CHAPTER 6

School-Age Children With ASD

NIRIT BAUMINGER-ZVIELY

INTRODUCTION

The transition to school from the early childhood years of toddlerhood and preschool poses new social and cognitive-academic challenges for children with autism spectrum disorders (ASD). The preschool setting offers a relatively predictable, manageable, and protective social environment that includes few teachers and peers, with a few key adults addressing the child's needs, whereas the school setting is a significantly more complex and demanding social and academic environment characterized by frequent changes in daily routine and an abundance of interactions with various adults and peers (e.g., Fabes, Martin, & Hanish, 2009). In typical development (TYP), the peer group gains special importance in the school years. Social behaviors gradually become less straightforward, thereby demanding much more effort to decipher and perform. In particular, the spontaneous authentic behaviors and emotions that peers exhibit at younger ages are gradually replaced by mediated or inhibited behaviors and hidden emotions, requiring children to acquire deeper social and emotional understanding and knowledge in order to comprehend interpersonal situations and participate in them effectively (e.g., Fabes et al., 2009). In a like manner, more advanced language and pragmatic skills are required to take part in and make sense of peer behaviors. Adding to this, executive function capabilities such as cognitive flexibility, planning, and problem-solving skills are all necessary to cope efficiently with both the social and academic demands of school (e.g., Fabes et al., 2009). In light of the core deficits found in children with ASD in these areas (e.g., peer interaction, social communication, social cognition, executive functioning), the social-emotional and cognitive-academic demands of school can pose serious difficulties.

Indeed, Staar, Szatmari, Bryson, and Zwaigenbaum (2003) traced an increase in difficulties in the social domain (based on the Autism Diagnostic Interview; Rutter, Le Couteur, & Lord, 2003) in school-age children with ASD (age 6–8 years) compared to preschoolers (age 4–6 years), and an even more robust increase in social difficulties for higher functioning children on the spectrum (Asperger syndrome). Both school-age groups

Handbook of Autism and Pervasive Developmental Disorders, Fourth Edition.
Edited by Fred R. Volkmar, Sally J. Rogers, Rhea Paul, and Kevin A. Pelphrey.
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showed greater impairment than their younger counterparts—in their range and appropriateness of facial expressions and in their greeting behaviors. The older children with Asperger also showed a decline with age in their level of sharing behaviors, appropriate social responses, and vocal expressions. This overall decline in social functioning measures may reflect these children's increasing difficulty in meeting the greater social expectations for the early school years due to their sociocognitive and sociocommunicative skill deficits.

Two findings of Klin et al. (2007) for cognitively high-functioning children with ASD (HFASD; i.e., IQ >70) are of particular interest in this regard. First, these researchers demonstrated that in two independent samples of school-age children and adolescents with HFASD (7–18 years), socialization scores based on the Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984) were two to three standard deviations below IQ, and a similar but smaller gap between IQ and adaptive functioning emerged for the VABS communication domain (one to two standard deviations). Second, age was negatively linked with both VABS domains, suggesting that the gap increases with age between individuals with HFASD and their typical peers, both in communicative and social abilities. This suggests that older children and adolescents with ASD become increasingly more impaired relative to their age-mates with TYP.

Links between the social and academic domains were found in school-age children with HFASD (Estes, Rivera, Bryan, Cali, & Dawson, 2011). Children with higher social skills at age 6 years demonstrated higher levels of academic achievement, specifically in word reading, at age 9 years. However, 60% of the sample showed lower academic achievement than would be predicted based solely on their intellectual ability, indicating the complicating effects of the autism-related deficits and/or the presence of additional specific disabilities in academic domains. Also, Montes and Halterman's (2006) nationwide survey of U.S. children from kindergarten (age 5–6 years) through eighth grade (age 13–14 years) revealed that children with ASD and children without ASD were equally likely to attend public schools, but the former were significantly less likely to receive A and B grades compared to the latter (43% vs. 74%, respectively). Furthermore, children with ASD were more likely to carry multiple diagnoses compared to children without ASD, mainly learning disabilities (67% vs. 8%), attention deficit disorders (54% vs. 7%), and speech impairments (58% vs. 4%). Psychiatric comorbidities like depression and anxiety were found to increase in frequency in the school years for children with ASD, comprising 5.6% of ages 4–6 years, 48.4% of ages 7–10 years, and 46.0% of ages 11–17 years (McPheeter, Davis, Navarre, & Scott, 2011). Children with HFASD seemed to be at a greater risk for these two psychiatric disorders than children with lower cognitive functioning on the autism spectrum (LFA; IQ <70), probably because those with stronger cognitive abilities understood and were distressed by their deficits (Mayes, Calhoun, Murray, Ahuja, & Smith, 2011). Perhaps higher functioning children are easier to diagnose because they are able to report about their psychiatric symptoms.

However, it is important to note that despite the overall significant difficulties elicited by the transition to school and its heightened social and academic demands, areas of growth were also identified during middle childhood for children with ASD, especially in cognitive and linguistic functioning. For example, L. M. Turner, Stone, Pozdol, and Coonrod (2006) found that 9-year-old children with ASD who were first diagnosed before age 3 ($n = 25$) demonstrated improvements over time in cognitive and language skills. Cognitive scores increased for most children (68% showed an increase of 15 points); at age 2 years 84% of the children showed significant cognitive delay (two or more standard deviations below the mean), whereas at age 9 half the children revealed average to higher cognitive scores. Likewise, at age 2 years 60% of the children showed very low expressive language capabilities, whereas at age 9 years 88% revealed at least some functional language; a substantial minority (32%) could engage in conversations with an unfamiliar examiner (using the Autism

Diagnostic Observation Schedule [ADOS]; Lord et al., 2000); and only 12% were nonverbal.

In this chapter, I describe areas of ability and disability among school-age children with ASD, referring to ages 6–12 years but at times due to topic's importance also to a wider age range including younger children and adolescents (on the condition that the samples' mean chronological age [CA] was within the 6- to 12-year range). After briefly providing general information about ASD prevalence in the school years, this chapter will discuss the disorder's core deficits and abilities that hold important implications for the social and academic functioning of children with ASD, in the areas of social functioning (sociocognitive capabilities and sociocommunicative skills), repetitive behaviors, and cognitive-academic characteristics. The chapter will conclude with future directions for research.

SCHOOL-AGE ASD PREVALENCE AND GENERAL CHARACTERISTICS

Surveys of the U.S. population of school-age children with ASD (at age 8) have shown a significant 78% increase in recent years, from 2002 to 2008, growing from 1:150 to 1:88 (Centers for Disease Control and Prevention [CDC], 2012). A careful look at the ASD prevalence rates for boys (1:54 in the United States, 1:66 in the United Kingdom) and for girls (1:252 in the United States; 1:208 in the United Kingdom) emphasizes the need to plan services to meet the needs of almost 2% of the school-age population (CDC, 2012 in the United States; Baron-Cohen et al., 2009 in the United Kingdom). With regard to cognitive functioning in school-age children with ASD, 38% show an intellectual deficit (IQ <70, LFA), 24% fall in the borderline range of intellectual abilities (IQ = 71–85); 62% do not reveal an intellectual deficit (IQ >70; HFASD); and 38% have an IQ over 85 (CDC, 2012). The boy-to-girl ratio differs somewhat in ASD groups with different cognitive functioning levels, ranging from 6:1 to 15:1 for children with HFASD (IQ >70) and ranging from 2:1 to 6.5:1 for low-functioning (IQ <70) children (Johnson & Myers, 2007).

In a recent U.S. national survey examining treatment services for school-age children with ASD (ages 6–11 years), Pringle, Colpe, Blumberg, Avila, and Kogan (2012) found that most children received social skills training (60.1%) and speech or language therapy (68.4%), followed by 51.3% receiving occupational therapy and 40.2% receiving behavioral intervention. Furthermore, more than half of school-age children and adolescents with ASD use psychotropic medications (Pringle et al., 2012). To sum up, prevalence studies demonstrate that school-age children with ASD form a substantial and sizable group of children with varying degrees of cognitive functioning, who merit consideration of their specific needs based on their abilities and disabilities, as detailed next.

SOCIAL FUNCTIONING

The core social deficits in autism pertain to these children's sociocognitive and their sociocommunicative capabilities.

Sociocognitive Skills

Sociocognitive capabilities such as social attention, social-emotional knowledge, and theory of mind (ToM) abilities establish the foundation for peer relations. This section will review the atypical development of sociocognitive skills that characterizes school-age children with ASD (e.g., see extensive review in Bauminger-Zviely, 2013).

Social Attention

Social interaction starts with children's ability to be attuned to others' faces, read their expressions, listen to their verbalizations, observe their body gestures, and integrate all these stimuli into a meaningful interaction. The social attention processes necessary at different developmental stages are hampered in ASD (e.g., as shown by Elison, Sasson, Turner-Brown, Dichter, & Bodfish, 2012,

for a large age range of 2.60–17.25 years). Elison et al.'s research suggested that the essence of these children's difficulty in social attention lies in their disproportional visual attention to nonsocial objects (e.g., trains, vehicle, road signs) relative to social stimuli (e.g., happy facial expression of males and females of various ages). Several researchers also found reduced eye gaze toward human faces in ASD versus TYP, for example, when Riby and Hancock (2009) presented children (CA = 12.4 years) with faces that were artificially embedded into pictures of natural scenes (e.g., harbor with boats, mountains behind a village) or were inserted into scrambled pictures containing objects. Children with TYP (CA = 10.4 years) were found to pay more attention to human faces when these faces were a distracter that slowed down their given task (searching for a butterfly from among human and nonhuman pictures), but children with ASD (CA = 12.11 years) did not reveal this preference for human faces (Riby, Brown, Jones, & Hanley, 2012).

It seems that level of cognitive functioning plays an important role in social attention capabilities. In Riby and Hancock's (2009) study, children with lower cognitive functioning directed fewer gazes toward faces than children with higher cognitive functioning. Interestingly, Riby et al. (2012) found that children with ASD who had higher cognitive functioning showed higher degrees of face distraction than their lower functioning counterparts, resembling the distractibility of the children with TYP. Studies focusing on HFASD indicate other subtle group differences. For example, Wilson, Brock, and Palermo's (2010) study of visual fixation using an eye-tracking procedure found that children with HFASD resembled their peers with TYP (CA = 10.13 years) in their strong bias to orient toward social stimuli (people) before orienting toward nonsocial stimuli (pelican, ice cream van). However, the children with TYP were quicker to fixate on the people and fixated their look primarily on people and secondarily on objects throughout the trial, whereas children with HFASD fixated equally between people and objects, and overall they looked less at faces compared with the TYP group.

Interestingly, attention capabilities may differ according to the social stimulus's complexity. Indeed, van der Geest, Kemner, Camfferman, Verbaten, and van Engeland (2002) and van der Geest, Kemner, Verbaten, and van Engeland (2002) reported no impairment in attention focused on static facial or emotional stimuli among children with HFASD (CA = 10.6 years) compared to age-matched peers with TYP. In the van der Geest, Kemner, Camfferman, et al. (2002) study, the two groups revealed similar gaze behaviors when viewing cartoon-like static scenes that included human figures. In the van der Geest, Kemner, Verbaten, et al. (2002) study, the HFASD group resembled the TYP group when viewing still photos of human faces displaying emotional states. In contrast, Evers, Noens, Steyaert, and Wagemans (2011) found that children with HFASD demonstrated a specific visual perception difficulty compared to children with TYP (CA = 7–11 years) when the task required attention toward a complex social static stimuli rather than a simple one (matching a larger versus smaller number of human faces) or attention toward dynamic (animated) human faces expressing emotions versus static human faces. Other research that included older children with HFASD (e.g., adolescents and young adults) reported greater difficulty in visually fixating on dynamic social interactions versus fixating on still photographs of such interactions, as well as less fixation on the eye region than TYP (e.g., Klin, Jones, Schultz, Volkmar, & Cohen, 2002).

In sum, social attention processes may be influenced by level of cognitive functioning and by the complexity of stimuli, but overall these processes are impaired in school-age children with ASD. This deficit may hold significance for other important aspects of social cognition, such as how children make sense of others' mental states, as described next.

ToM

Deficits in mentalizing other minds (ToM) in terms of others' thoughts, feelings, desires, and intentions have been suggested as a major characteristic of ASD and as an explanatory mechanism for these

children's difficulties in social functioning (see review in Baron-Cohen, 2000). Various verbal and nonverbal tasks and paradigms have been applied to assess ToM in school-age children with ASD. For example, the false-belief (FB) paradigm is frequently used to assess children's (true) belief versus their awareness of someone else's different false belief (e.g., Bauminger & Kasari, 1999; Lind & Bowler, 2009; Matthews et al., 2012; Peterson, Garnett, Kelly, & Attwood, 2009; Peterson, Slaughter, & Paynter, 2007; White, Hill, Happé, & Frith, 2009). FB may refer to first-order attributions ("X believes that P") or second-order attributions ("X believes that Y believes that P"). Peterson et al. (2009) found associations between first-order laboratory measures of FB on misleading-appearance tasks (e.g., a box of crayons containing candy, a pen that looks like a carrot) and children's mindreading in everyday interactions and conversations. Children with ASD (CA = 9.61 years) who passed the FB task versus those who failed were better at applying mindreading in everyday interactions and conversation, but even those FB passers still functioned in everyday skills below younger children with TYP (CA = 6.06 years). In another study, Peterson et al. (2007) showed that first-order FB scores (unexpected-location tasks) contributed significantly, beyond age and verbal skills, to age-referenced social maturity (rated as group entry, self-assertion, peer leadership, interactive social play, coping with disruptive peers, tolerance, and sensitivity) in children with autism (CA = 8.02), Asperger (CA = 8.58), and TYP (CA = 8.33 and 4.68). Children with autism scored below both age-matched and younger children with TYP, in both ToM and social maturation. Children with Asperger performed better on ToM than children with autism, but showed a lower proportion of FB passers compared with TYP and were rated as socially immature by their teachers.

Lind and Bowler (2009) stressed the fact that, differently from children with TYP (CA = 10.50 years), school-age children with ASD (CA = 10.42 years, verbal mental age [VMA] = 6.77 years) use verbal compensatory mechanisms to solve first-order FB unexpected-location tasks. Using the second-order FB ice cream van story (Perner & Wimmer, 1985), Bauminger and Kasari (1999) also found that verbal and full IQ correlated with performance on the FB and justification questions, but only for the group with HFASD (CA = 10.74 years) and not for age-mates with TYP. Interestingly, group differences in this study emerged only for justifications' relevancy; children with HFASD gave more irrelevant or incorrect justifications when asked to provide explanation to the belief question, probably due to deficits in social understanding (Bauminger & Kasari, 1999). Lastly, Matthews et al. (2012) explained heterogeneity in first-order FB tasks by considering early experience in social interaction. He found that early onset ASD (CA = 9.47 years) had poorer FB capabilities than their younger counterparts with TYP (CA = 5.76 years) and regressive ASD (CA = 8.88 years), who fall in between early onset and TYP.

A number of researchers have implemented advanced ToM tasks for the more able (IQ > 70) school-age children with ASD. Happé's (1994) original strange stories (SSs) were developed to assess understanding of lies, white lies, double bluff, persuasion, and misunderstanding by explaining why a character says something that is not literally true, thereby attributing mental states like desires, beliefs, or intentions (e.g., Brent, Rios, Happé, & Charman, 2004). In a revised SS, White et al. (2009), used a control scenario without mental states (stories on nature) to assess whether the source of the difficulties lay in attributing mental states or in comprehending text. Another type of task was developed by Baron-Cohen, Wheelwright, Scahill, Lawson, and Spong (2001), the nonverbal Reading the Mind in the Eyes ToM task, which requires children to recognize emotional states from a person's eyes (e.g., Brent et al., 2004). A third popular paradigm involves attributing mental states to computerized, animated, interacting geometric triangular figures (e.g., Salter, Seigal, Claxton, Lawrence, & Skuse, 2008). Finally, Peterson, Wellman, and Slaughter, (2012) used an assessment based on a revision of Wellman and Liu's (2004) five-step ToM model

of increasingly complex skills, the steps of which include (1) diverse desires (different people want different things), (2) diverse beliefs (different people have contrasting, potentially true beliefs about the same thing), (3) knowledge access (not seeing leads to not knowing), (4) FB (standard first-order misleading-container task), and (5) hidden emotion (people can feel a different emotion from the one they display) and understanding of nonliteral communication such as sarcasm and irony.

Unsurprisingly, in all these various studies of advanced ToM, children with ASD performed more poorly than their age-mates with TYP overall. This included lower performance on the Eyes task (e.g., Brent et al., 2004), on the original SS mentalizing task—where children with ASD provided more inappropriate mental-state responses to explain characters' intentions (e.g., Brent et al., 2004); on the revised SS (White et al., 2009), mainly on the mentalizing stories; and on the revised developmental ToM scale (Peterson et al., 2012), with special difficulty in understanding nonliteral communication (sarcasm).

Interestingly, in Peterson et al. (2012), children with autism also showed an atypical developmental sequence of ToM development, in which FB was found to be harder than hidden emotion, rather than the opposite as found for children with TYP. With regard to children's ability to use mentalizing language (e.g., "surprising," "mocking," "seducing" to tap the intentions of animated interacting geometric triangles), Salter et al. (2008) found that children with HFASD (CA = 10.37 years) were comparable to age-mates with TYP, although the HFASD group's description of the event in the animation was significantly less appropriate, emphasizing lack of social understanding rather than difficulties in tapping the figures' intentions (mentalizing). In a like manner, Pexman et al. (2011) reported intact ability to mentalize about others' beliefs but poor social understanding of these beliefs' social function. Children with HFASD (CA = 10.96 years) were able to identify ironic speech—they understood that speakers who make ironic criticisms hold a belief that is different from their words and that the speaker's intent is to criticize—but as in Salter et al., (2008), children in Pexman et al. (2011) could not understand the broader social function of irony, such as the speaker's humorous intent. Thus, taking the findings altogether, ToM capabilities are not intact in school-age children with ASD, and difficulties in ToM are also accompanied by a deficit in broader social understanding, another sociocognitive deficit characterizing ASD, described next.

Social-Emotional Knowledge

In addition to being attuned to ongoing social interactions, children must also make interpretations of these interactions' social and emotional stimuli. Making sense of social and emotional behavior requires accurate processing of social information, a "bank of knowledge" about social norms and rules, and emotion recognition and understanding capabilities.

Crick and Dodge (1994) proposed a social information processing (SIP) model to explain the mental processes involved in understanding social interactions. This model includes six main stages: encoding social and emotional stimuli, interpreting the encoded stimuli, searching for possible social or emotional responses, evaluating them, and choosing the best social solution to be enacted. Few studies have examined the SIP model in school-age children with ASD. Meyer, Mundy, van Hecke, and Durocher (2006), for example, found that children with Asperger syndrome (CA = 10.1 years) made more encoding errors (added information that was not in the vignettes) and suggested more passive responses and fewer assertive responses in the solution elicitation stage than children with TYP (CA = 10.2 years). Similarly, differences in encoding also emerged in Embregts and van Nieuwenhuijzen (2009), where children with HFASD (CA = 12.54 years) focused more on negative information in the scenario than did children with TYP (CA = 10.54 years). Group differences also emerged on assertive responses at the evaluation stage, where children with HFASD evaluated assertive responses less positively and considered themselves less capable of acting assertively than did

the TYP group. As in the Meyer et al. study, both groups understood that aggressive and submissive responses were inadequate.

The encoding stage is affected mostly by the child's attentional focus, based on the aforementioned difficulties in social attention; therefore, lower performance at the encoding stage is not surprising. The difficulties these children revealed on response elicitation and evaluation seem to be related to their lower social understanding capabilities. Indeed, children with ASD also show difficulties in judging the social appropriateness of videotaped social behaviors. Loveland, Pearson, Tunali-Kotoski, Ortegon, and Gibbs (2001) exposed children ($M = 9.12$) to four types of video scenarios: verbally appropriate (e.g., admiring a picture that someone offers to show), nonverbally appropriate (e.g., cooperating in making a sandwich), verbally inappropriate (e.g., when introduced, saying, "Is your father dead?"), and nonverbally inappropriate (e.g., hitting someone). The ASD group was less accurate at identifying examples of inappropriate social behavior than their peers with TYP, particularly for verbal inappropriateness. However, this group difference did not emerge when identifying appropriate behavior. Also, the ASD group had more difficulty providing explanations for the inappropriateness of verbal social behaviors than of nonverbal ones. Nah and Poon (2011) presented similar results for a series of socially inappropriate events in a comic strip (i.e., putting a leg on a table in public to see what was causing an itch). No group differences emerged for rating socially inappropriate behaviors, but children with HFASD (CA = 10.40 years) exhibited a specific difficulty in providing justifications for their responses. They provided inappropriate, bizarre, or inadequate ("I don't know") justifications instead of appropriate social justifications that would reflect social awareness. These studies attest to a core deficit in social understanding and knowledge, even in the face of some implicit awareness of behavioral norms. Emotional understanding poses another area of difficulty for children with HFASD, due to their limited social-emotional awareness and ToM capabilities.

Emotional Understanding

Various emotional understanding capabilities were examined in school-age children with ASD, including the ability to tell about and understand one's own personal emotional experience (e.g., Bauminger, 2004; Bauminger & Kasari, 2000; Losh & Capps, 2006; Rieffe, Terwogt, & Kotronopoulou, 2007); the ability to identify and recognize emotions in others and in social situations (e.g., Golan, Baron-Cohen, & Golan, 2008; Heerey, Keltner, & Capps, 2003); and the ability to demonstrate higher order emotional knowledge such as the understanding of the multidimensionality of the emotional experience by acknowledging mixed and hidden emotions as well as by suggesting coping strategies for emotional regulation (e.g., Barbaro & Dissanayake, 2007; Bauminger, 2004; Begeer, Terwogt, Rieffe, Stegge, & Koot, 2007; Dennis, Lockyer, & Lazenby, 2000; Jaedicke, Storoschuk, & Lord, 1994; Rieffe et al., 2007; Rieffe, Terwogt, & Stockmann, 2000).

Access to *one's own* emotional experience is closely linked with children's ability for self-introspection and for recalling events pertaining to the self—two capabilities considered lacking in ASD (e.g., Losh & Capps, 2006; see also expansion on this issue in Chapter 14 of this volume). Children with ASD (CA = 10.3 years) demonstrate deficits in recalling personal incidents of negative basic emotions like sadness, fear, or anger (Rieffe et al., 2007). A specific difficulty emerged in Losh and Capps (2006) in the ability of children with ASD (CA = 7–13 years, $M = 11.1$) to provide personal narration of complex emotions, which was most pronounced for self-conscious social emotions like pride, embarrassment, and guilt that require expression of awareness or concern for others' evaluations (versus complex nonsocial emotions like curiosity or surprise and versus simple emotions like disgust). On the whole, when asked to give an example of a time when they experienced a complex emotion like pride, these children provided examples of basic emotions such as receiving a video game, which likely illustrates joy or pleasure. Several other studies documented children's

difficulty in providing examples or explanations for social emotions that are directly linked with interpersonal relations, such as loneliness and jealousy (e.g., Bauminger, 2004; Bauminger & Kasari, 2000). Compared to children with TYP, children with ASD less frequently reported both affective loneliness, which reflects a desire for or absence of close intimate relationships (children with HFASD, CA = 10.74 years; Bauminger & Kasari, 2000), and affective jealousy as assessed by ratings like "When a kid from my class is going to play with another kid from class, and not with me, I feel sad" (children with ASD, CA = 11.14 years; Bauminger, 2004). To sum up, personal narration of emotional accounts are not intact in school-age children with ASD, and specific difficulties emerge for socially complex emotions, for linking emotions and interpersonal relations, and also for basic negative emotions.

The majority of research on emotion recognition or understanding *in others* did not specifically focus on school-age children with ASD, but those studies with such a focus portrayed difficulties, mainly in children's understanding of complex self-conscious emotions. For example, using color photos of a male actor expressing nine different emotions, Heerey et al. (2003) asked children to identify non-self-conscious emotions (anger, contempt, disgust, happiness, fear, sadness, and surprise) and self-conscious emotions (embarrassment and shame). Children with TYP (CA = 10.51 years) outperformed children with ASD (CA = 10.70 years) only with regard to the self-conscious emotions (significantly for embarrassment and nearing significance for shame). Interestingly, group differences were no longer significant after controlling for ToM capabilities, which stresses their importance for understanding complex emotions. In addition, Golan et al. (2008) found that children with HFASD (CA = 8–12 years) showed difficulty compared to their peers with TYP in recognizing complex emotions (guilt, loneliness) and mental states (bothered, friendly) in social contexts, including facial expressions, body language, actions, as well as auditory input (prosody, verbal, content). Altogether, for school-age children with ASD, identification of emotions is presumably more difficult for complex self-conscious affects than for basic ones and for emotions expressed within social contexts rather than those assessed with simulated materials.

Studies that examined *higher-order emotion understanding capabilities* in school-age children with ASD yielded interesting findings. First, these children showed a more unidimensional than multidimensional perception of emotions (e.g., Rieffe et al., 2007). When asked about stories of social interaction entailing several concurrent emotions, children with ASD (CA = 10.2 years) detected fewer emotions than their age-mates with TYP and had difficulty recognizing the simultaneous presence of two negative emotions (anger, sadness). Also, children with ASD reveal less sophisticated understanding of the source of emotional experiences, with problems in acknowledging the influence of mood on emotions (e.g., Begeer et al., 2007) and in providing explanations for the causes of simple (happy, sad, afraid, angry) emotions (Jaedicke et al., 1994).

Second, their understanding of hidden emotions may be impaired. Dennis et al. (2000) found that children with ASD (CA = 9.6 years) had difficulties in identifying deceptive emotions—which require consideration of protagonists' hidden beliefs (e.g., hiding tummyache from mother)—as well as in explaining the reasons for the deception (i.e., because the child wants to go to the playground). Both the identification of the deceptive emotions and their explanation necessitate awareness of protagonists' mental states (e.g., beliefs). However, Barbaro and Dissanayake (2007) presented conflicting results using a different methodology where children only had to name deceptive emotions but did not have to justify the protagonist's emotions. In Barbaro and Dissanayake (2007), children (CA = 8.01 years) were told that a puppet really feels X but does not want anyone to know how he feels, so he hides his emotion. They were asked to say how the puppet really feels; how he tries to look on his face (deceptive emotions); and how other story characters in the story thought he felt (understanding mental states). After controlling for VMA, there were no group differences (HFASD/TYP).

A possible integration of these two studies taken together, would suggest that the children with ASD showed less sophistication or maturity in understanding the rules for social and emotional displays, than do TYPs.

Overall, difficulties in emotional understanding in school-age children with ASD encompass various capabilities, including identifying one's own emotional experience (e.g., complex self-conscious social emotions and negative emotions); identifying emotions in others (e.g., self-conscious emotions and emotions in social interactions); and showing a less sophisticated and unidirectional perspective of emotions. These capabilities are all part of the aforementioned broader sociocognitive deficit in social understanding and ToM. Social attention, ToM, and social-emotional understanding, all impaired in ASD, are necessary to form adequate social interactions and to develop mature social relationships, and doing so without a full set of social-cognitive tools poses a real challenge for school-age children with ASD.

Social Interactions and Relationships

The second major aspect of social functioning is the ability to interact efficiently with peers and adults as well as to develop ongoing social relationships with adults and peers (e.g., attachment to a caregiver, friendship with peers). This section will describe the prevalence and nature of social interactive skills in school-age children with ASD, including play, conversation, and recreational capabilities, as well as children's friendship experiences and relationships within the family.

Prevalence of Social Interactions

Specific failure to develop developmentally appropriate peer relationships is considered a diagnostic characteristic of ASD by the new *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (*DSM-5*; American Psychiatric Association [APA], 2013). Indeed, observational studies (e.g., Bauminger, Shulman, & Agam, 2003; Hauck, Fein, Waterhouse, & Feinstein, 1995; Jackson et al. 2003; Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011; Pan, 2009) as well as research that implemented social network paradigms and sociometric evaluations (e.g., Chamberlain, Kasari, & Rotheram-Fuller, 2007; Kasari et al., 2011; Rotheram-Fuller, Kasari, Chamberlain, & Locke, 2010) all demonstrated low rates of naturally occurring social involvement in daily peer interactions for school-age children with ASD.

To pinpoint the effect of autism symptomology beyond the effect of low cognitive functioning (LFA), two studies compared social interactions in children with LFA and children with intellectual disability (ID) during two naturalistic school situations: lunchtime and free play during recess. Hauck et al. (1995), who focused on peer initiations, found that children with ASD (CA = 9.58 years) initiated bids of social interaction to their peers one third as often as children with ID (CA = 9.16 years). Likewise, in Jackson et al. (2003), children with ASD produced fewer positive responses, more "no responses" to peers, and less engagement in sustained play than children with ID; however, rates of simple conversation were similar between the groups. Interestingly, children with ASD showed more intact interactions with adults than with peers, producing more positive initiations (Huack et al.) and responses (Jackson et al.) toward adults than peers. For the same social settings (lunch time and free play during recess), a slightly higher frequency of naturalistic social interactions with peers was observed in Bauminger et al. (2003) for school-age children with HFASD (CA = 11 years); they spent half the time as their matched counterparts with TYP in social interaction. Similarly, Macintosh and Dissanayake (2006) found that children with HFASD and Asperger (CA = 8 years) were less able than TYP to participate in ongoing schoolyard social exchanges, particularly when interactions included three or more partners.

Studies that implemented social network paradigms and/or sociometric evaluations, mainly by collecting reports from the target child and his or her peers in inclusive settings, provide support for the observational data. Children with ASD were nominated as peripheral to social relationships with peers (i.e., having only tenuous

connections to one or two peers) or as secondary (i.e., involved in the classroom social network, but not the most nominated students in the class), and they received fewer reciprocal friendship nominations (e.g., Chamberlain et al., 2007; Kasari et al., 2011; Rotheram-Fuller et al., 2010). Importantly, according to Kasari et al. (2011), only a minority of children was found to be socially isolated with no connections at all (13%). Interestingly, another minority was found to be nuclear—most frequently nominated by peers (8%). To sum up, sociometric evaluations support observational findings indicating that school-age children with ASD tend to become involved in peer interactions, but to a much lesser degree and centrality compared to children with TYP. Low frequency may result from low quality of social interaction, as described in the following.

Nature of Social Interaction

Three types of spontaneous social initiations were examined in school-age children with LFA (Hauck et al., 1995): (1) positive—social initiations that enable positive-adaptive social interaction (i.e., give affection; give information; greet; initiate play; initiate joint attention; seek aid/information verbally and nonverbally); (2) low-level behaviors that may hold hidden communicative intent without the ability to transform them into active interaction (i.e., imitation; echolalia; looking; moving into proximity; neutral physical contact; ritualized interaction); and (3) negative—behaviors that result in nonadaptive and often aggressive interactions (i.e., aggression, provocation). Children's verbal and nonverbal attention-seeking behaviors as well as avoidant behaviors (e.g., moving out of proximity) were also examined. Children with LFA (like their peers with ID), showed a profile of social initiations including mostly positive and low-level interactions and very infrequent attention-seeking, negative, and avoidant behaviors. Although many interactions for both groups were positive, the LFA group engaged in more ritualized behaviors and the ID group engaged in more playful initiations. Findings for specific behaviors revealed that children with LFA made fewer play initiations toward peers and fewer imitations of peers' play compared to children with ID.

Bauminger et al. (2003) used a modified version of Hauck et al.'s (1995) observational scale to examine spontaneous social interaction in school-age children with HFASD versus age-mates with TYP. The modified scale included not only initiations but also responses in the three overall categories (positive, low-level, and negative), and more complex social behaviors were added. Behaviors added to the positive category included eye contact combined with a smile, social communicative behaviors ("Let's play"), sharing experiences and objects, expressed affection, talk that reflected an interest in another, requests, and providing help. In the low-level category, functional communication was added to tap intentions to fulfill one's own need with no clear social intention. Overall findings yielded an identical global profile of initiations and responses for the two groups' social interactions (HFASD/TYP), even if behaviors appeared at a lower frequency in HFASD. That is, most social behaviors were positive, followed by low-level, and to a much lesser extent the rarely observed negative behaviors. Group differences appeared only for positive and low-level interactions: The HFASD group showed a significantly lower frequency of all positive-adaptive behaviors except eye contact (which was at a similar frequency between groups). However, significantly more instances of low-level, merely functional communication appeared in the HFASD group than in the TYP group.

A deeper look at the specific behavioral profile for each group revealed that children with HFASD mainly showed passive low-level social behaviors such as eye contact (not combined with a smile) and close proximity, whereas children with TYP used a broader repertoire of more active and communicative behaviors such as eye contact and smile, affection, object sharing, experience sharing, social communication, talk that reflects interest in another, and helping. Another recent study on school-age children with ASD (CA = 7.9 years) versus those with TYP (Forde, Holloway, Healy, & Brosnan, 2011) revealed less spontaneous communication (i.e., not prompted by another peer/adult) and more

elicited social communication (i.e., prompted by another) during academic lessons (e.g., reading, mathematics, and drama) and during classroom free-play activities (e.g., watching DVDs, playing video games).

Hence, based on these studies, social interactions in children with ASD appear to occur not only less frequently but also differently in quality compared to children with TYP or ID. Particular attention should be paid to the low-level interaction behavioral category, for two reasons: (1) Children with ASD who spontaneously produce this type of behavior (i.e., close proximity) fairly often might think that they initiated an interaction that was not reciprocated by peers and may misjudge it as rejection. (2) Some of these behaviors are socially inappropriate (e.g., echolalia, rituals), denoting an active-but-odd interaction style (Wing & Gould, 1979) where children actively seek interactions with others but in an unusual way that may lead to unproductive spontaneous interactions with peers.

Collaboration, Play, and Conversation

ASD researchers have examined the ability to coordinate and co-regulate actions with a peer in a collaborative task (Stoit et al., 2011) as well as children's play and conversational behaviors (e.g., Capps, Kehres, & Sigman, 1998; Kasari et al., 2011; Macintosh & Dissanayake, 2006; Nadig, Lee, Singh, Bosshart, & Ozonoff, 2010). Stoit et al., for example, found that joint engagement and co-regulation of actions with a peer is limited in children with ASD (CA = 11.6 years) compared to children with TYP; when solving a computerized balancing task together with another child that required using one hand each to balance a ball on a bar, they revealed impairments in predicting the partner's response; in synchronizing their response to the partner's initiation (causing the ball to drop quickly after movement onset), and they did not delay the timing of their lift initiation to accommodate the partner.

Play and conversational behaviors—considered key components of peer interaction—are also not intact in school-age children with ASD. Macintosh and Dissanayake's (2006) study of schoolyard play behavior found that children with HFASD showed fewer episodes of simple play (play or activity with a common focus or goal but with no structure or rules) than children with TYP, although no group differences appeared in the frequency of complementary play (involving adoption of role/pretend character including games with clear rules or structure). This finding highlights a specific difficulty in unstructured activities, where children must operate social knowledge and creativity to create shared actions and play with peers. Difficulty in more advanced joint social play behaviors was also demonstrated in Kasari et al.'s (2011) observation of school playground behavior in children with ASD from first through fifth grades (CA = 6–11 years). Joint engaged actions with peers were of low frequency (18.6%), and another 20% of children's time was spent playing in structured games with rules. A significant amount of time was spent in solitary/unengaged activity (33.4%) or in low-level noninteractive parallel games (aware and unaware) and mere looking at other children's play activities (28%).

Inadequate conversational skills were found in school-age children with ASD (CA = 11.9 years) versus children with development delay (DD; CA = 9.4 years) matched on MA (8.9 and 7.4 years, respectively) during snack time in a semistructured conversation with a familiar adult (Capps et al., 1998). Children with ASD more often failed to respond to questions, repeated prior comments and questions verbatim, and provided more bizarre or idiosyncratic comments than the DD group. They also less often extended an ongoing topic of conversation by offering new relevant information; they produced fewer narratives of personal experience; and their narratives as a whole tended to be minimalistic and focused on the immediate physical environment, whereas the narratives of the DD group were always relevant to ongoing dialogue and included meaningful personal events. The more simplistic conversational behaviors like one-word utterances and yes/no replies did not differ between groups. Interestingly, only one nonverbal behavior during conversation differed between groups: Children with ASD nodded less than DD while

listening, whereas smile, appropriate affect, and use of gesture were similar between groups.

In a recent study, Nadig et al. (2010) showed that when children with HFASD (CA = 11 years) talked about their own peculiar areas of interest with an adult, the discourse was less reciprocal, including fewer contingent utterances and more monologue-style speech than the talk of age-mates with TYP (CA = 10.10 years). Difficulties also emerged on ending a conversation appropriately; children with HFASD more frequently walked away from a conversation without coherently ending it by making a friendly closure that accounted for the other person's perspective (e.g., Rubin & Lennon, 2004). In sum, children with ASD experience difficulties in navigating the communication demands of social conversation, and these difficulties may be partly explained by their sociocognitive deficits in social knowledge and ToM (e.g., Capps et al., 1998).

Recreational and Leisure Activities

Recreational activities are important for peer interaction as well as for children's well-being (e.g., Potvin, Snider, Prelock, Kehayia, & Wood-Dauphinee, 2012). Although not extensively examined in school-age children with ASD, two recent studies described these behaviors in school-age children with LFA (CA = 9.99 years; Solish, Perry, & Minnes, 2010) and with HFASD (CA = 9.25 years; Potvin et al., 2012). Parent reports in Solish et al. included three subscales: social, recreational, and leisure activities. Children with LFA were reported by parents as participating in significantly fewer social and recreational activities but showing a similar frequency of leisure activities compared to peers with TYP. These leisure activities were mostly home based as well as more passive and solitary activities like watching TV, reading, playing computer and video games, using the Internet, and going for walks.

More specifically, the profile of social activities for the LFA group showed a high frequency of going to the park and out to meals (89.2% and 77.3%, respectively); a medium frequency of birthday parties and movies (50.8% each), going to the mall (46.2%), and talking on the phone (44.6%); and a low frequency of playing at a friend's house (26.2%), having friends over (23.3%), sleepovers (15.4%), and chatting on the computer (13.8%). Thus, most of the low-frequency social activities involved peer interaction. Overall, recreational activities appeared at low frequencies for the children with LFA; the most frequent of these activities were swimming lessons (27.7%), horseback riding (15.4%), music, and soccer (12.3% each). Other activities were reported at very low frequencies: hockey, baseball, skating, and skiing lessons were all below 10%, and other team sports, gymnastics, karate, dancing, and art lessons were all reported below 5%.

The partner for the various activities differed between the groups. Children with LFA participated in fewer social and recreational activities with peer partners than children with TYP and in fewer recreational activities with peer partners than children with ID. Moreover, children with ASD participated in more social activities with parents than did children with TYP. Altogether, children with ASD were the least involved in activities with peers.

Similarly to Solish et al.'s (2010) parent reports for children with LFA, Potvin et al.'s (2012) study of self-reports in HFASD indicated that recreational activities more frequently occurred close to home and either included solitary activities or family members, which differed from the activities of peers with TYP. Diversity of activity was also significantly higher in the TYP group, especially for physical activities (e.g., bicycling, team and nonteam sports, track and field, water sports). Yet, interestingly, no significant group differences emerged overall for the social domain (e.g., going to parties and movies, hanging out, talking on the phone) or for expressed enjoyment from and preference for being involved in recreational activities. Also, surprisingly, pretend play was higher in frequency for the HFASD group than the TYP group. As expected, playing computer or video games was the most frequent activity reported for all of the participants with HFASD. The surprising results for social activities and pretend play may be

explained by the methodology—reported desired activities rather than actual ones—and another study comparing parental and self-reports may shed light on these discrepancies. However, this may also coincide with other findings reported here showing that ASD and more specifically HFASD do not relinquish social activities but rather lack sufficient knowledge for effective participation.

Friendship

In contrast to mere peer interaction, friendship poses higher requirements from children to co-regulate another person's perspectives and behaviors in order to develop an ongoing, durable, and stable set of reciprocal interactions (lasting a minimum of 6 months) that result in intimate and close bonding. Friendship formation is an enormous challenge for children with ASD due to their difficulties in intersubjectivity and ToM (e.g., Baron-Cohen, 2000; Rogers & Bennetto, 2001). Indeed, school-age children have significantly fewer reciprocal friendships compared to children with TYP (e.g., Chamberlain et al., 2007; Kasari et al., 2011; Rotheram-Fuller et al., 2010), children with ID (e.g., Solish et al., 2010), and children with other special education needs (e.g., Rowley et al., 2012). In Solish et al. (2010), 53.3% of children with ASD had no friend versus only 21.4% of children with ID and only 1.2% of children with TYP. Yet, even if to a lesser extent, friendship does exist in some school-age children with ASD, eliciting questions about its quality. Not many studies have explored quality of friendship in school-age ASD, but the few that did so yielded both similarities and differences compared with friendships in TYP. Self-reports on friendship quality found that friendships in ASD were not seen as more conflictual than those of their age-mates with TYP, but group differences favoring the TYP group did emerge on intimacy, help, companionship, and affective closeness (e.g., Bauminger, Solomon, Aviezer, Heung, Gazit et al., 2008; Chamberlain et al., 2007; Kasari et al., 2011).

Observational studies on friendship in school-age with ASD are scarce. A binational study that Bauminger et al. (2008) executed from Israel along with Rogers and Solomon from the United States extensively explored the quality of friendship by comparing children's interactions with their friends in three semistructured social situations—construction, drawing, and free play during break—in HFASD versus TYP groups (CA = 9.66 and 10.16 years, respectively; range: 8–12 years). Overall, TYP dyads outperformed HFASD dyads in the behavioral manifestations of friendship and in the dyadic qualities of interaction, as follows: The children with HFASD showed poorer cooperative skills, less positive affect, and less skillful conversational skills, as well as a more rigid conversation style. With regard to play complexity, the children with HFASD exhibited a higher frequency of mere parallel play and a lower frequency of constructive play. The qualities of the dyadic interactions containing a child with HFASD were less socially oriented, cohesive, harmonious, and responsive, as well as less enjoyable and close. All these differences support clinical as well as theoretical perspectives on friendship as a challenging social relationship for the child with HFASD.

However, interesting similarities also emerged between the HFASD and TYP friendship dyads on several complex social behaviors such as the incidence of prosocial behaviors, sharing, and eye contact with a smile, possibly suggesting that friendship may nonetheless offer an advantageous framework for enhancing social skills among children with HFASD. Indeed, in a recent study on preschoolers with HFASD conducted in my laboratory (Bauminger & Agam Ben Artzi, 2012), interactions with a friend demonstrated better qualities compared to interactions with a nonfriend (e.g., positive affect, complex forms of social and collaborative pretend play, shared fun, and reciprocity), but this was not yet examined for school-age children.

Interestingly, for those school-age children with HFASD who form friendships, the friendships are relatively long lasting, ranging from about 6 months to 4 years, and they comprise mainly same-age, same-sex pairs (e.g., Bauminger, Solomon, Aviezer, Heung, Gazit et al., 2008; Kasari et al., 2011). Children with HFASD may form "mixed" friendships

with peers who have TYP and may also form "nonmixed" friendships with peers who have a disability (most likely HFASD), but quality was shown to differ between these two friendship types (e.g., Bauminger, Solomon, Aviezer, Heung, Brown et al., 2008). Nonmixed dyads showed the lowest friendship quality (versus mixed and TYP-only friendships), as manifested in their highest frequency of parallel play and lowest frequency of engagement in goal-directed activity, sharing, and positive affect. Also, nonmixed dyads were less responsive and cohesive, exhibited a lower positive social orientation, and showed less complex levels of play. Nevertheless, despite the lower friendship quality observed for nonmixed dyads when interacting with a friend, the nonmixed friendships appeared more symmetric in the degree to which each partner assumed dominant or subordinate roles, such as leader and follower, whereas children with HFASD in mixed friendships had fewer leadership opportunities. Thus, even if it seems that a friend with TYP is important for the development of more complex social behaviors, a friend with ASD may be equally important for self-perception. An extensive review on friendship is beyond the scope of this chapter; interested readers can refer to Bauminger-Zviely (2013).

Family Relationships

Parent–child relationships have been extensively examined for younger children with ASD, but not so for older. To the best of my knowledge, only one study has examined security of attachment in school-age children with ASD. Using self-reports, Bauminger, Solomon, and Rogers (2010b) found that half of the children with HFASD (54.4%; CA = 8–12 years) perceived themselves as securely attached to their mother, thereby corroborating data from younger children with ASD (e.g., Rutgers, Bakermans-Kranenburg, van IJzendoorn, & van Berckelaer-Onnes, 2004). Despite the fact that 71% of the TYP group reported secure attachment to the mother, the two groups did not significantly differ in proportion of secure attachments; however, they did differ on the quality of parent–child relationships: Children with HFASD perceived their relationships with their mothers as less open to communication and less trustful compared to the TYP group. Thus, as for the younger children, it seems that for mid-childhood school-age children too, security of attachment does not provide the complete narrative of the relationships with caregivers.

One important aspect that may affect child–parent quality of relations is parental stress (especially mothers'), which has been shown to be particularly high in parents of children with ASD, compared to parents of children with TYP or with other disabilities like Down syndrome, cerebral palsy, or ID (e.g., see review in Hayes & Watson, 2012). A recent study showed that autism severity (per the ADOS; Lord et al., 2000) adversely affected the overall quality of parent–child relationships (CA = 7.4 years) during semistructured play interactions, and specifically contributed to the dimensions of coordination, communication, emotional expression, responsivity, and mood, resulting in nonsatisfactory parent–child interactions (e.g., Beurkens, Hobson, & Hobson, 2012). In another study (Bauminger, Solomon, & Rogers, 2010a), parental stress was related to the severity of both internalizing and externalizing behaviors in children with HFASD (CA = 9.66 years).

Following attachment theory, parents' internal working models of attachment may be transmitted to their child and may affect the child's capacity for social relationships. Recent research showed this for school-age children (CA = 4–16 years, most between 6 to 13 years) with ASD (Seskin et al., 2010). Parents who themselves were securely attached had children with more developed social skills and a greater capacity to engage in developmentally appropriate social interactions, such as initiating and responding in two-way presymbolic gestural communication; organizing two-way social problem-solving communication; and engaging in imaginative thinking, symbolic play, and verbal communication. Altogether, studies that explored child–parent quality of relationships for school-age children are quite limited, and future studies would do well to untangle these relationships for this age group, due to their importance for children's development and well-being. Studies have accentuated

the importance of the families' emotional and social support networks as well as participation in parental support groups as factors promoting positive psychological adjustment in the parents of children with ASD (e.g., Benson, 2012; Clifford & Minnes, 2012). This, in turn, may render positive effects on the quality of child–parent relationships.

Siblings

The effect of siblings with TYP on the proband with ASD has not been extensively examined, especially for the school years. Some evidence has shown the important contribution of siblings with TYP to probands' socialization capabilities (per the VABS; Sparrow et al., 1984), with a more robust effect for younger siblings than for older siblings (e.g., Brewton, Nowell, Lasala, & Goin-Kochel, 2012). In a like manner, siblings with TYP were found to provide effective opportunities for probands to experience and acquire various interactive and play skills. Two studies that included spontaneous observations of the proband–sibling interaction in routine social activities at home (Knott, Lewis, & Williams, 1995, 2007) highlighted that, even if to a lower extent compared to children with Down syndrome, probands with ASD engaged in a wide range of interactive play behaviors with their siblings, ranging from simple rough and tumble to sophisticated play with a toy theater, and they were actively involved in the interaction for 66% of the time spent together (Knott et al., 1995), which significantly surpasses the percentage of time spent in social interactions with peers, as described earlier. These interactive behaviors of the proband continued to grow over a 1-year period, but mainly due to greater initiations on the part of the siblings with TYP (Knott et al., 2007), indicating that these siblings with TYP may play an important role in scaffolding and supporting social interactive skills in probands with ASD, despite the probable asymmetry of the interactions. This asymmetry may evolve into an overprotective relationship that might also have a negative side. For example, in a recent study (O'Brien, Slaughter, & Peterson, 2011), having an older sibling was found to be disadvantageous for ToM development in probands with ASD (CA = 3.67–12.67 years; M = 6.67), even after controlling for the effects of age, VMA, executive function, and ASD severity. This may be due to apparent overcompensation on the part of the older sibling with TYP for their younger proband with ASD during social interactions, and as such may hinder the latter's opportunities for sociocognitive growth. Further discussion of siblings' effects of the proband with ASD is beyond the focus of this chapter; see Chapter 40, this *Handbook*, Volume 2, for elaboration.

Internal and External Components That Contribute to Social Interaction

Contributors to social interaction include children's intrinsic characteristics on the one hand and children's social environment and significant social agents on the other hand. Among intrinsic components found to contribute to social interactions are children's IQ (e.g., above 50 versus below 50, in Stone & Caro-Martinez, 1990), children's adequate vocabulary and ability to use language functionally (e.g., Hauck et al., 1995), and children's speech level (e.g., Stone & Caro-Martinez, 1990). Language age was also found to contribute to conversational contingency and to the ability to provide new information in a conversation. Not surprisingly, lower severity of social impairment (e.g., on the VABS socialization measure; Hauck et al., 1995) was linked with greater social participation, and a higher ability to meet peers for play dates at home (according to parents' report) was linked with more active social participation of the children on the school playground (Frankel, Gorospe, Chang, & Sugar, 2011). Children's more restricted interests were inversely related to the ability to develop verbal exchanges during a conversation (Nadig et al., 2010).

Among the extrinsic components found to contribute to children's degree of participation in social interactions are the social situation's level of structure (e.g., recess versus social activities in physical education; Pan, 2009) and the type of social task (e.g., simple social play versus rule-governed games; Macintosh & Dissanayake, 2006), in favor of the more semistructured social

situations and tasks. In terms of partner type, peers with TYP were found to evoke more complex social behaviors in children with ASD, but interactions with an ASD partner are more egalitarian (Bauminger et al., 2003). Thus, inclusive settings are important, but interactions with another child with a disability also hold significance in terms of children's sense of self-worth and ease in the interaction. Interestingly, the presence of a one-on-one aide during school recess resulted in less active involvement of the ASD child (Kasari et al., 2011). Thus, aides' roles during unstructured times should be carefully planned.

Summary of Social Interaction

All in all, school-age children are involved in a wide range of interactions with peers and adults along various social settings and tasks, albeit to a lesser degree and quality than their counterparts with TYP or ID. Their social interaction profile emphasizes the need for interventions in school (see Chapter 35, this *Handbook*, Volume 2), particularly during nonstructured social situations in school (i.e., recess). Such interventions may enable children with ASD to develop more efficient interactive behaviors with their peers and may reduce the high loneliness reported by these children relative to their counterparts with TYP (e.g., Bauminger & Kasari, 2000) as well as their heighted risk for being bullied and ridiculed by peers compared to the risk faced by children with TYP or with other special education needs (e.g., Rowley et al., 2012). Interestingly, Rowley et al. (2012) demonstrated that more socially able children with ASD (CA = 10–12 years) reported greater bullying and victimization than their less socially able counterparts. This may signify, in line with findings described earlier (Wing & Gould, 1979), that the more able children act actively but oddly in their peer interactions and therefore are more vulnerable to peer harassment. Indeed, a recent comparative intervention study for ASD in the schoolyard found that intervention using peer mediators with TYP was more efficient than intervention using adult mediators in terms of reducing isolation on the playground (e.g., Kasari, Rotheram-Fuller, Locke, & Gulsrud, 2012), suggesting that more such models are greatly needed.

As seen throughout the section on social interaction, one reason for their inadequate social interactions lies in these children's inappropriate (odd), repetitive, and stereotypic interests and preoccupations, as described next.

Restricted, Repetitive Patterns of Behavior, Interests, or Activities

In the new *DSM-5* (APA, 2013), a pattern of restricted, repetitive behaviors (RRBs) is considered the second major deficit in ASD, after the sociocommunicative deficit. This is a broadband domain encompassing abnormal motor stereotypies and sensory difficulties, atypical areas of interest and activities, and insistence on sameness. RRBs are important to consider in ASD due to the fact that they interfere with many aspects of everyday functioning and interactions; thus, they may hinder effective learning from the environment as well as place considerable stress on family functioning (Bishop, Richler, Cain, & Lord, 2007). Indeed, RRBs are not specific to school-age children because they span all developmental and functioning levels, but a recent study (Richler, Huerta, Bishop, & Lord, 2010) presented developmental trajectories of RRBs that are relevant to school-age children (CA = 9 years). In line with other studies (e.g., Bishop, Richler, & Lord, 2006; Cuccaro et al., 2003), RRBs were factored out into two main subtypes: (1) repetitive sensorimotor (RSM) comprising hand or finger mannerisms, such as flicking or twisting fingers; complex body mannerisms, such as spinning in circles; unusual sensory interests, such as peering at objects from the side; and repetitive use of objects, such as lining up toys; and (2) insistence on sameness (IS) comprising difficulties with minor changes in routine, such as insisting on sitting in the same seat in the car; resistance to trivial changes in the environment; refusing to make any changes in room organization; and compulsion and rituals, such as insisting on turning right out of the driveway. The developmental trajectory for

RSM showed that children with a diagnosis of autism at age 2 years revealed more severe RSM behaviors at age 9 compared to children with milder PDD-NOS (pervasive developmental disorder not otherwise specified). Also, higher cognitive ability at age 2 was associated with milder RSM behaviors at age 9 and with greater improvement in these behaviors over time (between 2 to 9), even after controlling for diagnosis. Interestingly, an early communication/social deficit did not correlate with RSM. The developmental pattern differed for IS, in which social/communicative impairments at age 2 were positively associated with concurrent IS behaviors. Milder early impairments were associated with more severe later IS behaviors, but cognitive abilities did not correlate with IS.

In line with Richler and her colleagues' findings, Lam, Bodfish, and Piven (2008) identified the same two subclassifications (RSM and IS) in individuals with ASD between the ages of 20 months and 29 years (CA = 9.02 years), as well as third classification of "circumscribed interest" that included behaviors such as intense, focused hobbies, strong preoccupations with odd topics (such as sewer systems or garage doors), and unusually strong attachment to certain objects. Examination of each subclassification's correlations revealed that RSM was more prevalent in younger children with lower verbal IQ, greater social deficits, greater communication impairments (in verbal subjects), and more severe loss of language. Like in the studies by Richler's group, Lam et al. also found that IS was correlated with social and communication impairment. Interestingly, circumscribed interest was independent of subject characteristics. Also, in Bishop et al. (2006), younger children were more likely to engage in RSM, whereas older children were more likely to exhibit IS (CA = 15 months to 12 years, n = 830). Overall, Bishop et al. also found that RSM behaviors (classified as lower order behaviors including primitive brain processes; M. A. Turner, 1999) were more common in LFA, whereas IS behaviors (classified as high-order, cognitively mediated behaviors; M. A. Turner, 1999) were more common in HFASD, but that both types of behaviors (even if to a lower extent) were noted across development in every age and IQ group. For example, lower order behaviors such as hand and finger mannerisms were present in 38% of the 6- to 12-year-olds with HFASD, and higher order behaviors like circumscribed interests were present in 27% of the lowest functioning 6- to 12-year-olds. In accordance with these findings, Lam et al. (2008) found that multiple forms of RRBs in an individual were related to more severe ASD social and communicative symptoms.

While relating only to low-order motor behaviors (e.g., rocking, finger posturing, repetitive vocalizations), Joosten, Bundy, and Einfeld (2012) touched upon a relatively neglected topic in RRBs, namely, the identification of underlying motivators for RRBs in children with ASD (CA = 9.7 years). Motivators were divided into intrinsic (i.e., enhanced sensation and decreased anxiety) and extrinsic (i.e., seeking attention, objects, or escape) and were observed and rated by parents and careers along three social settings: free time, transition, and engagement in a task. Transition periods evoked many RRBs in the children with extrinsic motivators; escape and intrinsic anxiety reduction were most strongly linked to this setting. Free time periods mostly elicited sensation seeking, as well as motivators like gaining attention or objects. This study showing that motivators for RRBs may differ based on the situation may hold important implications for intervention planning, emphasizing the possible role of setting in mitigating or increasing RRBs.

Sensory Processing and Motor Dysfunction

As was previously described, sensory processing abnormalities are important aspects of RRBs and are highly prevalent in ASD (e.g., 90% of ages 2.8–11.6 years; Leekam, Nieto, Libby, Wing, & Gould, 2007). Indeed, sensory processing dysfunction, defined as "hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment," are included as a diagnostic criterion under the broadband domain of RRBs in the new *DSM-5* (APA, 2013).

Sensory abnormalities offer important explanations for social functioning in ASD, for example,

atypical sensory processing significantly correlated with social impairment based on the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) in both children with TYP and with HFASD (Hilton et al., 2012). More specifically, abnormal responses to multisensory, touch, and oral sensory/olfactory stimuli were identified as possible predictors of social severity in ASD (CA = 6–10 years, $M = 8.89$; Hilton et al., 2012). Sensory profile was also linked with maladaptive functioning measured using the VABS; specifically, atypical taste/smell sensitivity, auditory filtering, and movement sensitivity were associated with less maladaptive behavior in children with ASD (CA = 2.75–9.58 years; $M = 7.8$; Lane, Young, Baker, & Angley, 2010). Atypical auditory responsiveness—including filtering difficulties, sensory underresponsiveness, and sensory seeking—were associated with academic underachievement; in addition, tactile sensitivity was associated with attention difficulties and hyperactivity. Also, reduced auditory filtering was related with inattention to cognitive tasks in children with HFASD (CA = 6–10 years; Ashburner, Ziviani, & Rodger, 2008). These findings hold significance for class organization and teaching strategies, supporting the importance of visual modalities and the consideration of reducing noise distractions and unpredictable tactile input during academic lessons.

According to a recent meta-analytic study (Ben-Sasson et al., 2009), differences between ASD and TYP were greater for underresponsivity (e.g., unawareness or slow response to sensory input, such as a tendency to walk into things), followed by overresponsivity (e.g., exaggerated, rapid onset and/or prolonged reactions to sensory stimulation, such as distress from loud noises), followed by sensory seeking (e.g., craving of and interest in sensory experiences that are prolonged or intense, such as engaging in rhythmical movements). However, differently from the overall sensory processing abnormality score and from the other two modalities (i.e., overresponsivity and seeking), underresponsivity did not yield a clear developmental trajectory. Overall sensory processing abnormalities, overresponsivity, and sensory seeking each showed an increase in frequency from infancy up to age 6–9 years and then a decrease (e.g., Ben-Sasson et al., 2009), thus the highest increase in frequency was reported for school-age children age 6–9 years (versus infancy—CA = 0.0–3.4; preschool—CA = 3.5–6.4; and adolescents—CA = 9.5+). It seems that school-age children are at risk for experiencing heightened sensory difficulties compared to the other age periods. This may accentuates the special extrinsic demands with which children with ASD must cope when entering the school system, but on the other hand it may also reflect an intrinsic increase in these symptoms in the early school years. Whether this finding reflects innate growth or environmentally based growth in symptomatology currently remains unknown; however, school-age children's special sensitivity in this domain holds important implication for interventionists. Based on another finding of Ben-Sasson et al. (2009) showing greater sensory abnormalities in children with more severe ASD, it seems that school-age children with LFA are at the greatest risk for vulnerability to sensory difficulties.

Sensory-Motor and More General Motor Dysfunctions

Sensory-motor and in ASD have gained increasing attention in recent research due to these dysfunctions' potential contribution to these children's sociocommunicative deficit. These motor impairments may limit children's ability to play in the schoolyard with peers or even to develop speech and thus communicate with other children. Researchers have reported a range of motor dysfunctions in ASD. For example, a recent meta-analysis of 41 studies explored substantial deficits in motor coordination (e.g., movement preparation or planning) including arm movement, gait, and postural stability across ages (from toddlerhood up to young adulthood) in ASD versus TYP, pinpointing a slight reduction in symptoms along development (Fournier, Hass, Naik, Lodha, & Cauraugh, 2010).

Another study (Ming, Brimacombe, & Wagner, 2007) based on retrospective clinical reviews presented a high prevalence of other aspects of motor dysfunction in a large cohort of children with ASD spanning a wide age range ($n = 154$;

CA = 2–18 years). Specifically, 51% of the sample exhibited hypotonia (reduced resistance during passive movement in the limbs); 34% exhibited oral and muscle motor apraxia (impairment of the ability to execute skilled movements and gestures, despite having the desire and the physical ability to perform them, such as blowing a bubble or licking lips with tongue in the oral apraxia and difficulties in holding a pen in the hand apraxia); only 19% exhibited toe-walking (present, whether intermittent or persistent, sometime during the child's life for at least 6 months); and only 9% exhibited delayed gross-motor millstones (such as independent walking, walking up steps, and jumping up). Interestingly, improvement was observed for all domains with age: Younger children with ASD (CA = 2–6 years) showed a higher frequency of motor impairments than older children (CA = 7–18 years), but age differences were significant only for hypotonia (63% versus 38%, respectively) and neared significance for apraxia (41% versus 27%). Thus, school-age children may be at reduced risk versus young children for experiencing the aforementioned motor impairments, but not free of them. One difficulty in the Ming et al. study is the lack of normative comparisons for each of these motor domains, making it difficult to estimate their exact risk rate for the population of ASD.

Other studies including school-age children with ASD demonstrated motor impairments in various gross- and fine-motor capabilities compared to children with TYP. Impairment in gross-motor skills included difficulties with balance and impaired gait, slower speed and more dysrhythmia with timed movements of hands and feet, greater overflow during performance of timed movements and stressed gait maneuvers (Jansiewicz et al., 2006) and reduced overall coordinated locomotor skills (Staples & Reid, 2010), more specifically difficulties in hopping and galloping (Pan, Tsai, & Chu, 2009). Impairment in fine-motor skills included, for example, poor object-control skills such as ball catching, rolling, batting, and dribbling (Pan et al., 2009; Staples & Reid, 2010). Lastly, a recent study suggested a sensorimotor deficit in children with Asperger (CA = 10.72 years), demonstrating a link between motor dysfunction (movement performance like bilateral motor coordination) and sensory integration deficit in proprioceptive and vestibular processing, which are considered important for motor performance and for the development of "body schema"—the internalized model of the body in action (Siaperas et al., 2012).

Taking these findings altogether, the difficulties demonstrated by school-age children with ASD in all three domains—RRBs, sensory processing, and motor functioning—appear to affect their ability to form adequate and efficient peer interactions and may also influence these children's academic skills, as seen next.

COGNITIVE-ACADEMIC FUNCTIONING

Cognitive-academic difficulties are not considered a diagnostic criterion of ASD; however, difficulties in this arena are extensive and hold specific implications for understanding children's performance in school, as described here (see also comprehensive review in Bauminger-Zviely & Kimhi, 2013a).

Executive Function (EF)

The higher-order cognitive functions that aid in developing goal-directed behaviors—EF—may provide explanations for how children with ASD process information (e.g., Hill, 2004). EF difficulties have been well documented in children with ASD, specifically in the areas of cognitive planning and flexibility (e.g., see reviews in Hill, 2004, and in Van Eylen et al., 2011, for children and adolescents). Other EF subdomains such as working memory, generativity of novel ideas, and verbal fluency have yielded mixed results for school-age children, and response inhibition was found to be relatively intact (e.g., Ozonoff & Strayer, 2001; Robinson, Goddard, Dritschel, Wisley, & Howlin, 2009; Semrud-Clikeman, Walkowiak, Wilkinson, & Butcher, 2010; Vertè, Geurts, Roeyers, Oosterlaan, & Sergeant, 2006). In children with TYP, EF was found to be linked with various social abilities (e.g. self-regulation, ToM, and social cognition;

see review in Best, Miller, & Jones, 2009) and with various academic capabilities (e.g., math and reading; Best, Miller, & Naglieri, 2011). Also, EF abilities were linked with diverse areas of functioning in school-age children with ASD. For example, EF-behavior regulation (a composite score of inhibition, attention shifting, and emotional control) was linked with total RRBs, self-injury, compulsion, and rituals/sameness. Yet, EF-metacognition (e.g., working memory, planning, monitoring) did not correlate with RRBs (Boyd, McBee, Holtzclaw, Baranek, & Bodfish, 2009). However, the EF-metacognition index was found to predict the VABS adaptive composite score (Sparrow et al., 1984) as well its socialization and communication subdomains, stressing the importance of EF for general sociocommunicative functioning in ASD (e.g., Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002). Lastly, EF was found to positively link with level of participation in school activities (e.g., Zingerevich & LaVesser, 2009). Taken altogether, EF capabilities seem to greatly contribute to various functional domains in school-age children with ASD.

Cognitive Characteristics

As stated previously, recent reports documented that at about 40%–50% of school-age children have co-occurring intellectual deficits (e.g., Charman et al., 2010; Johnson & Myers, 2007). The profile of children with ASD on various intelligence tests has often demonstrated a gap between performance IQ (PIQ) and verbal IQ (VIQ), favoring PIQ, as reflected, for example (e.g., Mayes & Calhoun, 2003), in poor verbal abilities (Comprehension and Vocabulary subtests) versus good visuo-spatial skills (Block Design substests) on the Wechsler Intelligence Scale for Children (WISC) for school ages (Wechsler, 1974). However, it should be noted that other researchers found little PIQ–VIQ discrepancy (e.g., Charman et al., 2010), and in many cases this PIQ–VIQ gap was shown to diminish with age (e.g., Joseph, Tager-Flusberg, & Lord, 2002) and was found to be related with improvement in language ability, especially among children with HFASD (Sigman & McGovern, 2005). Moreover, the most improvement in cognitive and language functioning was found to occur between the preschool and middle school years (versus middle school and up), with greater gains for HFASD versus LFA, whose language skills did not show improvement after the middle school period (Sigman & McGovern, 2005).

Another important cognitive characteristic of ASD that may render significant influence on children's learning process is their poor capacity for abstraction of information across multiple stimuli or situations (e.g., categorization, concept formation, metaphor understanding). For example, in Ropar and Peebles (2007), children with ASD (CA = 12.11 years, VMA = 8.6 years) preferred to sort books by concrete dimensions of color and size over abstract dimensions like category membership. Another cognitive deficit related to abstraction is these children's lack of generalization capabilities, which hampers their ability to apply previously learned concepts or information to novel stimuli, particularly when the novel information is less similar to the category's prototype (e.g., Froehlich et al., 2012).

Memory and imitation are two other basic cognitive skills that are important for learning and are hampered in school-age children with ASD. Memory deficits are well recognized in ASD versus TYP, spanning verbal, nonverbal, autobiographic, and everyday memory aspects (e.g., Southwick et al., 2011). Furthermore, these children's recall strategies do not sufficiently consider items' relatedness unless cued recall is supplied at the retrieval stage (as opposed to the storage stage; Southwick et al). Also, with increases in task load, individuals with ASD show decreasing verbal and spatial working memory abilities (see review in Bauminger-Zviely & Kimhi 2013a).

Imitation, which is the basic ability that enables learning, whether social or academic, is considered to be deficient in ASD (see review in Williams, Whitten, & Singh, 2004). Yet, some forms of imitation (of action style, Hobson & Hobson, 2008; of gestures, Vivanti, Nadig, Ozonoff, & Rogers, 2008) were found to be more impeded than others,

such as simple imitation of actions taken on objects (Hobson & Hobson, 2008). Although considerable variability characterizes motor imitation in ASD, it is a cardinal obstacle that thwarts productive learning. To sum up, the cognitive profile of children with ASD, which includes difficulties in abstraction, memory, and some aspects of motor imitation, all affect these children's academic achievements in major learning domains.

Academic Abilities

Patterns of academic abilities and disabilities in reading, writing, and mathematics have not yet been clearly demarcated in ASD inasmuch as a wide range of academic achievement outcomes has been reported for this population, ranging from significantly above expected levels to far below expected levels (e.g., Estes et al., 2011). In a recent review of academic abilities of children with ASD, Whitby and Mancil (2009) concluded that areas such as basic reading, encoding, and rote skills are less impaired than reading comprehension, written expression, graphomotor skills, processing of complex materials in all academic domains, and problem solving. Furthermore, in many cases, deficits arose when academic requisites shifted from rote tasks to abstract tasks that demanded conceptual understanding.

Indeed, a recent study (Heumer & Mann, 2010) that evaluated *reading abilities* like decoding and comprehension in 384 children with ASD (CA = 10.08 years) in comparison to 100 children with dyslexia (CA = 11.2 years) yielded opposite profiles for the two groups regarding decoding and comprehension. The children with ASD showed good decoding skills but poor comprehension abilities, whereas the opposite profile emerged for the children with dyslexia. Other studies support this reading comprehension deficit in ASD (e.g., see reviews in Nation, Clarke, Wright, & Williams, 2006 and Randi, Newman, & Grigorenko, 2010). To read for understanding, readers must apply a wide array of cognitive abilities, such as inference and attention, motivational strategies, knowledge of vocabulary, and prior knowledge of the topic (Randi et al., 2010). Randi et al. (2010) pointed out that comprehension difficulties in ASD may stem from problems in integrating information with a coherent context, from general language impairments like difficulty in comprehending linguistic units beyond the word level, and, when reading longer texts, from memory dysfunction.

Underlying cognitive and sociocognitive deficits characterizing ASD such as ToM, EF, and weak central coherence (WCC) may also impair reading comprehension. WCC is a detail-oriented, overlooking-the-forest-for-the-trees cognitive style associated with children with ASD. Due to WCC, readers with ASD may tend to focus on single words rather than global meanings (e.g., Randi et al., 2010). This piecemeal processing may impair children's extraction of global configurations and higher level meanings, thereby resulting in a failure to understand and use contexts efficiently (e.g., Happé & Frith, 2006). Deficits in readers' ability to understand others' perspectives (ToM) may hinder comprehension of even simplistic, mundane texts because in ASD the understanding that communication enhances interpretation of intended meanings is deficient (Hale & Tager-Flusberg, 2005). Tager-Flusberg and Sullivan (1995) found that children with ASD showed difficulty in supplying appropriate mental-state explanations for story events, in comparison to children with TYP. Likewise, Losh and Capps (2003) reported that children with HFASD provided fewer explanations for characters' internal states, in comparison to children with TYP. EF deficits in ASD such as poor cognitive flexibility may hinder readers' ability to shift flexibly between phonological and semantic processing on the one hand and decoding and comprehension strategies on the other (Randi et al., 2010).

Hyperlexia is a term that denotes a disproportionate gap between superior word reading skills and poor reading comprehension skills (Cardoso-Martins & da Silva, 2010; Grigorenko, Volkmar, & Klin, 2003). There appears to be a higher frequency of hyperlexia among children with ASD in comparison to children with TYP or with other clinical disabilities, with 5% to 10%

of children on the spectrum exhibiting hyperlexia (Grigorenko et al., 2003). Many children with hyperlexia are described as having an unusual passion and interest for the printed word, and they may regard reading as a decoding process without emphasis on comprehension (Cardoso-Martins & da Silva, 2010).

Reading and writing are interrelated skills under the broad domain of literacy. *Writing* reflects the ability to form letters and words in order to communicate. It involves motor-graphic (handwriting) as well as cognitive capabilities, including planning, language, and orthographic abilities. In school, writing (like reading) is a cardinal skill, and after proficiency in forming the letters is achieved, a more complex process starts that includes higher order cognitive demands and compositions (Kushki, Chau, & Anagnostou, 2011). Despite its importance, writing skill in ASD is an overlooked topic. In a recent review (of seven papers), children with ASD were found to show poor handwriting skills, specifically lower legibility, poorer letter formation, and poorer handwriting quality than their peers with TYP (Kushki et al., 2011). Moreover, the processes that contribute to handwriting development, such as fine-motor skills, motor control, and visual-motor integration, were found to be impaired in ASD (Kushki et al., 2011). Poor quality of composition skills in narrative and expository texts was found in adults with ASD (CA = 25.75 years; Brown & Klein, 2011). Interestingly, ToM was found to be linked with writing quality and text length across both genres (narrative and expository), but future studies would do well to untangle composition skills in school-age children with ASD. In Myles-Smith et al. (2003), children with Asperger (CA = 11.7 years), given a standardized test of written language skills and handwriting legibility, demonstrated poorer handwriting skills than children with TYP (less legible letters and words). However, informal evaluation of written samples further revealed no group differences in written quantity or in use of grammatical rules, whereas the children with Asperger did have more difficulty producing qualitative writing than their peers with TYP.

Mathematic skills in ASD is an even a more overlooked topic of study than writing or reading. Computational mathematics skills are more intact than skills for solving complex mathematical problems, at least in HFASD (e.g., Whitby & Mancil, 2009). Cihak and Foust (2008) reported that when these students are taught mathematical skills, they can acquire functional activities such as counting, managing time, and money skills. Also, once competent in basic computational math, they can learn to manage banking, purchasing, and budgeting.

Summary

On the whole, the cognitive-academic domain is challenging for school students with ASD, who evidence difficulties mainly with regard to more complex tasks in areas such as information processing, memory, mathematics, reading, and writing. Moreover, abstract learning is more impaired than concrete tasks in ASD. Intervention studies aiming to enhance academic capabilities as well as additional studies that explore the academic profile of children with ASD are greatly needed (for expansion on cognitive-academic strategies and interventions, see Bauminger-Zviely & Kimhi, 2013b).

SUMMARY AND CONCLUSIONS

In this chapter, abilities and disabilities of school-age children with ASD in the sociocognitive, socio-communicative, RRB, and cognitive-academic domains were described. As seen along the chapter, even if children reveal progress in some areas during the transition to school, such as in language, many areas nevertheless require extensive support. In the social domains, teaching should focus on both social-emotional understanding as well as helping children develop productive peer interactive behaviors. Help in supporting peer friendship and peer interaction seems to be especially important because schoolchildren's social difficulties in peer interaction place them at risk for bullying and victimization by their peers, a circumstance that holds significant implications for their quality

of life and well-being (e.g., Cappadocia, Weiss, & Pepler, 2012). More adequate peer interaction, and especially friendship, may possibly lessen the risk for comorbid affective difficulties such as depression or anxiety (e.g., Cappadocia et al., 2012). In the cognitive-academic domains, help should be given with an emphasis on abstract learning, reading comprehension, solving mathematics problems, and supporting handwriting difficulties based on graphomotor challenges. Interventionists should also take into consideration these children's frequent comorbid psychiatric conditions (e.g., learning difficulties, attention-deficit/hyperactivity disorder, anxiety, and depression) as well as their unique characteristics in motor planning and sensory processing, which all affect these children's capabilities for learning both in the academic and the social spheres. Cognitive and sociocognitive underpinnings to the socioacademic deficit such as ToM and EF were also reviewed, as well as their influence on the unique way in which children with ASD process information. School-age children with ASD form a substantial portion (between 1% and 2%) of school-age children in general, with increasing rates along the recent years. All told, currently available research outcomes indicate the need for substantial emphasis on designing appropriate interventions that will support this population's multidimensional deficits in order to increase independence and productive functioning. Interventions aiming to facilitate functioning along the various domains reach beyond the focus of this chapter, but are covered extensively in other chapters in this *Handbook* (see Chapters 33–37, 40, and 47) as well as in Bauminger-Zviely (2013).

CROSS-REFERENCES

Chapter 1 addresses diagnostic issues and Chapter 2 the broader autism phenotype. Chapters 5, 7, and 8 focus on autism in infants and young children, adolescents, and adults. Chapters 30 through 37 address aspects of intervention relevant to school-age children with autism.

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