

An Update on Neurocognitive Profiles in Asperger Syndrome and High-Functioning Autism

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This article provides an overview of the similarities and distinctions between individuals with autism and those with Asperger syndrome (AS). First, we review the cognitive and neurocognitive profile underlying deficits characteristic of autism spectrum disorders. Particular emphasis is placed on recent comparisons of high-functioning autism to AS on the basis of neuropsychological testing, and implications of neuropsychological profiles for the cognitive deficits and clinical presentation of AS.

Asperger syndrome (AS) is currently conceptualized as a neurodevelopmental disorder, related to autism with regard to deficits in social interaction and restricted or obsessive interest patterns, but characterized by less severe language and cognitive impairments (Volkmar & Klin, 2000). Almost 60 years ago, an Austrian pediatrician, Hans Asperger (1944/1991), introduced this disorder as “autistic psychopathy” to the German-speaking world when he described four unusual boys with fluent language skills but peculiar ways of using language, social isolation, abnormal voice prosody, a desire for sameness, repetitive behavior, and odd nonverbal communication. Asperger’s case descriptions emphasized odd use of eye gaze, speech, and movements, as well as difficulty with learning in a conventional manner. The need for predictability, routine, and sameness was underscored in a case example where Asperger commented, “If something was only slightly different from the way that he

had imagined it or from what he was used to, he was upset and confused and would go into long tirades” (p. 61). Originally, he wrote that this disorder could occur on a continuum, at any level of ability, from mental retardation to intellectual genius.

Just a year prior to the publication of Asperger’s (1944/1991) paper, Leo Kanner (1943) published an account of 11 children with “early infantile autism” in English. Kanner’s and Asperger’s papers provided case illustrations with salient distinguishing features between these conditions. Wing (1998) commented that individuals could be selected from each group to represent contrasts in behavior and clinical presentation. Members of Kanner’s group of children were characterized by severe language delays or the absence of language, whereas Asperger’s cases were characterized by their pedantic, long-winded, and precocious speech. The prototypical cases described by Kanner were either mute or echolalic, lined up toys, were socially oblivious, and

memorized meaningless facts, whereas Asperger’s prototypical cases were socially awkward but interested in others, spoke fluently (albeit in an unusual manner), lacked common sense, and were “specialists in unusual fields” (Frith, 1991, p. 12). Yet, both accounts also contained strikingly similar symptoms, including impoverished social interaction and use of language for communication, stereotypic patterns of behavior, special interests, and resistance to change.

Several of Asperger’s and Kanner’s cases overlapped to the point of almost identical symptom presentation (Schopler, 1998). The diagnostic criteria described by Asperger, including atypical social behavior, egocentricity, communication difficulties, and circumscribed interests, can be found in Kanner’s definition of autism (Schopler, 1998). In fact, as Wing (1998) observed, the primary difference appears to be one of severity. The closer intelligence and language abilities are between comparison groups, the more similar the clinical symptoms. This suggests that these disorders may be described differently on the basis of severity and cognitive ability. However, aside from these severity-dependent differences, the disorders have not been distinguished as valid separable categories. In spite of such similar descriptions, each manuscript initially received attention and interest primarily in the language in which it was published—Kanner in the

English-speaking world and Asperger in the German-speaking world—for almost 40 additional years.

Diagnostic Criteria

Following extensive literature reviews conducted in 1992, AS was included as a separate diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV; American Psychiatric Association, 1994)*, under the class of pervasive developmental disorders (PDD). At approximately the same time, the World Health Organization's ICD-10 (WHO, 1993) also included AS, with the recognition that its features might overlap significantly with autism and that this diagnosis might also be difficult to differentiate from other variants of pervasive developmental disorders. Individuals with both autism and AS are characterized by *DSM-IV* and ICD-10 criteria as having abnormalities of reciprocal social interaction and restricted, stereotyped, repetitive interests. They differ only with respect to onset and severity of symptoms.

According to *DSM-IV*, individuals with AS do not have a delay in language acquisition and exhibit normal intelligence. Thus, in order to meet criteria for AS, an individual would need to demonstrate normal development prior to the age of 3 in language and cognitive development, as well as in self-help and adaptive skills, and general curiosity about the environment. However, this leaves a minority of persons with high-functioning autism (HFA) who do not have a language delay and whose level of intellectual functioning is within the normal range, to be distinguished from AS on some diagnostic grounds. The *DSM-IV* does not stipulate that the abnormalities of social interaction and circumscribed interests or repetitive behavior are fewer or less severe in AS, as compared to HFA (Mayes, Calhoun, & Crites, 2001). However, if an individual meets diagnostic criteria for autism, then the diagnosis of autism takes precedence.

The text revision of the *Diagnostic and Statistical Manual—Fourth Edition*

(*DSM-IV-TR; American Psychiatric Association, 2000*) provides updated information on the basis of empirical data. The revision reflects not an update to the diagnostic criteria but rather new information available since the literature reviews of 1992 prepared for *DSM-IV*. At the time of the original *DSM-IV* publication, information on AS (aside from diagnostic criteria) was limited. Among associated features of AS, the *DSM-IV-TR* mentions variable cognitive functioning, mild motor clumsiness or awkwardness, overactive behavior, inattention, and an association with secondary emotional difficulties, such as depression. The revisions specifically state that although no clinically significant language delays may be present, the more subtle features of social communication may indeed be impaired. In addition, the *DSM-IV-TR* (APA, 2000) specifies that rather than “social and emotional indifference” (p. 80), which is often viewed in autism, the individual with AS displays an “eccentric and one-sided approach to others” (p. 80; such as pursuing a conversational topic regardless of the reactions of others). Furthermore, the repetitive and restricted behaviors, which characterize autism as well, are described as “primarily manifest in the development of encompassing preoccupations about a circumscribed topic or interest, about which the individual can amass a great deal of facts and information” (p. 80). It is important to note that communication difficulties are also described, related to topic preoccupation, excessive verbosity, limited self-monitoring, failure to use appropriate conversational conventions, and failure to use and respond to nonverbal cues. The *DSM-IV-TR* points out that although early adaptive behavior, language, and cognitive development are within normal limits prior to age 3, caregivers may have noted unusual behaviors earlier in development. These revisions, then, suggest that individuals with AS do indeed present with unusual behaviors early in development and in fact may also present with language abnormalities. In sum, then, the most recent *DSM-IV-TR* explanations serve to highlight the overlap between these conditions.

Cognitive Differences

Given the substantial symptom overlap between AS and autism, it is not surprising that several recent studies question whether these disorders are truly separable. Although the majority of persons with autism are also debilitated by mental retardation, individuals with high-functioning autism have a normal IQ and may be indistinguishable from those with AS. When comparisons on intellectual, motor, visual-spatial, and executive function tasks failed to reveal group differences in their recent empirical study, Miller and Ozonoff (2000) concluded that Asperger syndrome “may simply be high-IQ autism” (p. 227). Ozonoff, South, and Miller, (2000) compared children with HFA and AS on cognitive function, current presentation, and early history, reporting that the fundamental differences in symptom presentation were best described as a matter of symptom severity. A review of their specific findings suggests that, certainly, there may be subtle differences in presentation. For example, the group with AS was more likely to display circumscribed interests, while the HFA group demonstrated greater insistence on sameness. However, these may be differences of degree. Ozonoff et al. concluded that AS is on the same spectrum as autism but that “it remains to be seen whether the magnitude and type of group differences found in the current study are sufficient to provide external validation for the Asperger Syndrome label” (p. 43).

Although one of the key diagnostic distinctions between these conditions is early language development, Mayes, Calhoun, and Crites (2001) provided empirical evidence that presence or absence of speech delay is irrelevant to later presentation of autistic symptoms, language, and ability profile among high-functioning children diagnosed with either autism or AS. With respect to the use of early language development as a distinction between the conditions, empirical studies do not use consistent criteria for separating individuals with AS from those with HFA prior to making comparisons. For example, the current gold standard in

autism spectrum disorder diagnoses, the *Autism Diagnostic Interview-Revised* (ADI-R; Lord, Rutter, & LeCouteur, 1994), does not require delayed or disordered language development as a criterion for a diagnosis of autism. Therefore, it is common to find individuals who meet criteria for a diagnosis of HFA without language delay. At best, then, we currently have no clear distinction between a high-functioning person with autism and one with AS. It seems that the differences between autism and AS are severity dependent, with symptom presentation most similar between individuals with AS and HFA.

For this reason, many researchers are advocating the use of one broad label of "autism spectrum disorder" (ASD) to apply to both categories. Wing (1998) proposed that the spectrum of autistic disorders is characterized by impairments in three categories: social interaction, communication, and imagination, with rigid/repetitive activity patterns. Each category could range with regard to degree of impairment as well as common associated features, such as sensory abnormalities and language deviance, potentially yielding numerous manifestations of the disorder ranging from subtle to marked to severe.

Szatmari, Tuff, Finlayson, and Bartolucci (1990) posed two important questions with regard to neurocognitive abilities in AS and HFA. These researchers asked whether the two disorders have similar or different cognitive profiles and whether the core deficits involved are in language or problem solving. Although the external validity of AS apart from HFA continues to be uncertain, at best, examining and comparing neurocognitive patterns in HFA and AS may prove useful in enhancing our understanding of social and behavioral symptoms along the autism spectrum, as well as in sorting out potential areas of overlap or demarcation. In the search to understand the abnormal behavior presentation associated with autism, a number of cognitive deficits have recently been defined. Within each of these developments, comparisons have been made between individuals with AS and HFA

to determine whether differences were present.

Metarepresentation

One contribution of major importance to the understanding of atypical social behavior in autism was the identification of perspective-taking deficits, or theory-of-mind deficits, as the basis for the distinctive quality of social behavior observed in autism. The key feature of social deficits in autism is the lack of reciprocity: an inability to appreciate that others think, feel, and view the world in a manner different from oneself. Lack of interest in the ideas or feelings of others, a key feature of autism spectrum disorders, would clearly stem from such a deficit. In addition, poor capacity to read social cues, use and respond to communicative gestures, and establish peer relationships would potentially stem from such a deficit.

The cognitive view of autistic spectrum disorders, as described by Frith (1991), holds that the ability to represent mental states, such as thoughts, feelings, or beliefs, is impaired among individuals with autism. Indeed, several empirical studies conducted in the late 1980s and early 1990s provided strong evidence of impaired information processing in the ability to recognize that others could believe something that is not, in fact, true (Baron-Cohen, 1995; Baron-Cohen, Leslie, & Frith, 1985; Leslie, 1987). By the age of 3 or 4 years, the typically developing individual is able to rely on representations of mental states, such as believing, thinking, knowing, and pretending. This deficit in the capacity to represent the mental states of others has been referred to as a "metarepresentational" deficit.

Over the past decade, based on observations that the ability to attribute mental states to others was absent or impaired in persons with autism spectrum disorders, a variety of experimental tasks were devised to document the perspective-taking deficit. Numerous studies confirmed the failure of individuals with autism to pass false-belief tasks. For example, on the classic "Sally/Ann" task, a

puppet show is presented to the participant in which a doll named Sally places her marble into a basket and goes out to play. While she is away, a second doll, Ann, moves Sally's marble into a box. The question is posed to the child: When Sally comes back, where will she look for her marble? Although typical 4-year-olds are able to pass this task easily, knowing that Sally will look where she believes her marble to be—where she left it—rather than where it really is, adolescents with autism assumed that Sally would know what *they* knew—that she would look in the box. This is a very well replicated phenomenon in autism; persons with autism fail this and a variety of tasks designed to assess ability to understand false belief (Baron-Cohen, 1995; Ozonoff, Pennington, & Rogers, 1991; Perner, Frith, Leslie, & Leekum, 1989), deception (Sodian & Frith, 1992), and intention and desire (Phillips, Baron-Cohen, & Rutter, 1995).

In the course of these empirical studies, some important differences between participants with AS and those with autism have been observed. Specifically, participants with AS have been found to perform better on false-belief tasks than those with high-functioning autism (Bowler, 1992; Ozonoff, Rogers, & Pennington, 1991). As a result, Ozonoff et al. suggested that AS may be separable from autism with regard to cognitive profile and empathic ability. In fact, Asperger (1944/1991) also stated that his original cases often demonstrated a remarkable ability to "be a judge of character" (p. 73). Using a younger and more verbally capable sample, however, Dahlgren and Trillingsgaard (1996) found no differences between children with HFA versus AS on the same theory-of-mind tasks. In fact, both groups performed almost as well as a sample of normally developing children. In this case, language competence was thought to explain proficiency on these tasks. Within the normal range of intelligence, it was concluded, children with AS and those with HFA perform similarly, and not as poorly, on false-belief tasks.

An explanation for these results was provided by Baron-Cohen, O'Riordan,

Stone, Jones, & Plaisted (1999), who pointed out that the sorts of tasks described above are relatively simple. Indeed, these simple tasks can be viewed as assessing the earliest developing theory-of-mind skills, usually achieved between the ages of 4 and 6 years. However, social cognition continues to develop beyond those years. Fortunately, tests of more advanced theory-of-mind skills were also continuing to be developed. In one such study, children with AS and HFA who were able to pass false-belief tasks of varying difficulty showed impairments in the detection of faux pas, or social blunders. Using stories in which "a speaker says something without considering if the listener might not want to hear or know, and which typically has negative consequences which the speaker never intended," participants with AS and HFA found these items to be significantly more difficult than control participants (Baron-Cohen et al., 1999; p. 408). In another study, Jolliffe and Baron-Cohen (1999) presented a series of naturalistic theory-of-mind stories, the Strange Stories test (Happé, 1994), to groups of normally intelligent individuals with AS, HFA, or typical development. Acceptable performance on these tasks requires that the participant be able to comprehend a series of everyday situations in which people say things they do not really mean, and provide justification for the characters in the stories, such as ascribing the motivation of sparing the feelings of another by pretending to like a gift. These tasks require the recognition of sarcasm, irony, and pretense. Interestingly, the autism and Asperger groups had difficulty providing context-appropriate interpretations, instead tending to become overly focused on the statement in isolation. For example, the participants with autism and AS misattributed statements of pretense as "a joke" and sarcasm as pretense. These mistakes did not occur among the typical participants. In sum, then, a deficit in theory of mind, or perspective-taking ability, appears to be present to some degree among individuals with autism. This deficit may explain their unusual social behaviors. However, it is also important to note that

perspective-taking skills seem to improve with increasing language competence, perhaps due to the use of verbal compensatory strategies to solve such problems, albeit via a circuitous route. Yet, the last finding, regarding the inability to integrate information within a context, may also be related to the behavioral features of autism spectrum disorders.

Complex Information Processing

The particular pattern of responding in which participants with autism spectrum disorders failed to integrate context into their interpretations pointed to another realm of hypothesized cognitive deficit in autism spectrum disorders: abstract reasoning. *Abstract reasoning* can be defined as the capacity for generating mental representations, thereby permitting the development of novel thoughts and behaviors, hypothetical thinking, and flexible interaction with others and the environment. A capacity for abstract reasoning also involves the propensity toward meaning making, or organizing simultaneous events or parts into a meaningful whole. Rather than synthesizing aspects of a situation into a complete picture, individuals with autism spectrum disorders tend to focus on parts, regardless of their relevance, and either fail to appreciate higher order meaning or disregard it altogether.

Minshew, Goldstein, and Siegel (1997) referred to this as a pattern of deficits in higher order cognitive abilities, with a selective deficiency in complex information processing. These authors suggested that individuals with autism have a heightened awareness of details, coupled with impoverished capacity for the active organization of information. Under these conditions, it is not surprising that reasoning and problem-solving skills are severely affected. Such coexisting deficits and strengths would make it difficult to process complex information. Given the inherent unpredictability and complexity of social information, it is little wonder that the individual with autism finds it so difficult to interpret.

An abstract reasoning deficit has long been viewed as a fundamental cognitive impairment in autism and has been documented across the spectrum of the disorder. For example, Rutter (1978) observed that among individuals with autism, lower general intellectual ability was related to sharp decreases in abstraction ability. There is clear evidence of a universally present deficit in abstraction abilities in individuals with autism, as well as a range of severity in its expression (Minshew, Goldstein, Muenz, & Payton, 1992; Prior & Hoffman, 1990; Rumsey, 1985; Schneider & Asarnow, 1987; Szatmari et al., 1990). Recently, a dissociation was found between concept identification, or rule learning, and concept formation, or complete understanding of concepts and generation of novel ideas among participants with HFA (Minshew, Meyer, & Goldstein, in press). Minshew et al. argued that deficits in concept formation and the inflexibility resulting from an incomplete understanding of concepts also provide a potential cognitive explanation for a variety of symptoms on the autism spectrum, including the inability to generalize learned concepts to other situations, consider context in applying a concept, and cope with novel situations and problems for which rules are not known. Deficient concept formation may also explain these individuals' narrow ranges of interests and their focus on details as the result of an inability to organize information around conceptual themes.

Frith (1991) also described this phenomenon, stating that among persons with autism, low-level processing is intact and high-level or conceptual integration ability impaired. While typically developing individuals have a preference for constructing meaning by integrating information into context, individuals affected by autism spectrum disorders may tend to focus narrowly on details without seeing the gestalt, or the larger picture. This deficit in conceptual integration skill explains the success of individuals with HFA on block design and embedded-figures tests, which require the participant to ignore context in favor of details (Jolliffe & Baron-Cohen, 1997; Shah &

Frith, 1993), coupled with impairment on object integration and scenic tasks (Jolliffe & Baron-Cohen, 2001); concept formation tasks such as 20 Questions, Absurdities, and Object Sorting (Minschew, Meyer, & Goldstein, in press); and prototype formation (Klinger & Dawson, 2001), all of which require the participant to synthesize various aspects of a presented stimuli simultaneously to form a meaningful whole. In fact, recent evidence regarding the abstraction deficit in autism suggests that ability to categorize new information by forming prototypes or concepts is impaired. This may explain the need for rote practice, the tendency for inflexible behavior, and the poor social functioning of individuals with autism in social situations, which tend to be highly variable and unpredictable. In addition, this may be linked to the tendency of individuals with autism spectrum disorders to rely on individual facial features rather than processing the face as a whole—in other words, processing faces piecemeal as if they were objects (Hobson, Ouston, & Lee, 1988).

Abstract reasoning deficits also help explain the findings of extensive research on the executive dysfunction hypothesis, namely, that individuals along the autism spectrum have difficulty with planning and organizing, shifting cognitive set between two representations, monitoring performance and making use of feedback, and generating novel ideas. Executive dysfunction was originally viewed as an abstraction deficit characterized by poor capacity to disengage from the immediate external context but, instead, guiding action via internal mental representations (Dennis, 1991). This definition was subsequently applied to autism as *cognitive inflexibility*, or the impaired capacity to shift between two mental representations (Ozonoff, Pennington, & Rogers, 1991). Indeed, executive dysfunction under the present definition is pervasive among individuals with autism spectrum disorders. However, recent empirical evidence suggests that the highest functioning individuals with autism are able to shift set flexibly when provided the rules by the experimenter or situation. Yet, when task demands were

changed to include assessment of capacity to form a concept under novel conditions, individuals with HFA were found to exhibit a significant impairment in cognitive flexibility (Minschew et al., 1992). Minschew and colleagues (in press) stated that among the highest functioning individuals with autism, the deficit in concept formation results in cognitive inflexibility and the inability to spontaneously form schemata, or paradigms that organize information. This is consistent with impressions that the capacity for creativity, or “the generation, manipulation, and transformation of images to generate novel representations,” is impoverished among individuals with HFA (Craig & Baron-Cohen, 1999, p. 319).

Thus, among individuals with HFA, the abilities to integrate information into context and generate new ideas or concepts are impaired. In other words, the tendency to seek out the gestalt, impress meaning upon, or use context in processing experiences is diminished, yielding a bottom-up, piecemeal processing style that fails to take context into account. This weakness may help explain poor theory of mind, as it is probably not natural for the individual with HFA to generate hypothetical ideas regarding what others may be thinking or feeling in context. In addition, pragmatic language deficits would likely be evident when a communicative partner fails to account for context, such as what the speaker knows or does not know, cares to hear, or may intend during a conversation. This tendency toward part-whole processing and abstract reasoning deficits that range from an inability to identify concepts and learn rules to limited understanding of concepts (which causes inflexibility in their application) to poor concept or strategy formation has been documented among the highest functioning individuals with autism and most likely applies to individuals with AS, although a direct comparison study has not yet been published.

Several studies have begun to directly compare individuals with AS and those with HFA on a variety of measures in the abstraction and social-cognitive domains.

For example, Craig and Baron-Cohen (1999) conducted a set of studies revealing impoverished creativity among children with AS and autism. Both groups generated fewer novel changes to objects, and when they did generate ideas, these were reality-based rather than imaginative. A deficit in pretense, imagination, and creativity, possibly related to capacity for abstraction, was equally evident among participants with AS and HFA. This set of studies suggested, however, that the abstraction deficit may have existed in both groups.

Joint Attention

Another important neurocognitive domain that has contributed to our understanding of autism spectrum disorders is nonverbal communication skills, specifically, joint attention. Joint attention, or the capacity to share attention between other individuals and objects, is a capacity that develops during the first year of life. Joint-attention deficits are present among individuals with autism prior to theory-of-mind and abstraction deficits, as they have been observed during infancy and prior to the onset of the other, later developing abilities (Mundy & Markus, 1997; Mundy & Sigman, 1989). Joint-attention deficits are the earliest indicators of an autism spectrum disorder. For example, individuals with autism spectrum disorders use gaze abnormally, fail to monitor the gaze of others to share experiences, point to make requests but not typically to share attention, and fail to monitor the gaze of others to infer intended reference in conversation. Although the relationship between a meta-representational deficit—such as in theory of mind or abstraction—and joint attention is as yet unclear, Mundy and Sigman (1989) suggested that these deficits could both reasonably reflect “difficulty with abstracting contingencies in social interaction” (p. 180). Deficits in joint attention may help explain such nonverbal communication abnormalities as the abnormal gaze (aversion or staring), failure to use conventional gestures, and inappropriate or stilted facial expres-

sion seen in individuals with both AS and HFA.

Abnormalities in the use of nonverbal communication, such as gaze, are pervasive among individuals along the autism spectrum. As mentioned earlier, individuals with ASD tend to focus on details of faces, processing them as if they were objects (Hobson et al., 1988; Schultze et al., 2000). In addition, they focus on the mouth region of the face, rather than the eyes, to ascertain emotion (Klin, Jones, Schultz, Volkmar, & Cohen, in press). Using only photographs of the eyes, participants with HFA and AS were impaired at recognizing complex mental states when compared with nondisabled adults (Baron-Cohen, Wheelwright, & Jolliffe, 1997), suggesting that using information from the eye region as cues to the mental state of another person was a poorly developed skill in this group.

Clinical experience suggests that from a very early age, the typically developing child actively searches for ways to organize information to make sense of his or her environment. After finding an empirical relation between theory of mind and central coherence, Jarrold, Butler, Cottington, and Jimenez (2000) suggested that the drive to integrate information in a meaningful way is likely a developmental precursor to joint-attention and theory-of-mind skills. The capacity to abstract contingencies across modalities begins in infancy, and perhaps some of the first experience doing so comes about through social interaction. Thus, the capacity to co-create meaning, understand information in a relational rather than concrete sense, use sets of related abstract notions, resolve ambiguities, and think in degrees are all processes that may be affected by a disorder that targets complex information processing.

Summary

Many of the studies looking specifically at each of the above domains provided an opportunity for specific comparisons between individuals with AS and those with HFA, and the results suggested quantitative differences based on severity and in-

tellectual ability, rather than qualitative differences. The domains mentioned earlier have also been explored in a variety of combinations. Research has begun to demonstrate impaired social communicative skills in individuals with AS, potentially linked to the same deficits as found in persons with autism. Ellis, Ellis, Fraser, and Deb (1994) studied a small sample of young people with AS and found a tendency toward impaired social judgments. Given that the participants with AS were often unable to answer questions about the appropriateness of social behaviors and often guessed at their responses, these authors suggested links to theory of mind as well as difficulties with forming abstract representations of ideas.

In another recent study, participants with AS revealed an interesting processing pattern when presented with facial-emotion photos paired with a written word; they exhibited a bias for stating the written word, rather than the emotion displayed, when the two did not correspond (Grossman, Klin, Carter, & Volkmar, 2000). The participants did not show a specific deficit in recognition of facial affect, and this suggests they are capable of perceiving and comprehending basic emotions. However, the authors argued that they are capable of this "because their thinking is analytic and verbally mediated rather than holistic and intuitive as it would be in individuals without AS." This is consistent with Frith's (1989) argument that the theory-of-mind deficit is less severe among individuals with AS than among individuals with autism because it develops late and atypically, and the former apply it haltingly in the real world, but it is nevertheless present enough to warrant a diagnosis of a mild autism subtype.

Many researchers have argued that the diagnostic validity of AS separable from autism ought to be revealed in patterns of deficit on psychological testing. Szatmari et al. (1990) directly compared individuals with AS and HFA on neurocognitive measures and found that participants with HFA differed from those with AS on a grooved pegboard test (visual-motor planning) and the *Wisconsin Card Sorting Test* (cognitive flexibil-

ity). However, these differences were reported to be minor. Thus, when the AS and HFA groups were combined and compared with other control groups, the children on the autism spectrum (regardless of AS vs. HFA diagnosis) showed outstanding deficits in motor coordination, higher order nonverbal problem solving, and language comprehension. In 1997, Ehlers and colleagues conducted a comparative study of cognitive profiles among children with AS and HFA and discovered that the group with AS showed poorer results on nonverbal visual-motor tasks (Object Assembly and Coding), scored better on a number of verbal tasks (Information, Similarities, Comprehension, and Vocabulary), and performed more poorly on arithmetic than those with autism. Participants with autism demonstrated strength on the Block Design task. Therefore, it was observed that the groups may be differentiated by better verbal ability in the AS group and better visuospatial function in the HFA group. These authors suggested that the AS group may not be as severely impaired in capacity for abstraction as those with autism. Again, this points to differences in degree.

Miller and Ozonoff (2000) conducted another empirical study to investigate the external validity of AS from the perspective of neuropsychology. Although participants with AS had significantly higher verbal and full scale IQ scores, larger verbal and performance IQ discrepancies, and better visual-perceptual skills than the autism group, these differences were diminished once the two groups were matched on intellectual ability. At that point, a trend toward poorer fine-motor performance was found in the AS group, but performance on other cognitive measures, including executive function, was similar. Once again, this speaks to the importance of matching the groups on cognitive ability in order to ascertain whether differences between the groups are apparent as a function of cognitive ability and severity of the disorder, rather than indicative of two separate disorders. It should also be noted that other studies have performed direct comparisons of fine and gross motor skills in AS and

HFA and found similar impairments relative to normally developing control groups (Ghaziuddin, Butler, Tsai, & Ghaziuddin, 1994; Szatmari, Bartolucci, & Bremner, 1989). Given that motor deficits can be found in HFA as well as in AS, this diagnostic feature also does not consistently differentiate the two groups (Ghaziuddin et al., 1994; Ghaziuddin, Tsai, & Ghaziuddin, 1992).

In sum, studies to date indicate that the two disorders are relatively indistinguishable on the basis of cognitive measures, with a few minor exceptions, which may be attributable to diagnostic severity in one or another domain. In addition, it seems that individuals with AS occasionally perform better on tasks assessing theory of mind and abstract reasoning—to the extent that these skills have been compared systematically. And yet, this better performance can easily be attributed to higher intellectual ability and verbal compensatory strategies. Both AS and HFA appear to share metarepresentational, abstract reasoning, and nonverbal communication difficulties that are providing the foundations for a cognitive explanation of the symptom profile in ASD.

Treatment Implications

Gutstein (2001) referred to the tendency of the child with autism to seek out predictability as an end in itself, avoiding the processes of variability and change in social encounters that must be experienced to bring true experience-sharing and enjoyment. Thus, individuals on the autism spectrum tend to interact with others as if they were objects, for instrumental rather than social reasons. Abnormal social behavior in HFA and AS ranges from aloof and indifferent to others to intrusive and odd. However, the main quality to be observed is a lack of reciprocity in social interactions. Due to profound deficits in nonverbal communication, abstract reasoning, and perspective taking, the student with AS will exhibit severe difficulties in social interactions. They may have few or no friends, in spite of a

clear desire to interact with others. The student may become a victim of social harassment, bullying, or outright rejection by peers. Many children and adolescents with AS are aware of social rejection and develop anxiety with regard to social interaction, which serves to complicate their handicaps.

With regard to developing social competence, the *Relationship Development Intervention* (Gutstein, 2001) provided a programmatic intervention to teach experience-sharing as an end in itself, and at the same time target ability to think from multiple perspectives, process information in gradations rather than in black and white (or concrete) thinking, appreciate and seek out novelty or variety in experiences, and develop greater imagination and creativity. This intervention targets deficits in social reciprocity, communication, and inflexibility. The key to this intervention is targeting the capacity for social relatedness, which is often delayed to an infant or toddler level, even among very cognitively capable individuals on the autism spectrum. By providing the motivation to share experience, which can be accomplished only through the balance of predictability and novelty, symptoms of rigidity, need for sameness, and impaired communication are also addressed. Indeed, it is through the co-creation of shared experience that individuals with autism and AS are learning to play, develop symbolic competence, and appreciate multiple perspectives.

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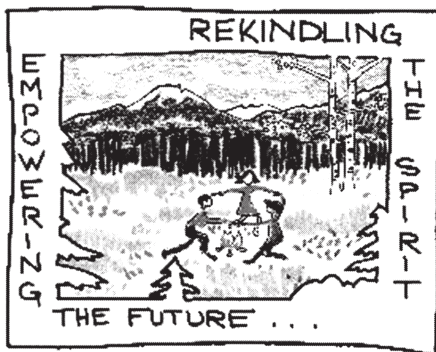
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