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Social and Pragmatic Language in Autistic Children

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Autism spectrum disorder (ASD) includes several developmental disabilities that can affect a child very early on in life. According to the Centers for Disease Control and Prevention (CDC), ASD is often caused by genes, but other biological and environmental factors could also play a role. The CDC states that autism spectrum disorder is characterized by impaired emotional, social, and communicative abilities. Children with ASD may have trouble adapting to situations, engaging others socially, or displaying interest in the way things look, feel, sound, smell, or taste. In their interactions with others, they may ignore or act aggressively toward them. The severity levels of ASD may vary from mild to profound impairment. The CDC also explains that ASD can only be diagnosed by observing behavior and development, which may result in a late diagnosis. While there is no cure for ASD, the CDC emphasizes that early treatment or intervention can be very beneficial in helping an autistic child develop typically, at a rate that comes close to matching those of his or her peers.

Children with ASD are especially impaired in pragmatic language, which refers to communication in a social context. Specifically, ASD children may have problems knowing how to take turns talking, initiate conversation, or understand facial expression and body language. Researchers have noticed this and attempted to gain more knowledge about the relationship between language and social interaction in autistic children. However, this relationship is not a simple one. There are many factors that contribute to impaired social language, including

attentional deficits, impaired language processing, and abnormal mentalizing, which is the ability to recognize and distinguish the emotional and mental processing that occurs in others, separate from oneself. Researchers have come up with different methods and ways of approaching the problem, and each technique comes with both benefits and disadvantages. Two specific methods utilize fMRI and mathematical trajectories to understand and describe social interaction and language in autistic children.

The first method is to examine brain functions in typically developing (TD) children and children with autism. Written by Elizabeth J. Carter et al. and published in the Open Access journal *PLOS ONE,* "Is He Being Bad? Social and Language Brain Networks during Social Judgment in Children with Autism" claims that even though they behave similarly, autistic children do not make use of the same social and language regions of the brain as TD children when making a social versus physical judgment (8). Carter et al. began the article by stating that "autism has three key characteristics: impairments in social interactions, reduced communication skills, and restricted interests and repetitive behaviors" (1). Of the three characteristics, impaired social interaction is the most distinct. Carter et al. also noted several previous studies on a similar topic. In general, the studies demonstrated that autistic kids did not perform as well as typically developing children in identifying and expressing accurate judgments concerning social behavior and language (1-2).

Carter et al. hypothesized in their study that autistic children would display different brain activity than TD children on social judgments but similar activity concerning physical characteristics. In their study, they tried not to necessitate the use of linguistic processing, so that they could focus on mental activities rather than the child's ability to convert thoughts into verbal communication. Carter et al. chose 13 typically developing children aged 7-15 and 12

autistic children aged 8-16 years from the Autism Center for Excellence Subject Core at the University of Pittsburgh. The participants were screened using a variety of methods, including a questionnaire, interview, and testing. Through this process, Carter et al. excluded children who did not meet the specific criteria. They ensured that there was no significant difference between the groups in IQ (2).

During the analyses, Carter et al. used functional magnetic resonance imaging (fMRI) to scan the brain activity of the patients. The researchers used 32 trials, in which they presented a pair of cartoon pictures to the participant using a projection screen inside the scanner. For one half of the presented stimuli, the patients were asked if a particular character was being mean or bad (a social judgment), and for the other half, they were asked if the picture took place outdoors (a physical judgment). The two images were displayed for 4 seconds and followed by symbols that signaled a response. Each scanning session took about 8.5 minutes total. After the fMRI scanning, 20 total participants were tested with eyetracking software (3). Carter et al. wanted to use eyetracking to ensure that any differences in brain activity were not due to different visual patterns. For this test, 16 of the stimuli were again presented, and the location, number, and duration of fixations were recorded (4).

In the results, Carter et al. found that there were no significant differences in accuracy or response time between the two groups. However, both groups answered questions concerning physical condition correctly more often than questions concerning social behavior (4). In the fMRI scanning, there were no areas where autistic children had more brain activity than TD children. Carter et al. also discovered when using the eyetracking software that there were no differences between the two groups in overall time spent looking at the pictures as a whole, or in the time spent looking at critical regions, which were necessary for finding the correct answer

(5). Carter et al. noticed that when they compared social versus physical conditions, the TD kids had more brain activity in social cognition and language areas, unlike the autistic group. The TD children also had stronger responses in brain activity when being asked questions about social behavior (5). Although the test was made to be relatively simple, the TD kids used more brain regions than they strictly needed in order to complete the task, and the autistic children did not (5-6). These brain regions were mostly devoted to social/language tasks, which indicates that these social skills are incorporated into language (6).

Carter et al. discussed three specific areas of the brain when interpreting the data. The medial prefrontal cortex, left superior temporal pole, and bilateral inferior frontal gyrus all showed abnormal activity in the autistic children compared to the TD children. These brain regions are collectively correlated with empathy, morality, facial expression, understanding feelings and behavior, and language processing (par. 6-7). Carter et al. also noted that the children with autism did not automatically use linguistic coding in their social interactions, which explains their difficulty in expressing themselves in past studies. Carter et al. found a strong connection from their research to Gazzaniga's theory of language function, which states that language regions of the brain are automatically used to interpret and incorporate incoming information. This failure to use language as an interpreter can affect how an autistic person is able to recall or describe events (7). In their conclusion, Carter et al. emphasized that their research is useful in backing up evidence for TD kids using social and language brain regions that are not required to complete relatively simple tasks. Additionally, they pointed out that abnormal function in certain brain regions does not cause and is not correlated with impaired performance. In fact, autistic children may understand that certain behavior is inappropriate, but are unable to effectively express themselves (8).

While Carter et al. examined speech at a fixed point in time, another study focused on language development across different ages and the influence of predictive variables. An article entitled "Trajectories of Pragmatic and Nonliteral Language Development in Children with Autism Spectrum Disorders" claims that in terms of chronological age, autistic children develop slower in both pragmatic and nonliteral language than children with typical development (TD), and both age and basic language skills are accurate predictors in determining pragmatic and nonliteral language in kids with autism and TD (par. 49). Written by Elizabeth M. Whyte and Keith E. Nelson from Pennsylvania State University and published in the *Journal of Communication Disorders,* the researchers take a unique approach by using a cross-sectional developmental trajectory analysis to examine the effects of age, vocabulary, syntax, and theory of mind in predicting advanced language skills in children with autism spectrum disorder and TD children (par. 15). Whyte and Nelson emphasize that understanding progress predictors can help speech-language pathologists choose the best intervention method (par. 3). They define pragmatic language as "the understanding and use of the literal aspects of context during communication" (par. 4) and nonliteral language as the "use of language where there is a specific mismatch between the literal meaning of the individual words of the phrase and the expected interpretation" (par. 4).

Whyte and Nelson also mention researchers who have created experiments on the topic of language abilities in autistic children. Some studies have shown that while autistic children have trouble using pragmatic and nonliteral language skills, both ASD and TD children are able to improve their abilities over time (par. 6-7). Other studies have shown that basic language abilities, such as vocabulary and syntax, can be predictors of pragmatic competence in ASD children, indicating a correlation between basic and advanced language skills (par. 8). Whyte and

Nelson describe a theory, called the theory of mind, which corresponds with understanding the emotional/mental state of others and is thought to be associated with the impaired social functioning of ASD kids. These children might have problems using advanced language skills because they are unable to use social and linguistic context to help them understand depth of meaning in communication (par. 9). The type of study that Whyte and Nelson chose allowed the researchers to examine language development rates for cross-sectional samples, or samples that were collected at only one point in time. This method let them compare rates of development regarding age or other possible predictors (par. 13).

For their research, Whyte and Nelson chose 26 children with ASD and 69 typically developing children, both groups ranging from 5-12 years of age. These participants were native English speakers with normal hearing and vision, and they were recruited from various different locations (par. 17-19). Whyte and Nelson tested pragmatic language by exploring the child's use of language in social settings and verbal language in appropriate contexts (par. 21). They tested figurative language, indirect requests, and sarcasm as parts of nonliteral language assessment (par. 22). They also assessed basic language skills, mainly syntax and vocabulary, by asking the child to complete sentences verbally and testing their verbal IQ (par. 23-24). Last, Whyte and Nelson had the children match an expression or mental state to a picture of a person's eyes, to determine scoring for the theory of mind (par. 25).

In the developmental trajectory analysis, Whyte and Nelson performed separate regressions on the two groups of children in order to measure how the outcome variables of pragmatic and nonliteral language were changed according to the predictor variables of syntax, vocabulary, and theory of mind skills (par. 28). The researchers also split the trajectories to look at pragmatic and nonliteral language separately (par. 29). They used the trajectories to study

cross-sectional development (par. 30). Whyte and Nelson found that in both groups, age, syntax, vocabulary, and TOM scores were predicative of scores on pragmatic and nonliteral language tests. Generally, older kids with ASD performed better than younger kids, and the ASD children with better basic language abilities performed better than the ones that did not have strong basic language skills (par. 40). The researchers discovered that in pragmatic language development, syntax and vocabulary were strong predictors, and these two trajectory rates did not differ significantly between the ASD and TD groups (par. 42). In nonliteral language development, age and basic language skills were excellent predictors. However, ASD children developed slower as they got older (par. 43). Additionally, there was a strong correlation between TOM scores and nonliteral language (par. 45). Whyte and Nelson concluded that ASD children need to have a strong foundation of basic language skills in order to successfully develop more complex ones (par. 45). In this way, they are similar to typically developing children. These basic and TOM skills can be used to help a child improve linguistically (par. 50).

Both studies addressed the problem of linguistic skills in autistic children; however, the researchers approached the issue with different goals and techniques. Carter et al. noticed that autistic children have trouble identifying and explaining social behavior. In order to develop a deeper comprehension of why this occurs, they used brain scanning and compared autistic children with typically developing children. Their effort at understanding attempted to find the biological source of the problem, instead of only looking at behavior. While behavior can give helpful clues that indicate where the problem may lie, it can also be deceiving. In the case of this particular study, Carter et al. pointed out that autistic children being unable to explain social behavior could stem from a problem with using language to interpret information, not the inability to recognize and distinguish social behavior. They discovered that using language and

linguistic skills even in situations where it is not strictly necessary can help interpret information to be stored and expressed later. Children with autism seem to be impaired in this ability, thinking mainly in visual terms over linguistic terms. Carter et al. were able to come to this conclusion because of their approach—tracing symptoms to the source of behavior, the brain.

Whyte and Nelson chose to use a very specific method in their study. Instead of a group-matching approach like Carter et al., they decided to use a cross-sectional developmental trajectory approach. The group-matching method, as performed by Carter et al., would have allowed them to compare language skills between two groups at a certain point in time. A cross-sectional developmental trajectory method is different because it takes a large age range (5-12 years) and compares the groups to see how their language skills change across different ages and what influences those changes, while still only taking a sample at one point in time. Whyte and Nelson chose this method because they wanted to learn more about language development in autistic children, and they saw a relationship between basic language skills and more advanced language skills. They wanted to compare an autistic child's progress with a TD child, instead of merely assessing his or her performance at a certain age.

Each of the researchers used techniques that had their advantages and disadvantages. While Whyte and Nelson's approach let them examine development over time without actually stretching out the research, one drawback of the developmental trajectory approach is that it assumes all children will grow up the same way. Whyte and Nelson looked at a young child and a preteen and assumed that the young child would develop the same way the preteen did, which combines the participants in a way that ignores their individual growth patterns. A disadvantage of the study by Carter et al. is that group matched experiments are sensitive to only overall group

changes, while the developmental trajectory approach can identify which elements have caused the changes.

One of the main differences between the two studies is that Whyte and Nelson were trying to determine predictive variables. They wanted to find out what elements of language or cognition earlier in life could have a significant impact on the development of pragmatic and nonliteral language. Their method allowed them to analyze the patterns of pragmatic and nonliteral language development separately and compare them with each other using linear models. They transformed their data into mathematical terms to examine the slopes and intercepts of the trajectories. Carter et al. did not examine development of language skills. Instead, they wanted an overall snapshot of how autistic children's brains function. Like Whyte and Nelson, their autistic participants had a large age range, 8-16 years. However, their group-matching approach did not allow them to individually identify and examine the different aspects of brain function among different ages. Instead, they took analyses from the entire group and combined them to form a general consensus.

The two approaches demonstrate that the problem of social language in autistic children can stem from both biological brain activity and from basic language skills. These may be only two of the influences on communication in autistic children. However, these two influences represent the great nature versus nurture controversy, which debates whether a person's character traits, behavior, and innate qualities are a result of genes (nature) or the environment (nurture). Whyte and Nelson demonstrate the nurture side of the controversy. The level of effective pragmatic and nonliteral language is based upon how well the autistic child has learned and comprehended basic language skills. Carter et al. represent the nature side. All autistic children are born with their brain functioning in a different way than typically developing children. Both

sides of the argument are valid and help contribute to a diverse selection of perspectives and opinions on the topic of pragmatic language in autistic children.

Works Cited

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