze coefficient.

DISCUSSION

It is impossible with any degree of certainty to determine what individuals with autism spectrum disorder are actually perceiving when studying eye gaze patterns. Determining the semantic informativeness of a given image is beyond the scope of this study. It is therefore conjecture that when their attention is not on what would be a typical key area, the perception of nuance in the social scenario may be missed. The aim of this study was to determine differences in the dynamic components of eye gaze patterns between children with ASD and typically developing children. As previously mentioned, analyzing areas of interest and eye gaze patterns can provide an insight into how individuals decode and process socially relevant information. Some studies have indicated that facial scanning and processing is abnormal in individuals on the autism spectrum.[30,31] We hypothesized that dynamic patterns of eye gaze would be measurably different between the two groups. The results in this study confirm the objective differences in dynamic parsing of social situations between children with typical development and those with ASD's. Our study shows that specific differences in the length of time, frequency and number of times visual gaze fixation occurs on areas of interest in a social situation can be an important part to understanding how social situations are perceived in individuals with ASD. The length of the symbolic sequence indicates the actual length in terms of distance, the study participant moved his/her gaze throughout the areas of interest on an image.

Children with typical development moved their eye gaze a discrete distance between areas of interest and back again, presumably in order to sufficiently perceive the context of the social situation, while the group of children with ASD had a shorter amount of distance seen moving their eye gaze about the image. This indicates that often the individual with ASD might become fixated on parts of the image or areas of interest without appropriately scanning the image to perceive various parts of the image. The time used to scan all key areas, shows that the individuals with ASD had longer time to scan the key areas demonstrating a longer amount of time moving their eye gaze about a social scenario.

A child with typical development might quickly scan the picture in order to comprehend all aspects of the given context. This same task took children with ASD a longer amount of time, showing a possible likelihood there was more difficulty grasping the meaning of the image. The number of the key-area pairs and effective gaze coefficient investigate the number of consecutive key-area pairs in the gaze sequence. Individuals with ASD had a much lower number of key-area pairs indicating that the way they processed the visual stimulus is much more “detached” than that of the participants with typical development. The consecutive sequence of an eye gaze can give information as to how an individual is processing a social interaction. Again, eye gaze movement from a handshake to a face, would indicate an understanding of the social context, while the gaze from a handshake to the sky in the image, indicates that the significance of that handshake may not be perceived. The number of appropriate consecutive key-area pairs is less in the group of children with ASD than those without.

To our knowledge, ours is the first study to look at these differences of gaze behavior in a dynamic way. Prior studies have looked at static differences in location of discrete areas of interest;[32,33] however, ours is unique to the dynamic processing and movement of eye gaze in a social scenario. The use of multiple subjects in a rather typical social scene also determines whether an individual is adequately perceiving the meaning and context of the situation by recognizing the faces as well as the conjoined or common focus such as a handshake. While the handshake itself is not a particularly interesting visual focus, in the context of a meeting between multiple individuals, the handshake becomes pertinent.

This study indicates that often individuals with ASD tend to gaze at particular areas that may be of interest and rather than understanding the situation as a whole, focusing on smaller areas of the visual stimulus. Rather than moving their eye gaze appropriately in a given image in order to adequately perceive the social context, individuals with ASD tend to have increased fixation time on areas of interest with decreased time moving their eye gaze across areas of interest.

The images of multiple subjects give us an indication as to how individuals with ASD may be applying meaning to a social context. Individuals with typical development may move their eye gaze appropriately across key areas of interest such as a person’s face, hands or what holds the subject’s attention in order to sufficiently comprehend the meaning or ‘story’ behind a given image. Where individuals apply their gaze is an important aspect to understanding how they may be perceiving a social interaction. Children who have ASD may not be adequately perceiving the significance or intention of a given interaction.

This study gives insight into how individuals with ASD process information related to a social interaction in a dynamic manner. Further research is necessary to appropriately apply this knowledge to use as objective measures when addressing individuals with deficits in reciprocal behavior. Additionally, this information may be used as a means to determine added modalities in which to contribute to social skill building and processing in individuals with ASD.

LIMITATIONS

There are several limitations to this study. Children within the study group were noted to be on the autism spectrum, and only some added qualifiers were given regarding their level of severity in the absence of reporting IQ scores or other assessment measures. Since there was some inconsistency in how children were diagnosed, the interpretation of our findings is limited. We did not compare the differences in eye gaze patterns between the higher functioning subset on the autism spectrum with those more severely affected. It would be interesting to see if differences between individuals with higher functioning ASD would have such significant differences in social processing. In this case, a much larger study group and sample size would be required for adequate comparison. Also, our study did not compare individuals with learning disabilities or other challenges such as attention deficit hyperactivity disorder to determine whether individuals with intellectual disability or inattention may show typical patterns. IQ testing or other developmental testing was not done prior to the study and this was not controlled for in the control vs ASD groups. This may have a large impact on our results because many with atypical gaze patterns may have had differences due to developmental delay or other attentional issues in addition to their autism spectrum diagnosis. It would be perceivable that significant differences such as long fixation time in the ASD study group would remain, however further research is required in order to determine whether these groups would also be distinguishable with regards to social parsing. The wide age range in our groups is also a limitation. The differences between eye gaze patterns in younger vs. older children may also be a factor in perceiving social context. This study also did not control for gender differences between the two study groups. A large difference in 25% female in the ASD group vs. 42% female in the control group may also have been a factor in interpreting the results. This was not controlled for in our statistical analysis. In the future work, we plan to evaluate detailed aspects of the study participants such as gender, age distribution and IQ information, and explore how they will affect the way the participants with autism spectrum disorder perceive the scene.

CONCLUSION

The analysis described herein is a novel approach to determining differences in the eye gaze patterns of individuals on the autism spectrum. By using a social scene of interacting subjects and comparing dynamic components of analysis, this study gives added insight on the individual with ASD’s ability to adequately decode and interpret a given social scenario. This study suggests a difference in the way individuals with ASD process a given social situation through measuring dynamic gaze patterns. We propose that this observation is an important insight into the way ASD may affect social perception and may give added benefit to future diagnostic and therapeutic modalities. Further research is required with larger sample sizes to evaluate differences in dynamic eye gaze patterns among individuals with autism spectrum disorder.

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COMPLIANCE WITH ETHICAL STANDARDS

"All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

CONFLICT OF INTEREST

Author Kathy Ralabate Doody has received research funding from SUNY, Buffalo State from the Horace Mann Faculty Research Grants Fund.

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