

Social Information Processing in Children: Cognitive and Rorschach Correlates in an Inpatient

Psychiatric Setting

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TITLE OF PROJECT: **Social Information Processing in Children: Cognitive and Rorschach Correlates in an Inpatient Psychiatric Setting**

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Abstract

Social cognition refers to an individual's ability to appropriately perceive and understand social information that drives communication and interpersonal relationships with others. Two primary skills involved in social cognition include Theory of Mind (ToM) and Affect Recognition (AR). Social cognition is typically measured in children using structured, neurocognitive tasks, although performance-based measures can also be utilized in order to evaluate a child's skills in this area. Previous literature has found that the Rorschach is related to neurocognitive functioning in children and adults. This literature has not specifically focused on social cognitive abilities and is under-investigated in children. Therefore, the present study aims to further investigate the relationship between the NEPSY-II (ToM and AR subtests) and Rorschach in measuring social cognition among a sample of children in an inpatient setting through the use of archival psychological assessment data. A series of Spearman's rank-ordered correlational analyses examining the relationship between ToM and AR performance with various Rorschach structural variables included in the IMP, Interpersonal, Affective Processing, and Self-Perception clusters, revealed a significant negative relationship between ToM and PTI, X-%, M-%, Afr, and WSumC, whereas a significant positive relationship was found between ToM and WDA/XA%, DQ+, Mp > Ma, and FD. AR was significantly negatively correlated with X-%, PTI, and a High Afr, whereas AR was significantly positively related to WDA/XA%. Generally, results of the present study suggest that children with increased disinhibition of affect tend to exhibit poorer performance on ToM and AR, whereas children with more affective control and tendencies to engage in fantasy withdrawal display more advanced performance on ToM and AR. Furthermore, children with poor reality testing capabilities are prone to display social cognitive deficits on structured ToM and AR tasks.

CHAPTER I.

INTRODUCTION

Statement of Purpose & Overview

In general, this study will aim to shed light on the implications of social cognitive information processing in an inpatient psychiatric sample. More specifically, two major components of social cognition, Affect Recognition (AR) and Theory of Mind (ToM), and their correlates (related constructs) in this setting will be explored. ToM refers to an individual's ability to be aware that others have mental states that differ from their own (Baron-Cohen, Leslie, & Frith, 1985). These skills allow individuals to interact in a socially appropriate way and, in turn, communicate effectively with others (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen et al., 1995). Research shows that ToM skills play a role in the overall development of social abilities, and deficits in ToM hinder an individual's ability to attain competence across various social behaviors (Mazza et. al, 2017). Additionally, performance on tasks of ToM, including those that examine true versus false beliefs, demonstrate that higher ToM abilities are associated with higher levels of socially adaptive behaviors and decreased incidences of social problems (Bishop-Fitzpatrick et. al, 2017). ToM is also extremely important for effective communication, and empirical studies reveal a close link between mentalist and communicative abilities (Resches & Pérez-Pereira, 2007).

AR is the ability to gather information from an individual's affective state, mostly relying on others' facial information in order to infer judgment about their current emotional state. The process of affect recognition is rooted in being able to adequately perceive faces and identify specific facial expressions (Berggren, Engström, & Bölte 2016).

In order to research the correlates of social cognition in this sample, the proposed study will examine the relationships between neurocognitive indicators of both AR and ToM and constructs on a performance-based measure. In particular, the relationship between performance on the AR and ToM subtests of the NEPSY-II and various structural variables on the Rorschach will be examined. Previous research has revealed that the Rorschach does have neurobiological relationships and implications (Porcelli et. al, 2013). In particular, the interpretation of M (human movement) responses relates to mirroring activity in the brain (Porcelli et. al, 2013). Additionally, brain areas related to higher level visual processing, attentional processing, and perception and processing of emotions become activated when individuals take a Rorschach (Giromini et. al, 2017). It is evident from this previous research that there is a connection between the Rorschach and aspects of neurocognitive functioning, although the proposed study will specifically examine how both AR and ToM (when measured using a structured neurocognitive test) relates to various aspects of personality functioning on the Rorschach.

Generally, this research may allow the field to further investigate the association between constructs measured on neurocognitive and performance-based tests. More importantly, this study may provide clinicians with a better understanding of how aspects of social cognitive abilities relate to various aspects of personality functioning, including both personality structure (e.g., stress tolerance, reality testing and thinking, affective processing) as well as the view of self and others among children in an inpatient psychiatric setting. The examination of these relationships has applications for effective diagnostic decisions and treatment planning.

CHAPTER II.

LITERATURE REVIEW

Social Cognition & Relevance in Child Development

Social cognition refers to the skills that are necessary for individuals to understand, perceive, and navigate their interactions with others in an appropriate manner. In general, skills in this area are essential in order to effectively communicate with others across a variety of real-life situations. Social cognition skills broadly involve understanding the emotions of others as well as recognizing and holding the other's unique perspective in mind (Loukusa, Mäkinen, Kuusikko-Gauffin, Ebeling, & Moilanen, 2014).

The various aspects of social cognition are pivotal in child development, particularly based on the fact that the skill sets involved in this form of information processing are closely intertwined with emotional development (Bear, Manning, & Izard, 2003). Additionally, social cognitive skills foster the development of responsible behaviors among children, which emphasizes the fact that these skills not only have important effects on an individual's own course of development, but on their interactions with the broader community as a whole (Bear, Manning, & Izard, 2003).

More specifically, social cognition helps promote positive relationships with others as the child develops, which in turn can establish a more stable and positive school climate (Bear, Manning, & Izard, 2003). The literature shows that school-aged peers tend to prefer establishing connections with other children who display appropriate skills that relate to social cognition; in particular, one review in this area of literature found that school-aged children prefer to become friends with peers who can adequately inhibit aggressive and antisocial behaviors, and engage in

more prosocial behaviors that include being helpful, displaying sensitivity to others, and being able to cooperate with others and rules across contexts (Rubin, Bukowski, & Parker, 1998). However, the literature also shows that interpersonal connections among children are not solely contingent on a high frequency of engaging in these prosocial behaviors (Bear, Manning, & Izard, 2003). Rather, it is the child's understanding of knowing when it is appropriate to be prosocial versus being more aggressive and/or disinhibited that promotes and maintains these relationships (Bear, Manning, & Izard, 2003). This sense of understanding highlights the importance of developing adequate social cognitive skills. For example, one study found that peers who know when and how to display aggression for the appropriate reasons, such as during a sports game, are very rarely rejected by classmates (Bear & Rys, 1994). The relationship between teachers and children is also benefitted by this understanding of how to behave in varying social situations. In particular, the literature shows that teachers report feeling closer to those students who engage in prosocial behaviors in the classroom compared to those who required more guidance in navigating social situations with their classmates (Birch & Ladd, 1998). When these positive relationships are established among peers as well as between students and teachers, it is likely to result in a more positive school climate, which in turn influences the students to feel a greater sense of self-worth and to engage in more prosocial behaviors (Battistich & Hom, 1997).

In addition, the development of social cognition in children helps to foster academic achievement (Bear, Manning, & Izard, 2003). The literature reveals that those children who can understand the intention of others as well as consequences of their social behaviors are likely to be more successful across academic areas (Elias et. al, 1997; Wentzel, 1992, 1994, 1996). This phenomenon is rooted in the notion that many of the social cognitions and emotions that are

necessary for academic competence also contribute to social competence (Bear, Manning, & Izard, 2003). For example, students who pursue academic goals also tend to pursue social goals (Wentzel, 1996), and these students are likely to understand and internalize guilt from engaging in antisocial behaviors, which influences them to be more prosocial in that they adhere to the social and academic standards that are praised in the school setting and surrounding community (Williams, 1998).

Lastly, the current literature on the effects of social cognitive development in children supports the claim that skills in this area promote a positive self-concept (Bear, Manning, & Izard, 2003). In general, there are multiple aspects that contribute to a child developing a positive sense of self-worth that result from the interaction of genetic and environmental factors (Bear, Manning, & Izard, 2003). In general, a primary factor that contributes to a positive self-worth among children is the self-perception of feeling competent across various important domains of life, including the development of social interactions and interpersonal relationships (Bear, Manning, & Izard, 2003). A crucial component to a child's self-worth is their sense of behavioral and social conduct, particularly focusing on the morality behind their actions (Harter, 1985). In general, a review of the literature indicates that children develop a sense of lower self-worth when they begin to understand that their behavior is morally wrong or inappropriate to the social situation at hand (Bear, Manning, & Izard, 2003). Therefore, it is evident how the development of social cognition, which primarily involves an understanding and processing of information related to navigating and interpreting interpersonal situations, relates to a child's overall development of self-concept.

Social Cognitive Skills: Affect Recognition (AR) & Theory of Mind (ToM)

As discussed above, it is evident that the development of social cognitive skills is essential for appropriate development across childhood. In particular, social cognition impacts development of academic achievement, interpersonal relationships, and self-worth in children (Bear, Manning, & Izard, 2003). Therefore, it is important to understand the primary skills that encompass a child's ability to adequately navigate, process, and understand social information in their environments. For example, affect recognition (AR) is one primary skill involved in accurately perceiving social situations. AR is the ability to gather information, primarily from others' faces, in order to infer judgment about their current emotional state, and the process is rooted in being able to adequately perceive faces and identify specific facial expressions (Berggren, Engström, & Bölte 2016).

Human faces are one of the most salient stimuli that we can perceive in our environment, and the use of AR to discriminate between faces based on their individual features is a necessary skill for human survival. In particular, the process of facial identification is linked to a specific brain region known as the Fusiform Face Area (FFA) (Kanwisher & Yovel, 2006). This supports the claim that facial recognition and identification are essential skills for human survival, specifically given that there is a neurobiological link between this skillset and areas in the brain. Furthermore, if we could not discriminate between faces in our environments, it would be difficult to have any form of social communication or facilitation, and without this communication, humans would not flourish. Faces can provide us with information about sex, age, mood, gaze, and ultimately, the ability to distinguish between faces has played a role in the survival of our ancestors (Kanwisher & Yovel, 2006).

Another primary social cognition skill, Theory of Mind (ToM), involves an individual

being aware that others have mental states that differ from their own (Baron-Cohen, Leslie, & Frith, 1985). These skills allow individuals to interact in a socially appropriate way and, in turn, communicate effectively with others (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen et al., 1995). Research shows that ToM skills play a role in the overall development of social abilities, and deficits in ToM hinder an individual's ability to attain competence across various social behaviors (Mazza et. al, 2017). Additionally, performance on tasks of ToM, including those that examine true versus false beliefs, demonstrate that higher ToM abilities are associated with higher levels of socially adaptive behaviors and decreased incidences of social problems (Bishop-Fitzpatrick et. al, 2017). ToM is also extremely important for effective communication, and empirical studies reveal a close link between mentalist and communicative abilities (Resches & Pérez-Pereira, 2007).

Measuring Social Cognition in Children

Various aspects of social cognition, including both ToM and AR, can be measured through various psychological measures. This may include self-report and parent-report measures of behaviors, symptom checklists used by the clinician, diagnostic interviews, performance-based measures, and structured, neurocognitive tasks. Although a clinician may be able to gain a sense of a child's social cognitive abilities through a more unstructured interview or a parent-report measure, a structured, neurocognitive task allows the clinician to determine whether or not there is actually a level of impairment in the specific area of functioning as a result of brain-behavior relationships (Miller, 2015). Additionally, neurocognitive tests are designed to measure certain constructs that may not be normally distributed in the general population compared to measures of general cognitive ability that follow a normal distribution (Miller, 2015). The focus of these measures is to differentiate cases in the lower end of the

distribution in order to help clinicians decipher the severity of the particular impairment (Miller, 2015).

A Developmental Neuropsychological Assessment (Korkman, 1998), or the NEPSY, is one standardized psychological assessment tool that clinicians can use to measure social cognition in children by using structured, neurocognitive tasks (Brooks, Sherman, & Strauss, 2009). The original NEPSY, published in 1998, solely allowed clinicians to evaluate other essential areas of cognitive functioning, including language, learning and memory, sensorimotor functioning, visuospatial processing, and attention and executive functions (Brooks, Sherman, & Strauss, 2009). Since the first edition, there have been efforts to enhance the clinical and diagnostic utility of this assessment tool by increasing the domains of cognitive abilities represented on the measure (Brooks, Sherman, & Strauss, 2009). In particular, based on the need to enhance the assessment of children with ASD, the second edition of this assessment tool added a Social Perception domain (Brooks, Sherman, & Strauss, 2009). The Social Perception domain includes two primary subtests, Theory of Mind (ToM) and Affect Recognition (AR), with the overall purpose of evaluating a child's ability to engage in facial affect recognition and comprehend others' perspectives, beliefs, and intentions (Brooks, Sherman, & Strauss, 2009).

In terms of ToM, this subtest on the NEPSY-II is designed to evaluate several aspects of this social cognitive ability. Generally, the subtest is designed to assess the child's ability to understand various mental functions, which includes false-beliefs, intentions, deception, components of imagination, emotion, and pretending (Brooks, Sherman, & Strauss, 2009). Additionally, the ToM subtest is aimed to see if the child can understand that others have their own unique ideas, thoughts, and feelings that may be different from the child's as well as to see if the child can understand how emotion relates to social context in recognizing how an

appropriate affect is related to varying social contexts (Brooks, Sherman, & Strauss, 2009). The ToM subtest itself includes two tasks, a verbal task and a contextual task. The verbal ToM task involves the child being read various scenarios or shown pictures, and the child is required to answer questions that require a certain level of understanding of another's unique point of view (Brooks, Sherman, & Strauss, 2009). The contextual task includes the child being shown a picture that displays a social context, and the child is asked to pick a photograph from options that best represents the appropriate affect of the person in the picture (Brooks, Sherman, & Strauss, 2009).

In terms of the facets of ToM that the NEPSY-II has embedded into the subtest, the task includes the appearance-reality distinction (Miller, 2015). This involves showing the child a picture of an object that does not actually exist, and the child must rely on their imagination and sense of reality in order to label the object in a concrete way (Miller, 2015). Additionally, the ToM subtest includes questions that will help clinicians understand the child's ability to distinguish between mental and physical states; for example, the child will need to listen to scenarios and identify corresponding photographs that depict an individual's experience in reality versus a dream state (Miller, 2015). Subsequent aspects of ToM reflected on the subtest include understanding figurative language, understanding that seeing may lead to knowing certain pieces of information, and recognizing another person's emotional state through contextual cues (Miller, 2015).

Another essential milestone in the development of ToM among children involves an understanding of false beliefs, which reflects the child perceiving that others hold beliefs that may differ from reality (Liu et. al, 2008). This milestone is generally achieved by children across various cultural backgrounds (Liu et. al, 2008; Wellman et. al, 2008). Measures of false-

belief understanding have been used in many studies that have explored the individual differences in development of ToM skills among children (Lane et. al, 2013). The NEPSY-II ToM subtest includes tasks that evaluate a child's understanding of false beliefs, which involves the child listening to a scenario and responding to a question while holding another's unique point of view in mind (Brooks, Sherman, & Strauss, 2009). Overall, the ToM subtest on the NEPSY-II has shown clinical utility in evaluating a child who may engage in atypical social behavior, including social avoidance, poor social skills, and an inability to understand another's perspective (Miller, 2015).

Regarding the AR subtest, the purpose of this task is to evaluate the child's ability to recognize affect from photographs of children's faces; the various affective states include happy, sad, anger, fear, disgust, and neutral (Brooks, Sherman, & Strauss, 2009). The AR subtest includes four different tasks depending on the age of the child. In one of the tasks, the child needs to state whether or not two faces display the same affect, whereas in a subsequent task that is more difficult, the child is required to select two photographs of faces that display the same affect from a choice of three to four photographs (Brooks, Sherman, & Strauss, 2009). On the third task, the child picks one of the four faces that is experiencing the same affect as the target face at the top of the page, and on the fourth task, the child briefly sees a target face, and is then expected to rely on memory to select two photographs that depict the same affective state as the face previously shown on the separated target page (Brooks, Sherman, & Strauss, 2009). In terms of clinical utility, the AR subtest on the NEPSY-II has been helpful in testing children with externalizing behaviors to decipher whether or not the child can read emotional states in others, and the subtest is also clinically valuable when assessing children for potential ASD and/or childhood/adolescent onset of schizophrenia (Miller, 2015).

When examining the intercorrelations of subtest scores on the NEPSY-II, the research indicates that most correlations between subtests are low, with the highest correlations occurring between subtests in the same domain (Brooks, Sherman, & Strauss, 2009). This supports the structure of the NEPSY-II in that specific domains of functioning are likely to be valid in identifying impairment in that specific area (Brooks, Sherman, & Strauss, 2009). Regarding the social perception domain, the AR subtest is moderately correlated with Body Part Naming and Identification, which are part of the language processing domain, and the AR subtest has minimal relationships with all other subtests in other areas of functioning (Brooks, Sherman, & Strauss, 2009). The ToM subtest is moderately correlated with various subtests of learning and memory and the language processing domains, including the following: Memory for Names – Delayed, Narrative Memory, Body Part Identification, Comprehension of Instructions, and Phonological Processing (Brooks, Sherman, & Strauss, 2009).

The clinical sample research in the NEPSY-II development has also indicated that the NEPSY-II, which is commonly used as a part of a comprehensive psychological assessment battery, is related to other measures of functioning (Brooks, Sherman, & Strauss, 2009). In particular, when looking at the relationship between the NEPSY-II and a measure of general cognitive ability, such as the WISC-IV, the research indicates that it is important to understand that many of the domain specific functions assessed on the NEPSY-II underlie the general cognitive domains that comprise intellectual functioning (Brooks, Sherman, & Strauss, 2009). Therefore, the NEPSY-II subtests correlate with the WISC-IV composites and subtests based on the underlying processes that are required to complete the subtests of each instrument as well as how the information and required responses are presented, such as in either a visual or verbal modality (Brooks, Sherman, & Strauss, 2009). Regarding the subtests that comprise the social

perception domain, AR showed very low correlations with all of the WISC-IV subtests and composite scores (Brooks, Sherman, & Strauss, 2009). This relationship suggests that the skills measured through the AR subtest are not strongly related to general cognitive functioning, which supports evidence for discriminant validity of this subtest measuring an aspect of social perception (Brooks, Sherman, & Strauss, 2009). A correlational analysis between the ToM subtest and the WISC-IV composite and subtest scores was not investigated in the original research sample studies. The NEPSY-II was also correlated with a common measure of academic achievement for children, the WIAT-II. Results of this analysis revealed that, similarly to general cognitive functioning, specific NEPSY-II subtests had stronger relationships with different WIAT-II composite and subtest scores, revealing a connection between underlying neuropsychological processes and academic achievement (Brooks, Sherman, & Strauss, 2009). The analysis between WIAT-II scores and the Social Perception domain of the NEPSY-II revealed low correlations between all scores of academic functioning and the AR subtest score, demonstrating a lack of a strong relationship between this aspect of social perception and various areas of academic functioning (Brooks, Sherman, & Strauss, 2009). However, the ToM subtest was highly correlated with Oral Expression on the WIAT-II, a subtest that required the ability to develop a story based on pictures of people engaged in different activities (Brooks, Sherman, & Strauss, 2009). This relationship reveals a strong connection between a child's ToM skills and his or her ability to rely on verbal skills in order to express thoughts and ideas in a socially accurate manner. When examining the NEPSY-II measure with other measures of neuropsychological functioning, such as the Children's Memory Scale (CMS), the AR subtest was moderately correlated with the Word Pairs subtest (Brooks, Sherman, & Strauss, 2009), although all other correlations were very low.

Regarding the relationship between the NEPSY-II social perception domain and behavior rating scales, the clinical sample research examined the relationship between the NEPSY-II and the Devereux Scales of Mental Disorders (DSMD) (Brooks, Sherman, & Strauss, 2009). The DSMD is a symptom checklist derived from the DSM-IV criteria for child mental disorders (Brooks, Sherman, & Strauss, 2009). The DSMD can be completed by a teacher, parent, or caregiver, and the measure yields scores in six clinical scales of symptomatology, including: Conduct, Attention/Delinquency, Anxiety, Depression, Autism, and Acute Problems (Brooks, Sherman, & Strauss, 2009). These clinical scales are also represented through composite scores that include Internalizing, Externalizing, Critical Pathology, and the Total Score (Brooks, Sherman, & Strauss, 2009). The research indicates that AR of the NEPSY-II was moderately, negatively correlated with the Conduct Scale and the Externalizing Composite (Brooks, Sherman, & Strauss, 2009). This relationship suggests that as a child displays more externalizing symptoms, he or she is likely to exhibit a poorer ability to recognize affective states from faces. Additionally, the AR subtest and the various symptom clusters on The Brown ADD Scales were analyzed (Brooks, Sherman, & Strauss, 2009). The results indicated very low, negative correlations, indicating that in general, as a child exhibits more impaired ADD symptoms, he or she will exhibit poorer performance across all of the NEPSY-II subtests, although there is no significant relationship between the AR subtest in particular and the symptom areas on this behavior rating scale (Brooks, Sherman, & Strauss, 2009). Lastly, the NEPSY-II was also correlated with the ABAS-II, a comprehensive measure of adaptive functioning, in a clinical sample (Brooks, Sherman, & Strauss, 2009). The results did not indicate any significant relationships between the AR subtest on the NEPSY-II and various

domains of the ABAS-II across children with learning disabilities, Intellectual Disability, and Asperger's syndrome (Brooks, Sherman, & Strauss, 2009).

The NEPSY-II development research also includes additional clinical sample studies on "special groups," that examines the performance on the NEPSY-II subtests between typically developing children and children with Intellectual Disability (ID), ASD, and emotional disturbance (Brooks, Sherman, & Strauss, 2009). The performance on the AR subtest was significantly different between children with ID and typically developing children, with the ID group attaining much poorer performance overall (Brooks, Sherman, & Strauss, 2009). Children with a DSM-IV-TR diagnosis of Autistic Disorder, without intellectual impairment, demonstrated significantly impaired AR skills compared to matched controls (Brooks, Sherman, & Strauss, 2009), although their ToM abilities were not examined in this analysis. Lastly, children with an emotional disturbance IEP classification from their school district were compared to a matched control group across NEPSY-II subtests (Brooks, Sherman, & Strauss, 2009). Many of the children in this clinical group did not carry a formal DSM diagnosis, although there was a presence of conduct, ADHD, and mood/anxiety symptoms in the sample (Brooks, Sherman, & Strauss, 2009). The results revealed that in terms of social perception skills, there was no significant difference in performance on the AR subtest between groups (Brooks, Sherman, & Strauss, 2009).

Social Cognition, Underlying Neural Mechanisms, & Personality Functioning

The underlying mechanisms of social cognitive skills are related to a child's developing brain structures (Adolphs, 1999), which is consistent with the fact that this form of information processing is typically measured through a structured neurocognitive task as mentioned previously. Despite this, the literature shows that neural underpinnings of social cognition are

not well understood and have been underexplored (Adolphs, 1999). The primary brain structures said to be involved in this form of information processing include the amygdala, ventromedial frontal cortices, and the right somatosensory-related cortex (Adolphs, 1999). There have been two major sets of studies that have explored these neural systems as essential to the development of social cognition in humans, including literature on social impairment following damage to the frontal lobe as well as social impairments among individuals with autism (Adolphs, 1999). The research on impaired frontal lobe functioning began following the injury of a railroad worker named Phineas Gage. Gage suffered from a large bilateral lesion of his frontal lobe, which included the ventromedial prefrontal cortex (Adolphs, 1999). Before this incident, Gage was described by family members and peers as a socially adept person who was always hard working and polite during his interactions with others; however, following the accident, Gage's personality took a radical turn, and he began to act in socially inappropriate ways, being interpreted as profane and uncaring (Adolphs, 1999). More modern case examples similar to Gage exhibit drastic personality changes due to damage of the ventromedial frontal lobes. However, the literature indicates that these cases do not show any impairments in areas of intelligence, language, perception, and memory on standardized neuropsychological evaluations (Adolphs, 1999). Therefore, the literature has explained this phenomenon by attributing the role of the ventromedial frontal cortices as one that helps individuals associate their emotional experiences with decision making processes in complex interpersonal situations (Adolphs, 1999). From this literature and theory, we can argue that there is a connection between social cognition, personality, and neurocognition.

Furthermore, the underlying neural mechanisms of social cognition have been explored through understanding a population of individuals with ASD (Adolphs, 1999). This line of

research developed from the belief that ASD symptomatology is particularly rooted in social cognitive impairments, in particular, clinical and diagnostic research commonly identifies that the primary hallmark of ASD is experiencing deficits in ToM, where the individual has a difficult time understanding and attributing the mental states of others (Adolphs, 1999).

Although the literature suggests that our understanding of the link between ASD diagnosis and underlying neural mechanisms is far from comprehensive, this particular deficit in ToM represents a high degree of domain-specific function, strengthening the argument for understanding brain-behavior relationships when conceptualizing social cognition (Adolphs, 1999). In addition, another developmental disorder, Williams Syndrome, supports the claim that social cognition must have a neural basis (Adolphs, 1999). For example, individuals with Williams Syndrome appear to have a hallmark symptom of being hypersocial, and research shows that this is one of the most significant impairments among this group of individuals compared to other domains of functioning (Adolphs, 1999). Based on a primary deficit in social cognition, similar to ASD, research on this disorder supports the modularity of social cognitive abilities, indicating that there must be specific neural mechanisms underlying the symptoms of these disorders (Adolphs, 1999).

In addition to frontal lobe functioning, brain structures at the more primitive level relate to our social cognitive abilities. For example, the amygdala works in conjunction with higher cortical areas in order for us to understand and interpret social judgments (Adolphs, 1999). In particular, the amygdala and higher cortical areas help us to process and interpret facial information, which is essential in recognizing affect and in turn relying on Theory of Mind skills to understand another individual's mental and emotional state (Adolphs, 1999). A review of the literature reveals that visual processing of faces is rooted in the fusiform gyrus, which is

embedded within the temporal lobe (Adolphs, 1999). Additionally, further MRI research supports the involvement of the superior temporal sulcus when an individual relies on socially relevant information (e.g., eyes, mouth) in order to make an accurate interpretation regarding someone's affective state (Adolphs, 1999). These high-level visual cortices and networks in the temporal lobe extend to and interact with the amygdala, which further guides our ability to engage in appropriate affect recognition (Adolphs, 1999). Various neuroimaging studies that rely on MRI and PET methodology have found that individuals who have damaged portions of the amygdala are unable to accurately engage in Affect Recognition compared to control groups (Adolphs, 1999), and the amygdala is particularly important for individuals to identify negative emotions from faces, including fear (Adolphs, 1999). These findings are consistent with historical research on the role of amygdala that has focused on the area's role in understanding appropriate social behavior, engaging with others in a socially acceptable manner, and relying on the amygdala's function in gauging fear and threat from social stimuli in life-threatening or dangerous situations (Adolphs, 1999). More recent research has attributed the amygdala's involvement in more higher-level social cognitive abilities, including Affect Recognition and Theory of Mind (Adolphs, 1999). More specifically, the amygdala has been shown to be involved in the processing of direction of eye gaze in a face in lesion and functional imaging studies (Adolphs, 1999). Additionally, in terms of understanding mental states, other functional neuroimaging studies have examined an individual's ability to judge how trustworthy or approachable a person is perceived to be; the results indicated that patients with amygdala damage were impaired in their ability to attribute trustworthiness in an accurate way compared to typically developing controls (Adolphs, 1999). Further research on social cognition and underlying neural mechanisms has focused on empathy, which is related to the human ability to

understand and process social information (Shamay-Tsoory et. al, 2007). In particular, evidence from functional neuroimaging and lesion studies show that the orbitofrontal and medial prefrontal cortex are involved in the human ability to be empathic (Farrow et. al, 2001; Shamay-Tsoory, Tomer, Berger, & Aharon-Peretz, 2003).

Additional research on social cognitive abilities has focused on how these skills relate to the development of our forming personalities (Lapsley & Narvaez, 2004). Given that the above literature highlights that social cognition is rooted in underlying neural mechanisms that are also involved in personality and behavioral traits, research in further understanding how social cognition and personality functioning are connected is necessary. Although this is an under-investigated area of research, one review has discussed taking a social-cognitive approach to understanding the moral aspects of our personality (Lapsley & Narvaez, 2004). This review argues that various aspects of our personality, including identity formation, are related to how we process and understand social information in our environments (Lapsley & Narvaez, 2004).

An additional aspect of personality development explored in the social cognition literature is temperament (Lane et. al, 2013). More specifically, this research is rooted in the emotional reactivity hypothesis, which argues that animals, including the human race, that flourish and survive have less reactive temperaments, which has supported the development of more sophisticated social cognitive abilities (Hermann et. al, 2007). This hypothesis supports the claim that children with less reactive temperaments will develop ToM skills at a more advanced rate (Lane et. al, 2013). One study further examined the relationship between temperament and false-belief understanding, one component of ToM, among preschool-age children from China and the United States (Lane et. al, 2013). Temperament was assessed using parent-report measures of the child's behavior as well as with physiological measures of children's reactivity

(e.g., salivary cortisol), and ToM was measured through the use of two false-belief tasks, which included an unexpected contents task (Perner, Leekam, & Wimmer, 1987) as well as a switched-location task (Wimmer & Perner, 1983; Lane et. al, 2013). Both tasks included characters that were represented with photographs of child-figurines that matched with the ethnicity of the child participant (Lane et. al, 2013). The researchers found that in general, children with more reactive temperaments (e.g., being more aggressive) demonstrated more impaired social cognitive abilities (Lane et. al, 2013). However, for the majority of children in both countries, children with greater physiological reactivity demonstrated more advanced ToM skills, although some of the Chinese children who demonstrated a more socially withdrawn, nonreactive temperament still evidenced advanced ToM skills compared to other Chinese children (Lane et. al, 2013). Generally, these findings demonstrate that social cognition, particularly Theory of Mind, is related to temperamental and cultural factors that ultimately contribute to an individual's personality and identity development.

Impairments in Social Cognition & Structured Neurocognitive Tasks

Social Cognition & Psychiatric Disorders

Given that social cognition is pivotal for a child's development (Bear, Manning, & Izard, 2003), coupled with the fact that these processes can be measured through neurocognitive tasks due to the neurological mechanisms underlying these skills (Adolphs, 1999), it is likely that individuals who experience various psychiatric disorders that affect brain function will have impairments in social cognition.

This notion has been explored throughout the scientific literature. In a 2011 review by Derntl & Habel, it is hypothesized that deficits in social cognition may potentially be a marker

for psychiatric disorders (Derntl & Habel, 2011). More specifically, the review summarizes various studies supporting the claim that individuals with various psychiatric conditions, including schizophrenia, have deficits in various aspects of social cognitive ability, including Theory of Mind, understanding emotions, and being empathic (Derntl & Habel, 2011). Neuroimaging findings were also reviewed, which support the neural dysfunction among the psychiatric populations that have behavioral deficits consistent with a lack of social cognitive ability (Derntl & Habel, 2011). Although further research in this area is necessary, it is postulated that deficits in social cognition may act as trait markers and/or endophenotypes for certain psychiatric conditions, like schizophrenia (Derntl & Habel, 2011).

In particular, the literature has explored social cognition specifically among individuals with schizophrenia and supports severe impairment in this area of functioning, particularly in Theory of Mind and Affect Recognition (Penn et. al, 1997). Although the general consensus of the research is that schizophrenia involves impaired social cognition, the cognitive and affective correlates of this impairment and the underlying mechanisms are still largely unknown (Shamay-Tsoory et. al, 2007). Studies in this field of literature suggest that the age of onset for schizophrenia has unique implications for social cognitive deficits; in particular, the literature studying adults suggests that adults with schizophrenia demonstrate ToM and AR deficits, whereas the literature focusing on children and adults, although more limited, indicates that children with social cognitive deficits may be at greater risk for developing a schizophrenia spectrum disorder in the future (Shamay-Tsoory et. al, 2007). More recent research has focused on how the deficits in social cognitive ability among adults with schizophrenia are global, in that the deficits are generalized beyond Affect Recognition and Theory of Mind abilities (Combs et. al, 2007). This notion has informed social cognitive interventions for this population in that past

interventions have focused on a specific area of social cognitive impairment, whereas more current interventions seem to argue for the integration of these skills as well as the generalization of interventions to be used in everyday interactions (Combs et. al, 2007). Additional research that has focused less on interventions for this population has placed more emphasis on understanding how these deficits influence performance on related structured tasks. Many of these studies have examined empathy and how that skill relates to cognitive functioning. This research stems from the claim that social cognitive impairment among individuals with schizophrenia may be rooted in an inability to empathize with others (Lee, Farrow, Spence, & Woodruff, 2004). In particular, one study examined both cognitive and affective empathy as well as cognitive flexibility, which relates to social cognitive abilities, in patients with schizophrenia compared to healthy controls by utilizing various assessment tools (Shamay-Tsoory, Shur, Harari, & Levkovitz, 2007). Affective empathy refers to the ability to share a feeling with another individual, whereas cognitive empathy refers to the ability to adopt another person's point of view or mental state (Shamay-Tsoory et. al, 2007). Both cognitive and affective empathy were measured using self-reports, including the Questionnaire Measure of Emotional Empathy (Mehrabian & Epstein, 1972) as well as the Interpersonal Reactive Index (Shamay-Tsoory et. al, 2007). Both of these self-report measures include questions that reflect engagement in perspective taking, emotional reactions to various interpersonal situations, and level of empathic concern across contexts (Shamay-Tsoory et. al, 2007). Cognitive flexibility was assessed using two tasks included in the CANTAB frontal/executive battery, which focus on evaluating rule acquisition and set-shifting abilities (Shamay-Tsoory et. al, 2007). The results of this study indicated that participants with schizophrenia had decreased levels of cognitive and