Language in children with autism spectrum disorders

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29.1 Introduction

Autism spectrum disorder (ASD) is a genetically linked, neurodevelopmental disorder characterized by impairments within the social-communication domain and the presence of stereotyped and repetitive interests or behaviours (American Psychiatric Association [APA] 2013). While previously referring to a group of pervasive developmental disorders (autism, Asperger’s disorder and Pervasive Developmental Disorder Not Otherwise Specified), ASD now serves as an umbrella term where severity levels are assigned. ASD is characteristically heterogeneous; that is, manifestation of impairments can vary greatly. For example, nonverbal IQ can range from meeting criteria for intellectual disability to within or above the normal range. While language impairment is not a diagnostic criterion for autism, deficits in language are often found – although heterogeneity is again pervasive. While some children with ASD acquire language comparable to typically developing (TD) peers, it has been reported that about 25 per cent remain nonverbal, never acquiring functional language (Tager-Flusberg, Paul & Lord 2005). Trajectories of language acquisition also vary, with some demonstrating typical but delayed development while others showing possible deviance (Eigsti, Bennetto & Dadlani 2007, Tek, Mesite, Fein & Naigles 2014). Lastly, for those who have language impairments, the language domain in which deficits are found (e.g. phonology, lexicon, syntax and pragmatics) can differ (Kelley 2011, Kjelgaard & Tager-Flusberg 2001). Impairment in pragmatics is most characteristic of individuals with autism, with the other domains showing more variability within and across children (Eigsti, de Marchena, Schuh & Kelley 2011). This chapter will review the development of each language subdomain by children with ASD, starting with prelinguistic markers and their role in predicting language outcomes. This will be followed with a discussion of...
the current methods and measures used to characterize language development in this population, and suggestions for future research directions.

29.2 Prelinguistic development

29.2.1 Social orienting

Because ASD is not diagnosed until children are aged 2–4 years, their infant communication abilities are not usually documented by researchers. However, two kinds of studies suggest that infants who are later diagnosed with ASD display communicative impairments prior to the onset of their first word. First, researchers have scrutinized home-recorded videos of the children prior to diagnosis (e.g. at their first birthday party), and observed that the children display less eye contact with and smiling at familiar adults, and fewer vocalizations (Osterling, Dawson & Munson 2002). Second, researchers have carried out a number of prospective studies of infant development, comparing infants at high risk for ASD (HR) because they have older siblings already so diagnosed, with infants at low risk for ASD (LR), who have unaffected older siblings. These studies have revealed that HR infants, especially those later diagnosed with ASD, showed less orienting to their own name (Zwaigenbaum et al. 2005) and fewer directed vocalizations (Ozonoff et al. 2010). Moreover, as a group these infants show a less consistent preference for speech over non-speech (Kuhl, Coffey-Corina, Padden & Dawson 2005). Analyses of individual differences have revealed that those HR infants who consistently prefer speech over non-speech have larger vocabularies and less severe autistic symptoms than those who prefer non-speech over speech (Curtin & Vouloumanos 2013, Paul, Chawarska, Fowler, Cicchetti & Volkmar 2007). Additional studies comparing LR and HR infants have investigated their early gestures and speech; these will be presented later in this chapter.

2.2 Joint attention

An enduring communication challenge for children with ASD concerns their ability to engage in triadic joint attention (JA); that is, to look an object or event in concert with a familiar adult, with indicators (e.g. gaze to the adult’s face) that they are aware of and, in fact, intend to engage in this joint attention. JA behaviour is usually described in terms of children’s responses to adult bids (RJA) or successful initiations via their own bids (IJA; Adamson, Bakeman, Deckner & Romanski 2009, Mundy, Sigman & Kasari 1990, Roos, McDuffie, Weismer & Gernsbacher 2008). JA may have a positive impact on language acquisition from a number of angles. From a cognitive perspective, children who efficiently shift their focus from objects or events to adults while the adults are producing speech relevant
to those objects/events may find it easier to map the speech (e.g. words) onto the meanings (e.g. object referents; Hoff & Naigles 2002, Mundy 2009). From a more social perspective, children who seek and respond to JA with adults may recognize the joint nature of communication and the role of intention discernment in said communications; discerning another’s intentions may allow children to discover linguistic meanings that may not be in plain sight (e.g. hidden objects) (Tamis-LeMonda, Kuchirko & Song 2014, Tomasello 1995).

Across the first five years of life, children with ASD consistently display less frequent and shorter periods of JA than their TD age- or language-matched peers (Bruinsma, Koegel & Koegel 2004, Mundy et al. 1990). With development and intervention, many children with ASD show significant improvements, with increases in the frequency of JA episodes overall as well as those accompanied by positive affect and by speech (Lawton & Kasari 2012, Morales et al. 2000). Interestingly, RJA and IJA seem to show different trajectories, with RJA improving and increasing in frequency well ahead of IJA (Mundy 2009, Mundy et al. 2007).

The overall heterogeneity of ASD is manifested in JA behaviours as well; therefore, researchers have investigated whether, akin to TD children (Baldwin & Meyer 2007), variation in children’s JA levels predicts variation in their subsequent language levels. A large number of studies have been performed (e.g. Kasari, Paparella, Freeman, Jahromi 2008, Luyster, Kadlec, Carter & Tager-Flusberg 2008, Mundy, Sigman, Ungerer & Sherman 1987, Mundy et al. 1990, Siller & Sigman 2008), with the consistent finding that children with more advanced JA skills – especially in RJA – have higher concurrent and subsequent language scores. A major drawback to these studies, though, is that almost all of them use an experimenter-administered standardized test, such as the Mullen Scales of Early Learning (MSEL; Mullen 1995), their outcome measure. These tests usually require the child to engage in JA; for example, s/he is shown a card with pictures on it, and must follow the administrator’s gaze or point to determine which images to describe or discriminate. It is possible, then, that the children’s scores on these language tasks are reflecting their concurrent JA abilities. More recent studies have employed similar language outcome measures to those used with TD children, including parental vocabulary checklists, spontaneous speech, and online eye-tracking comprehension tasks. These studies have the advantage of targeting more specific areas of language as well, and have found that children with ASD who demonstrate better or more sharply increasing JA over time go on to have larger vocabularies (Charman et al. 2003), use more varied word types in spontaneous speech (Kelty-Stephen, Tek, Fein & Naigles 2014), produce more varied syntactic constructions (Rollins & Snow 1998), and show more efficient comprehension of wh-questions and the ‘ing/ed’ aspectual contrast (J. Park, Tek, Fein & Naigles 2011). Hence, children with ASD...
who are able to engage in more JA are more likely to acquire a larger vocabulary and more complex syntax.

29.2.3 Gestures
The ability to use gestures (e.g. pointing, flapping hands to represent wings, nodding) may also impact language development in children with ASD. The gesture use of TD children has been shown to positively predict later vocabulary size as well as syntactic complexity (Rowe & Goldin-Meadow 2009a; also see Chapter 9). Gestures have both communicative and motor components, and motor deficits in children with ASD are also attested (Bhat, Landa & Galloway 2011, Gernsbacher, Sauer, Geye, Kees & Goldsmith 2008a). Indeed, motor delays and irregularities have been found to correlate with delays in language abilities in individuals with ASD across childhood. LeBarton and Iverson (2013) examined the fine motor skills of HR and LR infants from 12 to 24 months. Fine motor skill was evaluated through a parent interview that assessed, for example, the child’s ability to stack blocks, clap, draw horizontal/vertical lines and point. In general, HR infants scored significantly more poorly and had larger variability on fine motor measures compared to LR groups at 12, 18 and 24 months. Moreover, the infants who later received an autism diagnosis scored lower on fine motor measures at 18 months than HR infants who did not receive an autism diagnosis. A fine motor composite score, taking into account performance across the second year, was significantly correlated with later expressive language abilities at 36 months for the HR group, controlling for nonverbal IQ. Similarly, Stone and Yoder (2001) found that the expressive language of 4-year-old children with ASD was positively predicted by their motor imitation abilities at age 2. The number of imitative and play-based gestures (e.g. sweeping with a broom) that 2-year-olds with ASD produce has also been shown to positively predict their expressive and receptive language scores as late as 9 years of age, controlling for language scores at age 2 (Luyster, Qiu, Lopez & Lord 2007).

The extent to which the gestural difficulties of children with ASD – and so their relationships to later language – are attributable to their motor vs social/communication challenges is currently unclear. What we do know is that gesture continues to have atypical characteristics in children with ASD even into adolescence. For example, de Marchena and Eigsti (2010) examined the co-speech gestures of adolescents with ASD and found that, while the number and type of gestures that accompanied speech during a narrative task was similar between adolescents with ASD and TD controls, the narratives produced by the former were harder to follow and less engaging. This could be attributed to the asynchrony of gesture to speech in the ASD group; that is, the ASD group had longer absolute durations of their gestures compared to TD controls, so that their gestures began before and lasted after the co-speech.
29.3 Phonological development

Many aspects of phonological development seem relatively spared in children with ASD (Eigsti et al. 2011, Kjelgaard & Tager-Flusberg 2001). For example, TD infants commonly produce stops (e.g. /b/ in bat), nasals (e.g. /m/ in mommy) and glides (e.g. /w/ in wet) first, with affricatives (e.g. /ch/ in change) and liquids (e.g. /l/ in love) being produced later (Robb & Bleile 1994, Smit, Hand, Frelinger, Bernthal & Bird 1990). Schoen, Paul and Chawarska (2011) have found the same pattern in toddlers with ASD; that is, their most frequently produced consonants were stops and nasals. However, compared to age-matched TD controls, these toddlers with ASD produced significantly fewer late emerging consonants such as affricatives and liquids. This suggests that toddlers with ASD exhibit a delayed trajectory of phonological development rather than a deviant one. Typical but delayed patterns of consonant emergence have been observed in more severely language-delayed preschoolers with ASD as well (McCleery, Tully, Slevc & Schreibman 2006). Moreover, children with ASD do not seem to differ from developmentally delayed children in the proportion with which they produce canonical syllables (e.g. well-formed, speech-like sounds) (Sheinkopf, Mundy, Oller & Steffens 2000). The phonological errors of children with ASD also demonstrate a delayed rather than deviant trajectory. Cleland, Gibbon, Peppé, O’Hare and Rutherford (2010; see also McCleery et al. 2006) found that fewer than half of the children with ASD they studied made articulation errors. Moreover, among those who made errors, the total number of errors tended to be small; only 12 per cent of the children produced errors at frequencies out of the normal range. Finally, the most common errors were developmentally appropriate for their language age (e.g. replacing a liquid with a glide as in wabbit for rabbit).

It should also be noted, however, that speech production for individuals with ASD is not comparable to that of TD children on all accounts. The toddlers studied by Schoen et al. (2011) produced more atypical vocalizations (i.e., squeals), and also more non-English blends (e.g. /vw/) compared to both language- and age-matched groups. Sheinkopf et al. (2000) similarly found a higher portion of syllables with atypical vocal quality (e.g. use of abnormally long vowels, growls, squeals, etc.) in their autism group. These findings suggest that children with ASD have the ability to produce phonological forms like their TD peers, but have more difficulty suppressing the use of nonspeech sounds; this latter difficulty may be related to previous findings (see Section 29.2.1) of the diminished interest in speech in this population.

However, the notion that individuals with autism display delayed but not deviant phonological and phonetic development is not uncontested. Using an automated system to analyse children’s vocalizations, Oller et al. (2010) were able to differentiate between typical and atypical populations (including a language delayed group and a group with autism) in a
hierarchical cluster analysis using four acoustic feature groups: rhythm/syllabicity, high pitch control, low pitch control and duration of vocalizations. Correlations among the four feature groups also differed between the TD children and those with ASD. This suggests that organization of phonological and phonetic forms may differ between TD children and children with ASD. Moreover, Rapin, Dunn, Allen, Stevens and Fein (2009) found two distinct clusters of children with ASD, who were characterized by impairments in their expressive phonological abilities; these children (24 per cent of the total sample) performed near or at floor levels on standard measures of articulation. This is a higher percentage than observed by Cleland et al. (2010); however, a subgroup of children in the Cleland et al. sample did make developmentally inappropriate errors (e.g. a backing error, where a fronted segment such as /d/ in dog is replaced with a back segment /g/ to produce gog). These children accounted for 20 per cent of the total sample. Taken together, these findings suggest that while most children with ASD have intact phonology and phonetics, there is also a subgroup that has profound deficits in these areas.

Research investigating the perception of auditory phonemes in children with ASD has also yielded somewhat mixed findings. Because of their difficulties with behavioural responses, most studies examining speech perception in children with ASD have involved neurophysiological measures. For example, Kemner, Verbaten, Cuperus, Camfferman and van Engeland (1995) examined ERP responses (see Chapter 4 for definitions) to the detection of vowel changes and found that children with ASD (mean age of 9.8 years) had similar MMN and N1 responses (e.g. early pre-attentive electrophysiological responses to changes in stimuli) compared to age-matched TD and two developmentally delayed groups (i.e. ADHD and dyslexia). Similarly, HR and LR infants did not differ in their P150 response (e.g. a response to deviant stimuli occurring between 150 and 300ms after stimulus onset) to the perception of native (i.e. /d̪a/ and /ta/) and non-native contrasts (i.e. /da/ with a retroflex d and /da/ with a dental d; Seery, Vogel-Farley, Tager-Flusberg & Nelson 2013). In contrast, Kuhl et al. (2005) found that only the 2- to 4-year old children with ASD who previously showed preference for speech over nonspeech also demonstrated differential MMN responses to a consonant change (i.e., from /wa/ to /ba/); those with a nonspeech preference exhibited no MMN. Disparity among these studies may be attributed to differences in the populations examined, with Kuhl et al. (2005) examining younger children compared to Kemner et al. (1995), and Seery et al. (2013) examining HR infants. It is also possible that Kuhl et al.’s (2005) sample included some children who had phonological deficits in production as well (Rapin et al. 2009).

Overall, though, segmental phonology seems relatively intact in children with ASD; however, prosody is commonly observed to be impaired (see Diehl & Berkovits 2010 for a review). Expressive prosody across individuals with ASD has often been described as monotonous, pedantic (e.g.
with a limited pitch range), and/or variable, and sing-songy (e.g. with a wide pitch range). Incorrect use of stress on words (e.g. putting stress on the second syllable of *rhino* rather on the first) has also been reported (McCann & Peppe 2003). Receptive prosody, such as understanding affect and differentiating between statements and question, also seems impaired in children in this population (Peppe, McCann, Gibbon, O’Hare & Rutherford 2007). Importantly, it does not appear that a specific type of deficit in prosody characterizes individuals with ASD. Rather, atypicality regarding how prosody is used has been found to vary greatly among ASD groups in both production and comprehension (Peppe et al. 2007). More recent work using acoustic analysis, however, has, for example, found that high-functioning individuals had a larger pitch range compared to TD controls in specific formants of their speech while those with lower language function (defined by scoring below average on a vocabulary assessment and a previous history of language delay) had a narrower pitch range, suggesting that groups may be differentiated in the future by more subtle acoustic measurements (DePape, Chen, Hall & Trainor 2012).

### 29.4 Lexical development

Research on lexical development in children with ASD has studied their vocabulary growth and composition, their manifestations of several principles of word learning, and their levels of semantic organization.

#### 29.4.1 Vocabulary growth and composition

Most studies have found patterns of lexical development in ASD that are similar to those observed in TD. In the first longitudinal study of language development in children with ASD, Tager-Flusberg and colleagues (1990) reported that lexical diversity in spontaneous speech – i.e. using different classes of words – increased for all six children. Similarly, Eigsti et al.’s (2007) observations of the spontaneous speech of 5-year-olds with ASD found that these children were like their TD language-matched peers in vocabulary size and diversity of word use. Most recently, Rescorla and Safyer (2013) analysed in detail the first words toddlers were reported by their parents to say. Vocabulary composition of the first 100 words was remarkably similar for TD and ASD groups (mostly labels for food, body parts and people); however, vocabulary composition of lexicons of greater than 100 words began to differ by group, with children with ASD producing fewer words for e.g. actions and household items. Other studies have reported TD-ASD similarities only for a specific subgroup of children with ASD. For example, Tek et al. (2014) recorded toddlers’ spontaneous speech during six visits collected over two years, and divided the children into high-verbal (HV) and low-verbal (LV) subgroups based on their
standardized test scores at visit 6. Growth curves of the HV children’s use of noun and verb types increased in parallel with those of TD children; however, growth curves of the LV children’s usage were significantly shallower. Similarly, Kuhl et al. (2013) found that the ERPs of LR toddlers listening to familiar words were localized in the left hemisphere, whereas those of HR toddlers exhibited a more diffuse pattern of activation across the cortex. In an investigation of individual differences, Venker, Eernisse, Saffran and Weismer (2013) analysed 5-year-olds’ eye movements when asked to match words with pictures (i.e. looking-while-listening; Swingley 2012); children with ASD who were faster to look first at the matching scene had had higher vocabulary scores on standardized tests when they were 3 years of age.

29.4.2 Word learning strategies
The above similarities suggest that children with ASD acquire words using the same or similar strategies to TD children; however, explicit tasks testing these strategies have revealed both similarities and differences. The most basic strategies, such as the noun bias and mutual exclusivity (Markman 1989, Waxman & Hall 1993) have been attested in children with ASD. That is, when preschoolers with ASD see a scene including a novel object and action and hear a novel word that could refer to either (e.g. toopen), they choose (i.e. look longer at) the novel object as the referent of the word (Swensen, Kelley, Fein & Naigles 2007, Tek, Jaffery, Fein & Naigles 2008). Moreover, children with ASD ranging from 2 to school age have demonstrated mutual exclusivity, such that they pick the unnamed object (of an array also including named/familiar objects) as the referent of a novel word at above chance levels (Bedford et al. 2013, de Marchena, Eigsti, Worek, Ono & Snedeker 2011, Preissler & Carey 2005). Another strategy seen in preschool-aged children with ASD is the use of syntax for verb learning (i.e. syntactic bootstrapping). That is, children were shown videos of causative and noncausative actions performed simultaneously; these were paired with novel verbs in transitive sentences (e.g. The duck is gorping the bunny). When the two actions were separated and the children with ASD were asked to find gorping, they pointed to or looked longer at the causative actions, showing that they had used the sentence frame to focus on one of the two actions (Naigles, Kelty, Jaffery & Fein 2011, with 2- to 3-year-old English learners with ASD; Shulman & Guberman 2007, with 5-year-old Hebrew learners with ASD).

Not surprisingly, the use of social cues in word learning is more problematic for children with ASD. For example, Parish-Morris, Hennon, Hirsh-Pasek, Golinkoff and Tager-Flusberg (2007) demonstrated that 5-year-olds (with ‘vocabulary ages’ of 21 months) fast-mapped novel words to novel objects when the objects were salient and touches and points were used to highlight them; however, when the objects were hidden and the children
needed to use the experimenter’s eye gaze to determine reference, they performed at chance (see also Norbury, Griffiths & Nation 2010). Hani, Gonzalez-Barrero and Nadig (2013) recently replicated this task with toddlers with ASD but found that these children were able to determine reference via experimenter looking and pointing, even when the designated object was less salient than others in view. Bedford et al. (2013) included a feedback condition to their fast-mapping task; interestingly, LR but not HR toddlers appeared to take advantage of this feedback such that they altered their choices when informed that they had made an error.

More surprising are the difficulties that children with ASD appear to have using the shape bias (Smith 2000) to learn new words. Tek et al. (2008) presented novel objects to toddlers with ASD, paired with a novel noun, and examined whether the children extended this label to new objects of the same shape vs colour. Whereas TD toddlers as young as 24 months of age showed the expected preference to extend the labels to same-shape objects, language-matched children with ASD did not, even after multiple presentations over the course of two years. A recent follow-up of this study, now including over twice as many children, has still found little evidence for a shape bias in most of the children with ASD (Potrzeba, Tek, Fein & Naigles 2014).

29.4.3 Semantic organization
One of the most important factors in being able to categorize is being able to form the idea of what a prototypical member of the category is like; e.g. most TD North Americans would assert that a robin is a prototypical bird, while a kiwi is not. TD individuals implicitly extract prototypical features when learning a new category (Deng & Sloutsky 2012, Klinger & Dawson 2001), processing prototypical instances more quickly and accurately than atypical instances. In contrast, school-age children with ASD have been found to reject the prototypical exemplars of a dot-pattern category as members of the category more frequently than their TD peers (Church et al. 2010); moreover, in a verbal fluency task they produced more atypical items (e.g. yak, ocelot) than TD peers (Dunn, Gomes & Sebastian 1996). They also did not show the usual ‘deviance-detecting’ ERP response (i.e. N400) when hearing out-of-category names (Dunn & Bates 2005). These studies suggest that children with ASD have difficulties extracting similar features across exemplars, and/or using the frequency of occurrence of said features and exemplars, to form family resemblance or prototype semantic structures. However, with an older and higher-functioning sample engaged in a similar verbal fluency task, Inokuchi and Kamio (2013) found adolescents with ASD did produce more typical than atypical instances. Moreover, Gastgeb, Strauss and Minshew (2006) asked school age children and adolescents from both TD and ASD groups to judge whether images of typical, somewhat typical and atypical exemplars
were instances of a named category (e.g. cat or chair). Both groups were less accurate with and responded more slowly to the atypical than typical items; this pattern of results implicates the presence of some category structure because participants distinguished the instances based on relative familiarity and/or similarity with some stored representation.

Lexical priming (i.e. responding more quickly to doctor after hearing nurse) is another index of semantic organization. Some studies have found impairments in children with ASD; for example, Kamio, Robins, Kelley, Swainson and Fein (2007) found no speeded responding for semantically related targets over nonrelated ones in adolescents with ASD (see also Kamio & Toichi 2000). In contrast, Norbury (2005) asked school age and adolescent children with ASD to interpret ambiguous words (e.g. bank) in neutral vs biased contexts (e.g. the boy ran vs fished from the bank); like the TD controls, the children with ASD showed increased accuracy and decreased response times in biased contexts. Such context effects indicate that the children recognized – and so had formed – semantic relationships between the biasing verbs and target nouns.

Finally, McGregor et al. (2012) reported that school-age children with ASD provided poorer definitions of words and more superficial word associations, than their nonverbal-age-matched TD peers. And Naigles, Kelley, Troyb and Fein (2013) assessed the categorical induction abilities of school-age children with ASD, asking them how the properties of individual objects could be extended to new instances with the same labels. For example, if a group of homogeneous (but not identical) green snakes had blue eyes while a group of diverse snakes had grey eyes, would a new different-looking snake have blue eyes or grey eyes? Both TD children and those with HFA chose the more diverse group at above-chance levels, but the children with HFA were significantly less consistent across items than the TD group.

### 29.5 Grammatical development

As with their phonology and lexicons, the grammar of children with ASD looks intact in some ways but impaired in others. Several studies have found that children with ASD demonstrate similar patterns and processes of grammatical development as language-matched TD children: Tager-Flusberg’s et al. (1990) original study of grammatical development in six boys with ASD reported increases in MLU over time, as well as increases in the percent of words that were verbs and closed class grammatical items (e.g. prepositions). More recently, Tek et al. (2014) extended these findings to most of Brown’s (1973) fourteen grammatical morphemes, reporting that high-verbal preschoolers with ASD showed increased usage of the progressive, regular and irregular past, auxiliaries, third person singular, the copula and on, as well as increasing MLU and wh-question complexity,
over the two years these children were recorded. Their growth curves of these morphemes did not differ from those of TD children. In contrast, the group of low-verbal preschoolers with ASD, while also showing increased usage of in, the plural, articles, and the copula over the two-year period, had significantly shallower growth curves than those of the TD or high-verbal groups. Although not strictly developmental studies, several research groups have reported that the ranked order of acquisition of English grammatical morphemes – generally ordered by degree of consistent use in obligatory contexts at a single session – was similar for children with ASD and TD children (Bartolucci, Pierce & Streiner 1980, Howlin 1984, Park, Yelland, Taffe & Gray 2012). However, one study of children’s spontaneous speech has suggested atypical developmental patterning: Eigsti et al. (2007) calculated the IPSyn scores of 5-year-olds with ASD, and found that some children used more complex forms without also producing less complex forms (e.g. saying *What does it do?* without also saying *What is it?). Such findings point to the need for more longitudinal studies with children with a wide range of language abilities, to discover when and with which children such ‘developmental scatter’ occurs.

Comprehension studies using Intermodal Preferential Looking (Naigles & Tovar 2012) have demonstrated that toddlers and preschoolers with ASD understand both simple (SVO word order) and more complex (subject and object wh-questions) English constructions; moreover, reliable comprehension can be seen developmentally earlier than the children are observed to produce these structures in spontaneous speech (Goodwin, Fein & Naigles 2012, Swensen et al. 2007). Interestingly, reliable comprehension of these wh-questions was observed in the children with ASD only when they achieved general language levels similar to those of successfully comprehending (but younger) TD children. Demonstrations of children with ASD’s comprehension of grammatical constructions prior to producing them also suggests similarities with TD children, because the comprehension-before-production phenomenon is pervasive in the typical population (Maratsos 1998, Snyder 2011) and indicates that children with ASD are doing some processing of their linguistic input – and so learning about grammatical structures and patterns – without having to produce these structures first.

In contrast, when the sheer frequency of production of grammatical morphemes is compared across language-matched TD and ASD groups, children with ASD have shown selective impairments. For example, preschoolers with ASD produced fewer progressive, plural, and third-person singular forms than their TD peers, although not fewer past tense forms (Park et al. 2012). Among school-age children with ASD, between 7 and 14 years old, omissions of the third-person singular (Tager-Flusberg 2006) and progressive and regular past (Bartolucci et al. 1980, Howlin 1984) morphemes have been observed; moreover, a study of elicited production found that some children with ASD (with a wide age range: 5 to 15 years) omitted the past tense and third person singular more than half the time.
(Roberts, Rice & Tager-Flusberg 2004). Because this pattern of omissions resembles that of children with Specific Language Impairment (SLI; e.g. more frequent for verbal than for nominal morphology), the suggestion has been made that one subgroup of children with ASD has comorbid SLI whereas another subgroup has typical grammatical development (Roberts et al. 2004, Tager-Flusberg & Joseph 2003).

The resemblance of children with ASD to those with SLI is not pervasive, though; for example, language regression (when children who have made some progress in language development subsequently stop using speech) is reported to occur at high rates in children with ASD but is very rare in children with SLI (Pickles et al. 2009). Moreover, Williams, Botting and Boucher (2008) have pointed out that the errors in Roberts et al.’s (2004) elicited production task were more likely to be null or inappropriate responses rather than bare stems, and that the sheer rate of omissions in the spontaneous speech of children with ASD is much lower (10–25 per cent) than that of (vocabulary-matched) children with SLI (around 40–50 per cent). In addition, recent investigations of children with ASD’s comprehension of the progressive and past morphemes has revealed good performance, where 4-year-olds are able to match verbs with the progressive marker to ongoing activities and verbs with the past morpheme to completed actions (Tovar, Fein & Naigles 2012). Thus, the omission rate of grammatical morphemes in children with ASD may not implicate a genuine difficulty with acquiring these morphemes; the bases of the omissions have yet to be completely explained.

One area of grammar, involving personal pronoun use, has yielded consistent reports of commission errors. Pronoun reversals (i.e. using I for you) were reported in the first descriptions of autism (Kanner 1943), and are consistently attested in the speech of verbal children with ASD. Rates of pronoun reversal vary widely, though, with some researchers reporting rates as high as 50 per cent (Evans & Demuth 2012) and as low as 7–13 per cent (Cheng, Khetrapal, Demuth, Fein & Naigles 2012, Tager-Flusberg 1994). Given children with ASD’s documented difficulties with social interaction and social communication, a logical interpretation of these errors is that the children with ASD are confused about the role-dependence of these pronouns. That is, mature language users know that proper names consistently refer to the same person regardless of role whereas I is used by speakers about themselves and you is used by speakers about addressees. If a child has difficulty realizing that the same word can be used self-referentially by different people, and s/he hears their mother frequently refer to herself as I and the child as you, then s/he might indeed overuse I for you and you for I. However, children with ASD who reverse pronouns in production nonetheless usually interpret them correctly in comprehension tasks (Jordan 1989, Lee, Hobson & Chiat 1994). Moreover, high rates of pronoun reversal have been observed in TD children as well as linguistically precocious children (Dale & Crain-Thoreson 1993). And a recent
longitudinal investigation of the early predictors of pronoun reversal found that children with ASD who had lower vocabulary levels – but not necessarily lower socialization scores – produced more pronoun reversals (Cheng et al. 2012). It is possible, then, that pronoun reversals are more an indicator of linguistic than social immaturity.

Given the attested echolalia and documented difficulties with abstraction in the ASD population (Minshew, Meyer & Goldstein 2002), the question arises whether their use of grammar is productive and/or indicative of rule use. That is, children with ASD who are producing relatively long utterances may ‘just’ be imitating sentences they have heard before. However, Tager-Flusberg and Calkins (1990) found that children with ASD’s imitated utterances were not longer or more complex than their spontaneous utterances; this point has been buttressed by more recent studies directly examining rule use and productivity in children with ASD.

For example, Naigles et al. (2011) demonstrated that 3-year-old preschoolers with ASD had abstracted the SVO sentence frame, because they consistently assigned novel verbs in this frame to causative meanings (i.e. syntactic bootstrapping, see also Chapter 13). Allen, Haywood, Rajendran and Branigan (2011) have demonstrated syntactic priming in school age children with ASD, even with complex and infrequent passive constructions. That is, when experimenters described scenes using passive sentences, the children were more likely to do the same – even when describing different scenes and so using different lexical items. Park et al. (2012) asked 3- to 6-year-olds with ASD to affix grammatical morphemes to novel nouns and verbs (i.e. the ‘wug’ test) and found consistently correct performance with both the plural and the progressive morphemes. And Chin et al. (2013) have observed several spontaneous overgeneralizations of the past tense (e.g. threwed, dided) in one child with ASD from whom a large corpus of home-based interactions (34 hours over four months) was recorded.

Only a few studies have investigated more complex grammatical constructions in children with ASD. Perovic, Modyanova and Wexler (2013) compared both high-verbal (ASD-LN) and language-impaired children with ASD (ASD-LI) between 6 and 17 years old, with language-matched TD children, in a picture-pointing task assessing comprehension of possessives (Lisa’s mom is waving a flag), pronouns (Bert’s dad is washing him) and reflexives (Bert’s dad is washing himself). The TD and ASD-LN children performed better than the ASD-LI children on all three types of sentences; however, the ASD-LI children had particular difficulties with the reflexives. It is interesting that the children with ASD who were learning Greek in Terzi, Marinis, Francis and Kotsopoulou (2014) showed little difficulty with reflexives but more difficulty with clitic pronouns. The study of syntax in children with ASD is ripe for further and more detailed cross-linguistic investigations.
29.6 Pragmatic development

Difficulty with pragmatic use of language is the most consistent language-related characteristic of individuals with ASD (Happe, 1995, Turner 2008; see also Chapter 20) and is highly correlated with autism symptomology (Hale & Tager-Flusberg 2005a, Nadig, Lee, Singh, Bosshart & Ozonoff 2010). First we cover non-literal or figurative language (e.g. understanding irony and metaphors) and inferential language (requiring the speaker to understand what was implicitly implied in the utterance). We then look at two other areas of pragmatics: narrative function (successfully telling a story in a coherent manner) and discourse function (successfully engaging in a conversation through the use of strategies such as topic-maintenance and repairs). In Section 29.6.3 we consider strengths in pragmatic use of language. As pragmatics functioning involves knowledge beyond the syntactic and semantic levels, assessing pragmatics requires some level of competency in these areas of language. As such, the studies covered here involve only high-functioning children with ASD who are matched on language level with TD peers.

29.6.1 Figurative and inferential language

Dennis, Lazenby and Lockyer (2001) reported deficits in the understanding of figurative language (e.g. metaphors) in children with ASD. More recently, Rundblad and Annaz (2010) asked TD school-age children and language-matched children with ASD to interpret literal and metaphorical utterances in stories (e.g. whether the flood a character saw referred to a flood of people or a flood of a river). Within the age range of 5 to 11 years, older TD children performed better than younger children on this task; however, within the same age range, children with ASD performed more poorly, at close to floor levels.

School-age children with ASD also frequently have difficulty explaining the meanings and intentions underlying the figurative utterances that speakers produce (MacKay & Shaw 2004). For example, in a study of 8- to 11-year-olds by MacKay and Shaw (2004) children were told ‘Eve tells Adam that she has thousands of CDs’ (e.g. hyperbole), and asked, ‘How many CDs did Eve have? And why would Eve say “thousands” if she didn’t actually have thousands?’ Children with ASD performed more poorly than TD controls, matched on age and receptive vocabulary, with utterances that contained hyperbole, metonymy, and irony, frequently providing meanings that were literal interpretations. Understatements (e.g. a child in a hospital saying It was just a scratch) were the only figurative device with which both groups performed well. Additionally, the ASD group was uniformly impaired in their ability to articulate the intentions underlying the use of figurative devices (e.g. in the above story, that Eve wanted to show off).
In contrast, tasks that do not require verbal responses have elicited better performance with figurative language. Pexman et al. (2011) presented 10-year-olds with ASD with a series of puppet demonstrations that involved a speaker commenting on the performance of an actor. The speaker provided a literal criticism, an ironic criticism (e.g. *That was a great play* when the character missed a goal), a literal compliment, or an ironic compliment (e.g. *That was a terrible play* when the character scored a goal). Children evaluated speaker intention and belief by labeling the speaker as either a nice (duck) puppet or a mean (shark) puppet. Children evaluated the function of the utterance (e.g. to be serious for literal or humorous for irony) by a humour rating face scale. Similarly to expressive language- and age-matched TD control groups, the children with ASD successfully mapped criticism onto the shark puppet and literal compliments onto the duck puppet. All groups had difficulty mapping ironic compliments onto the nice/duck puppet. It appears, then, that by removing the demands of a verbal response, children with ASD were able to show comparable comprehension of irony, contrary to MacKay and Shaw (2004). However, understanding of the function of irony was still impaired for these children: overall, they chose more serious faces for ironic criticism utterances compared to both TD groups, who understood that irony was used as a humour device.

Assessments of inferential language have revealed similar patterns, with children with ASD demonstrating some understanding of the meanings but having difficulty in explaining the speakers’ intents (Loukusa et al. 2007, MacKay & Shaw 2004). For example, children with ASD in MacKay and Shaw (2004) were able to articulate the contextually appropriate meanings of indirect requests (e.g. *The cake looks delicious*) and rhetorical questions (Are you trying to get yourself killed?), but were unable to explain why speakers might use these devices. However, this is not to say that children with ASD do not understand any speaker intention. Capps, Kehres and Sigman (1998) found when 8-year-old children with ASD were asked indirect open-ended questions (e.g. *Can you tell me what happened at school today*), they provided elaborations rather than simply answering yes or no. This demonstrates that they were not treating the question in the literal sense but rather, were able to grasp that the intent of the speaker was to elicit more information from them.

### 29.6.2 Narrative and discourse function

Pragmatic difficulties across larger and more extended contexts are also commonly observed in this population. For example, when telling stories, children with ASD have been found to refer to characters inconsistently (and inappropriately) across clauses (and appear to continue to struggle with referential expressions into adulthood; Colle, Baron-Cohen, Wheelwright & van der Lely 2008). That is, use of a pronoun rather than the full noun phrase for a more prominent character indicates that both
listener and hearer are assumed to know this referent; however, 6- to
15-year-old children with ASD have been observed to use definite articles
to first introduce a character, or proper names for characters not in
common ground, at higher rates than TD groups matched on verbal ability
(Norbury, Gemmell & Paul 2014; see also Arnold, Bennetto & Diehl 2009
and Chapter 21 for research with TD populations).

Successfully producing a narrative also requires the speaker to maintain
the same themes and topic throughout the story. Losh and Capps (2003)
compared the telling of personal (e.g. friends, family and favourite things
to do) as well as more structured, storybook narratives (i.e. elicited from
Frog, Where Are You?; Mayer 1969) by children with ASD aged between 8 and
14 years old. To some extent, the ASD group was comparable to TD con-
trols (matched on verbal IQ) in length of the narratives and in the number
and types of syntactic devices (e.g. coordinate clauses and verb comple-
ments) produced. However, when producing personal narratives, children
with ASD used a more limited number of such syntactic devices and also
produced more irrelevant comments compared to TD controls. This sug-
gests that narratives produced by some children appear more stilted.
Additionally, they also produced fewer causal explanations (e.g. the internal
states of different characters) and links for both types of narratives; these are particularly important as they help connect different events into
a cohesive story. Difficulties in linking and organizing events together and
production of contextually irrelevant information were also found by

Engaging in a conversation, like producing a narrative, requires the
ability to relate new utterances to an overarching topic. The conversations
of children with ASD often involve irrelevant or idiosyncratic elaborations
as well as verbatim repetitions of the speech of the conversational partner.
For example, Nadig et al. (2010) found that when engaging in conversation
with an experimenter, high-functioning children with ASD (with a mean
age of 11 years) provided significantly fewer contingent elaborations and
responses compared to the language-matched TD group. The ASD group
only made more elaborations on topics that were introduced by themselves,
and of personal interest (see also Adams, Green, Gilchrist & Cox
2002). Interestingly, Capps et al. (1998) reported that 11-year-old children
with ASD included fewer personal narratives when engaging in a semi-
structured conversation about vacation, friends and school compared to a
developmentally delayed group matched on IQ and language age; they also
engaged in less nodding when their partner was speaking. Together, these
findings point to a reliance on scripts when engaging in conversations on
generic topics, whereas when the topic can be of personal interest, chil-
dren with ASD have difficulty aligning with their partner’s perspective.

It should be noted that all individuals with ASD in these studies pro-
duced a similar number of utterances to control groups. This suggests that
when engaging in a discourse, children with ASD are responsive to the
amount of speech they should produce. Their deficit seems to lie in the character of their responses. More specifically, their difficulty is in providing information that is relevant to the context at hand and this appears to be modulated by the discourse subject matter. Additionally, it seems to persist across development.

29.6.3 Strengths in pragmatic use of language
It is important to point out that children with ASD do perform appropriately with regard to some areas of pragmatics. For example, 10-year-old children with ASD studied by Volden (2004) demonstrated comparable abilities of conversational repair when encountering requests for clarifications compared to language-matched TD children. Both groups shifted from providing repetitions of their previous statement to giving more information when further prompted by interlocutors for clarification. Both groups also used an increasing number of gestures (e.g. pointing) and suprasegmental elements (e.g. slowed-down speech) with additional requests. Thus, children with ASD can show some sensitivity to the amount of knowledge an addressee has regarding the conversation at hand, and can use appropriate strategies to amend missing information.

Similarly, children with ASD have demonstrated sensitivity to the linguistic competence or needs of their addressees. School-aged children and adolescents with ASD (between 6 and 16 years old) studied by Volden, Magill-Evans, Goulden and Clarke (2007) used fewer utterances but included a greater proportion of core acts when describing events to a baby puppet or to a puppet that was described as a non-native speaker of English, compared to their descriptions to a peer puppet. Moreover, 6- to 16-year-old children with ASD were able to adjust their language when making requests, using more permission directives (e.g. May I take a candy?) and more politeness markers (e.g. please) when prompted to talk nicely to an old lady puppet, and more imperatives and aggravators (e.g. threats) when prompted to talk in a bossy way to a peer puppet (Volden & Sorenson 2009). These findings demonstrate that children with ASD are sensitive to the language competence of different speakers, are able to produce different syntactic structures for the same speech act, and can match the appropriate syntactic structure to the competence level of the speaker (see also Capps et al. 1998).

29.7 Methods
In this chapter we have illustrated many examples of the heterogeneity of children with ASD with respect to language, both within and across domains. One source of the variable characterizations may lie in the different methodologies employed across studies. Children with ASD are
usually administered standardized tests of language as part of their diagnostic battery. Depending on the child’s age and level of functioning, these might include tests such as the Mullen Scales of Early Learning (Mullen 1995), the Peabody Picture Vocabulary Test, third edition (PPVT-3; Dunn & Dunn 1997), the Expressive Vocabulary Test (EVT; Williams 1997), and/or the CELF (Semel, Wiig & Secord 1995). These tests yield scores that situate each child in relation to the range of performance of typically developing children, and so provide a general ‘snapshot’ of where s/he might be in the process of language development. As such, they are useful for clinicians who are developing an intervention plan. However, they are less informative for researchers who are attempting to determine just which aspects of language might be impaired vs intact, and/or developing typically vs atypically. For example, most standardized language assessments include just a few items – sometimes only one – assessing any given language construct (e.g. past tense, relative clauses, prepositional phrases); hence, item analyses (and so, construction analyses) have little power to distinguish among atypical populations (Spaulding 2012). Moreover, vocabulary assessments usually present pictures as the referents for the words being tested, which are most appropriate for investigating concrete words, and possibly only concrete nouns. Static pictures are also problematic for assessing the language associated with dynamic relationships (e.g. verbs and grammatical constructions) because these require the child to recognize and understand the artistic conventions used to represent motion and action (see Hirsh-Pasek & Golinkoff 1996 for a discussion of how these conventions are also challenging for TD infants and toddlers).

One prime example of the challenge of interpreting the scores of standardized tests comes from a frequently reported ‘expressive language advantage’ for young children with ASD (e.g. Hudry et al. 2014, Maljaars, Noens, Scholte & van Berckelaer-Onnes 2012, Paul, Chawarska, Cicchetti & Volkmar 2008, Weismer, Lord & Esler 2010). That is, children with ASD are reported to have better expressive language skills than receptive language skills, because their language production scores are higher than their language comprehension scores on many standardized assessments. For researchers of ‘typical’ child language, this is a counterintuitive finding: how can children produce what they do not understand? Some of the expressive/receptive language asymmetry can be traced to the echolalia that is often observed in children with ASD, which occurs when they repeat words and phrases just produced by others in the scene – or heard on videos – rather than providing topic-appropriate continuations of the current conversation (Sterponi & Shankey 2014, Tager-Flusberg & Calkins 1990). However, the assumption is that the expressive-language tests are not tapping echolalia; instead, the children are proposed to have ‘uneven’ language profiles, such that they do not understand some of the words and constructions they are producing (Maljaars et al. 2012).
The standardized tests, themselves, have several constraints that may help explain these puzzling findings. For example, tests which assess expressive language often use an easier stimulus–response format, whereas receptive language tasks involve multiple demands on working memory, the ability to scan all alternatives, the ability to deliberately reject similar alternatives, and good motor coordination for pointing tasks – all of which are known to be impaired in children with ASD. Moreover, standardized receptive language tests may include fewer items than their expressive language counterparts, such that missing one item on the receptive part leads to a relatively larger decrement in scoring (Kjelgaard & Tager-Flusberg 2001, Weismer et al. 2010). Furthermore, the expressive and receptive versions of the same test (e.g. the MSEL) do not uniformly assess the same constructs. For example, the expressive version of the MSEL includes many more vocabulary items than the receptive version; hence, children who are started at certain ‘basal’ levels are tested on more (potentially problematic) grammatical constructs in the receptive version than in the expressive version. Finally, a diminished receptive-language advantage has also been observed using tests that tap parental report, such as vocabulary checklists (Charman et al. 2003). Parent reports do not suffer from the same constraints as experimenter-administered tests; however, parents may also underestimate children’s receptive language because they may find it harder to discern which words their children with ASD understand. That is, because children with ASD may not provide obvious cues of comprehension such as compliance with directive shifts of attention, parents may not fully realize which words their children actually understand (Gernsbacher, Stevenson, Khandakar & Goldsmith 2008b). For all of these reasons, the purported ‘expressive language advantage’ of children with ASD should be treated very cautiously.

Task demands may also illuminate the relative strengths and weaknesses found in pragmatic functioning in children with ASD. For example, while MacKay and Shaw (2004) found that children with ASD have difficulty understanding irony, removing the demand of a verbal response appeared to improved performance (Pexman et al. 2011). Similarly, with additional prompting, thereby reducing some processing demands, children with ASD were able to produce more clarifications (Volden 2004), and further adjusted their register to correspond with the competence level of the speaker (Volden et al. 2007). As such, variation in executive functions (e.g. working memory) appears to be playing a role in the variation in pragmatic difficulties found in children with ASD (Turner 2008, Volden & Sorenson 2009, Volden et al. 2007).

Recently, new paradigms assessing the language production and comprehension of children with ASD have been developed; these paradigms specifically avoid the social and executive function difficulties inherent to ASD. For example, detailed analyses of language production can be
conducted based on naturalistic or semi-structured interactions between the children with ASD and familiar adults (Tager-Flusberg et al. 2009). These interactions usually provide enough data to support lexical, grammatical and pragmatic analyses, and the participation of familiar adults usually enables speech that is close to the children’s ability level. Recent studies have revealed intriguing detail about the grammatical abilities of children with ASD, such as the ‘developmental scatter’ observed by Eigsti et al. (2007) with respect to question forms, the truncated acquisition of Brown’s (1973) fourteen grammatical morphemes observed by Park et al. (2012), which appeared as two distinct developmental trajectories in Tek et al. (2014), and the different levels of sophistication for conversations versus narratives observed by Kover and Abbeduto (2010).

Newer paradigms assessing the language comprehension of children with ASD have borrowed methods employed with very young TD children, such as intermodal preferential looking (IPL; Piotroski & Naigles 2012) and looking while listening (Swingley 2012). In these paradigms, children sit in front of side-by-side visual displays that are either static or dynamic; the use of video here enables more ecologically valid tests of the words and grammatical constructions describing events and relationships. A single linguistic stimulus is presented, which matches only one of the two displays. However, instead of requiring the child to point to the matching display, the children’s eye movements are recorded and later coded off-line; the prediction is that if the child understands the linguistic stimulus, s/he will look more quickly and/or for longer periods of time at the matching display (Fernald, Perfors & Marchman 2006, Golinkoff, Ma, Song & Hirsh-Pasek 2013, Piotroski & Naigles 2012). The absence of any directives from live adults makes this an easier task for children with social difficulties; the entire task usually takes less than six minutes and so is well suited to the short attention spans of this population (Naigles & Tovar 2012). Recent studies have revealed that children with ASD demonstrate comprehension of SVO word order and wh-questions developmentally earlier than production (Goodwin et al. 2012, Swensen et al. 2007). Moreover, measuring children’s eye movements allows for assessment of speed of language processing as well as accuracy, and Naigles et al. (2011) have found that preschoolers’ speed of understanding SVO sentences is predictive of their later accuracy in novel verb learning. Additionally, both Tek et al. (2008) and Venker et al. (2013) have discovered individual differences in the speed and accuracy of the word comprehension and word learning strategies of children with ASD (see also Brock, Norbury, Einav & Nation 2008) and of lexical access (Bavin, Kidd, Prendergast, Baker, Dissanayake & Prior 2014). In sum, eye-gaze methods have great potential for illuminating the levels of efficiency and accuracy with which children with ASD understand specific linguistic constructions.
29.8 Future directions

A major direction for future research on language in children with ASD involves accounting for the heterogeneity of language presentation that is so characteristic of the syndrome. As summarized in this review, variability has been observed at each level of language: some children with ASD displayed severe phonological deficits whereas others demonstrated typical albeit delayed patterns of phonological development; many children with ASD consistently used mutual exclusivity and syntactic bootstrapping when learning novel words but using a shape bias for extending novel words was more problematic; children with ASD may display understanding of numerous grammatical constructions but selective impairments and omissions when producing them; the speech of children with ASD may demonstrate sensitivity to their addressee’s levels of knowledge in some situations (i.e. by providing extra information) but not others (i.e. by producing unclear pronouns).

This variability in language profiles of children with ASD is most likely rooted in a number of contributing factors. For example, variability in general cognitive ability, in executive functions such as working memory, and in basic sensory-motor processing have each been linked with language abilities in ASD (e.g. Kelly, Walker & Norbury 2013, Naigles et al. 2013, Tyson et al. 2014). Moreover, variability in language is also likely to be related to brain organization, and both structural and functional MRI studies of children with ASD have increased in number as techniques have been developed to facilitate their tolerance of scanning procedures (e.g. Eigsti, Schuh, Mencl, Schultz & Paul 2012, Eyler, Pierce & Courchesne 2012). Thus far, most research has primarily focused on discovering how the brains of children with ASD differ in language-relevant ways from those of TD children; however, more recent explorations have targeted neurophysiological differences within ASD groups that are related to their language levels (Joseph et al. 2014).

Variability in language impairment may also be traceable to the input and interactions that children with ASD may have experienced. Recent research has provided evidence that children with ASD are sensitive to similar facilitating components of linguistic input as are found to be influential in typical development, including maternal responsivity, specific labelling behaviours, and the use of lexically diverse sentences (e.g. Haebig, McDuffie & Weismer 2013, Hani et al. 2013, and see Naigles 2013 for a review). Finally, variability in developmental trajectory may also play a role in language presentation. An exciting new direction in this area involves a subgroup of children with ASD who were diagnosed as toddlers and received intensive intervention during their preschool years; by school age, these children no longer met criteria for ASD and scored at their chronological age levels on both verbal and nonverbal IQ. They have been termed Optimal Outcome (OO; Fein et al. 2013). Detailed assessments
of their language abilities are underway, but recent reports of their lexical and grammatical abilities find them to be indistinguishable from TD peers on most measures. Residual difficulties, though, have been observed in formulating sentences, which seem linked to verbal and phonological memory levels (Tyson et al. 2014), and in categorical induction tasks, which seem linked to overall vocabulary levels (Naigles et al. 2013). Their elicited narratives have not been found to differ from their TD peers in length, complexity, or causal references, although they have produced more self-corrections and idiosyncratic references (Suh et al. in press).

It is likely that many if not all of these factors combine to impact the language profiles of children with ASD. To discover their relative influences, future studies of this population would need to include multiple measures of perceptual, cognitive and language abilities – perhaps over a longitudinal time course – as well as measures capturing the children’s language environment and neurological functioning. As with other disorders of language acquisition and development (see Chapters 24–28), the language of children with ASD will only be comprehensively explained by a framework that includes interacting biological, social, cognitive, developmental and linguistic components.

Suggestions for further reading


