Deb Keen · Hedda Meadan
Nancy C. Brady · James W. Halle *Editors*

Prelinguistic and Minimally Verbal Communicators on the Autism Spectrum

Springer

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Foreword

In 1998, Amy Wetherby, Joe Reichle, and I published an edited volume entitled *Transitions in Prelinguistic Communication*. That book covered the emergence of intentional and symbolic communication (8 chapters) as well as prelinguistic assessment and intervention (9 chapters). It included just four of the authors of the present volume (Crais, Iverson, Halle, and Reichle). So what has changed in the two decades since this earlier book? It turns out the answer is "a lot"!

First the present volume is primarily focused on learners with autism and severe communication challenges and takes more of a life-span approach. Why would this be? The answer is obvious. The past two decades have generated a steady increase in research with a focus on severe communication challenges. Only three chapters in our 1998 book truly focused on the challenges faced by children and adults at the severe end of the continuum. Two of these three chapters addressed comprehensive behavior support issues and one addressed augmentative communication systems. In contrast, the 11 chapters in the present volume provide a broad picture of progress on many fronts, reflecting the increasing conceptual and methodological depth characterizing research on prelinguistic and minimally verbal communication.

Second, while the authors of these volumes adhere to the science of communication disorders (sorry, you will not find any facilitated communication "research" in these pages), they do this in a way that directly connects research to best practices. Furthermore, the central tenets that "all people communicate" and "all behavior is at least potentially communicative" permeate the entire volume. This optimistic, truly inclusive approach leaves no one out in the closet. It is even implicit in the use of the term "prelinguistic" in the title of the book.

Third, compared to two decades ago, the conceptual approaches and methods have continued to "mature". For example, in the not too distant past, the methods of applied behavior analysis and the theoretical and conceptual foundations of developmental psychology were rarely presented in an integrated fashion. Indeed, I recall people on different sides of these paradigms who considered the integration of various elements of these approaches as blasphemy. No more. Now an ethic seems

to increasingly prevail that views both approaches as useful tools with a little concern about the sanctity or purity of underlying theory. Thus, we find ABA methods and techniques, and developmental constructs and measures, integrated seamlessly with no apologies or caveats. That is as it should be.

Finally, since 1998, new technologies have had a major impact on communication and language intervention research and practice. The iPad is of course an obvious example, though hardly the only one. These technologies will continue to evolve in ways that will surely enhance research and especially practice.

The progress that has been made in the last 20 years, as evidenced by various chapters in this book, is a tribute to those investigators and practitioners who have contributed to the literature on prelinguistic communication. Of course, this may be of less importance to individuals who still struggle on a daily basis to communicate effectively. However, the authors of these chapters illuminate a path forward, while implicitly acknowledging that much work remains to be done.

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Reference

Wetherby, A. M., Warren, S. F., & Reichle, J. (1998). *Transitions in prelinguistic communication*. Baltimore, MD: Paul H. Brookes.

Preface

The impetus for this book emanated from two sources. First, we felt there was a need to gather in one place the knowledge gleaned from research over the past few decades about typical and atypical communicative development during the prelinguistic period for individuals on the autism spectrum. Early intervention research has proliferated dramatically, giving rise to an increased understanding of how language develops during the prelinguistic period and ways to assess and facilitate this development. The growth in understanding of language development has been accompanied with technological advances that have provided opportunities to develop and implement new assessment data collection tools (e.g., Language ENvironment Analysis – LENA^{TM}) and intervention devices (e.g., Proloquo2Go®). Second, we became aware of the need for more resources to support clinicians and educators who work with individuals on the autism spectrum who are minimally verbal throughout their lives. This book aims to address this need by drawing on contemporary theory and research to inform investigators, clinicians, educators, and students who share our desire to enhance the communicative competence of prelinguistic and minimally verbal communicators on the autism spectrum.

The book consists of 11 chapters organized into three sections. The first section comprises four chapters that introduce the reader to the book and describes prelinguistic communication. Chapter 1 by Keen, Meadan, Brady, and Halle is a general introduction, followed by Chap. 2 by Crais and Ogletree that details typical and atypical development through the prelinguistic period. Chapter 3 (Braddock and Brady) is dedicated to a closer examination of the role of joint attention during this period, while Chap. 4 (Iverson and Wozniak) deals with the transition from pre-intentional to more intentional and symbolic communication.

Section two focuses on assessment, with Chap. 5 (Trembath and Iacono) considering standardized assessment approaches and Chap. 6 (Brady and Keen) addressing more individualized methods of assessment. Chapter 7 (Sigafoos, O'Reilly, Lancioni, Carnett, Bravo, Rojeski, and Halle) looks in detail at functional assessment of problematic forms of prelinguistic communication. The third and

final section of the book examines interventions and consists of an extensive review of the intervention literature (Chap. 8 by Shire, Kasari, Kaiser, and Fuller), the use of AAC interventions (Chap. 9 by Reichle, Ganz, Drager, and Parker-McGowan), and the role of parents in communication development (Chap. 10 by Meadan and Keen). Chapter 11 (by Keen, Paynter, Trembath, and Simpson) concludes by arguing for greater uptake of evidence-based practices in the community in order to deliver improved outcomes for prelinguistic and minimally verbal communicators on the autism spectrum.

As we worked with chapter authors to complete this book, we were struck by the pace at which knowledge has advanced about theory and practice in relation to prelinguistic and minimally verbal communicators with autism. This book provides a much-needed resource that can guide future research and practice and help to reduce the research-to-practice gap, thereby delivering improved communication outcomes for individuals on the autism spectrum.

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Contributors

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Part I
Prelinguistic Communication Development

Chapter 1
Introduction to Prelinguistic and Minimally Verbal Communicators on the Autism Spectrum

Deb Keen, Hedda Meadan, Nancy C. Brady, and James W. Halle

Abstract Autism spectrum disorder (ASD) is a neurodevelopmental disorder described in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed., American Psychiatric Association, Diagnostic and statistical manual of mental disorders, 5th edn. Author, Washington, DC, 2013) as including impairments in social communication and restricted and repetitive behavior patterns. Prevalence estimates vary but according to the Centers for Disease Control and Prevention, (MMWR Surveill Summ 63(2):1–22, 2014), 1 in 68 children have ASD.

Impairments in social communication are a defining feature of ASD although there is a great deal of variability in the severity of these impairments and the way in which they manifest across individuals. In this book, we focus on prelinguistic communicators. The prelinguistic period of communicative development refers to the time between birth and when a child begins to use words meaningfully. Typically, infants experience the prelinguistic period from birth to around 18 months of age, during which time they progressively develop intentional and symbolic forms of communication representing a range of communicative functions.

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While typically developing infants follow a somewhat predictable path, the developmental trajectory for children with ASD is generally delayed and deviates from this typical pattern. Skills such as joint attention that usually begin to appear around 6 months of age are often absent and the child's attempt to express his/her basic needs may be limited and idiosyncratic.

Intervening early provides the best opportunity for children to acquire some of these prelinguistic skills that facilitate later language development, but acquisition of these skills may be delayed. In some cases, individuals may fail to develop the skills necessary to move beyond this phase of communicative development.

Various terms have been used to describe this particular sub-group of children, youth, and adults with ASD who have little or no functional speech. Terms such as "prelinguistic", "non-linguistic", "nonverbal", and "minimally verbal" have been invoked. Given the different terminology and definitions used by researchers to describe this sub-group, estimates of just how many children fall into this category have varied (Tager-Flusberg & Kasari, 2013). In a recent study of 246 children with ASD exiting an ASD-specific early intervention program at 5 years, 26.3 % had fewer than five spontaneous and functional words and a further 31–40.6 % were not using phrases/sentences (Rose, Trembath, Keen, & Paynter, in press). This study also found that more than half of the children who entered the early intervention program with minimal speech exited the program with a similar language profile. It is worth noting that the mean age of the participants entering this study was around 44 months and the mean period of intervention was just 14 months. The age at entry and the short duration of intervention may have impacted on the high proportion of children in this study remaining minimally verbal when considered in relation to results from other studies. For example, Weismer and Kover (2015) investigated language development in a community-based sample of 129 children with ASD who were assessed at four time points from a mean age of 2.5 years at the first visit to 5.5 years at visit 4. Although 66 children were identified at the first visit as preverbal, the majority attained some level of verbal skills by the end of the study. There are several factors that may help to explain the differences found between the two studies described above. First, the age at which the children commenced intervention (44 months versus 30 months) and the type and quality of the intervention likely influenced the outcomes. Second, it is possible that children who are still in the prelinguistic stage by 44 months (age at intake in Rose et al.) are more

likely to remain minimally verbal compared to children who are nonverbal at 2.5 years (age at intake in Weismer & Kover). The trend in recent years has been toward early identification of ASD followed by intensive early intervention. Around the world, the age at which children access early intervention is variable but in some communities, it may approximate more closely the age of children in the Rose et al. study due to later diagnosis and/or delays in receiving services due to long waiting lists (e.g., Synergies, 2014).

Thus results from the Rose et al. study are notable as they indicate that children with ASD experience significant on-going difficulties in developing early communication skills despite access to intervention services at around 44 months of age. They highlight the need for further research to increase our knowledge of how prelinguistic skills develop during the preschool years. The results from Weismer and Kover (2015) reveal that early intervention commencing from age 2.5 years and focused on reducing core ASD symptoms may facilitate language development. Targeted interventions that support minimally verbal children and educate communication partners about prelinguistic communication are critical if we are to improve the ability of individuals with autism and minimal verbal skills to optimize their communication and become more effective communicators.

It is for this reason that we embarked on a book about prelinguistic communication in ASD. Our intention was to acknowledge that while the prelinguistic period is typically considered to occur in early childhood, it may well persist into adulthood for a sub-group of individuals with ASD. We have therefore adopted a lifespan perspective throughout the book, taking into consideration adult communicators who remain at the prelinguistic stage of communicative development. A further impetus for the book has been the rapid expansion of research over the past decade into skill development in the prelinguistic period. Joint attention as a means of early detection of ASD and as a target for intervention has been a particular focus and has led to growth in our knowledge and understanding of this important area. Development and implementation of communication interventions for children with ASD, especially during the early years, has also received much attention from researchers. It seemed timely to bring the results from this research together in one place to inform clinical practice and identify gaps in knowledge and areas in need of investigation in the future.

This book is organized in three sections: skill development during the prelinguistic period; assessment of prelinguistic communication skills; and interventions to facilitate communicative development. The communicative development of children with ASD is best understood within the context of typical child development. To this end, Crais and Ogletree (Chap. 2) review the research on the prelinguistic period in typically developing children. Throughout the chapter, the emergence of joint engagement, joint attention, intentionality, and communicative forms and functions are examined as important building blocks for language learning.

Following this examination of key developmental features of the prelinguistic period in Chap. 2, Braddock and Brady (Chap. 3) present the current research findings on issues and challenges specific to individuals with ASD. In particular,

they synthesize findings from the significant body of research on joint attention that has been undertaken in the past two decades. Deficits in joint attention are a key early warning sign for ASD and, to address these deficits, early intervention has been a focus of research in recent years.

A priority for individuals during the prelinguistic period is to acquire new forms of intentional and symbolic communication. Iverson and Wozniak (Chap. 4) argue that the transition to these new forms changes the nature of the input the child receives from the communicative environment and influences learning opportunities that impact future development. When the transition is impaired or delayed, as occurs for individuals with ASD, there are far-reaching consequences.

Trembath and Iacono (Chap. 5) author the first of three chapters that examine current assessment practices for individuals with ASD who are prelinguistic communicators. This chapter focuses on standardized assessments and how these can make a useful contribution and inform intervention for this population. Brady and Keen (Chap. 6) contribute the next chapter on assessment practices, focusing primarily on non-standardized, individualized and informal methods of gathering information to provide communication profiles that can inform intervention.

The third assessment chapter focuses on problem behaviors. In 1985, Carr and Durand published a paper demonstrating that problem behavior can serve a communicative function. Research has also established that individuals who are minimally verbal and have limited means to express their wants and needs, often experience higher rates of problem behavior. Prelinguistic communicators with ASD are therefore at particular risk of acquiring problematic forms of communication. In Chap. 7, Sigafoos, O'Reilly, Lancioni, Carnett, Bravo, Rojeski, and Halle review the research literature on the use of experimental-functional analyses of problem behavior among individuals with ASD and consider implications for practice.

Shire, Fuller, Kasari and Kaiser (Chap. 8) provide a wonderful opening to our section on intervention by presenting results from an extensive review of the literature on intervention studies aimed at improving social communication for children with ASD who are preverbal or minimally verbal. In the following chapter (Chap. 9), Reichle, Ganz, Drager, and Parker-McGowan examine the use of augmentative and alternative forms of communication (AAC) frequently used by prelinguistic communicators. Technological advances have had a significant impact on AAC approaches in recent years and there has been an explosion in the number and types of devices and applications, or "apps" that are available. This has brought potential advantages and opportunities, but also challenges. Communication devices and apps are more readily available and affordable and consumers have a much wider choice than has previously been available. However, there is limited research available to help guide clinicians and parents in the selection and use of particular devices and apps that will best suit individual children, youth, and adults.

Parents play a vital role in their child's development and much has been written about the importance of professionals working in partnership with parents in achieving a good quality of life for individuals with ASD and their families. In the chapter by Meadan and Keen (Chap. 10), the role of parents and caregivers in

communicative development is explored, with a particular focus on parent-mediated interventions. Once again, technology has played a role here with parent education being delivered via online platforms and thus increasing the reach of these programs to families in traditionally under-resourced regional and remote locations.

The final chapter by Keen, Paynter, Trembath, and Simpson (Chap. 11) addresses the challenges of translating research to practice in prelinguistic communication. The field has taken great strides in building an evidence base around effective communication interventions. The need for research to add to this evidence base continues, but one of the real challenges that remain is how to facilitate uptake of these interventions in the community. Parents and professionals are using evidence-based practices, but the use of unproven or even harmful practices continues. Keen et al. examine why practices such as facilitated communication persist despite research showing they are ineffective, and they propose strategies to increase knowledge and use of evidence-based practices in the future.

We hope that this book provides resources to families, educators, students, and researchers who are invested in helping individuals with ASD and minimal communication skills to improve their lives through communication. Through our collective efforts, communication opportunities and skills will continue to advance, leading to more integrated, engaged, and happy lives.

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Chapter 2
Prelinguistic Communication Development

Elizabeth Crais and Billy T. Ogletree

Abstract The prelinguistic stage is viewed as the time period between birth and when a child or adult begins to use words/signs meaningfully. It is a time when children typically increase their ability to communicate with others, first using eye gaze, attending, and social-emotional affect and later adding gestures and other nonverbal means to communicate. This stage builds the foundation for later developing skills such as using words (or signs) and combining them into sentences to communicate, as well as understanding and gaining appreciation of the nuances of successful communication. For children, youth, and adults with autism spectrum disorder (ASD), the skills typically learned during this stage can be critical to helping these individuals be effective and successful communicators throughout their lives. Individuals with significant developmental disabilities including ASD can have substantially protracted prelinguistic periods of communication and language development. For some, a singular reliance on prelinguisitic communication may continue into adolescence or adulthood. Others may fail to develop productive communication altogether. Knowledge of prelinguistic skills, their developmental hierarchy, and their impact on children's and adults' current and future ability to communicate are key factors to be considered in assessing and intervening with children, youth, and adults with ASD. In this chapter, current research related to prelinguistic communication skills will be highlighted, along with challenges faced when examining prelinguistic skills, and the research and practice implications of looking at and intervening in the area of prelinguistic communication.

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2.1 Current Research on the Topic

Prelinguistic skills are often viewed as the underpinning on which many other communication and social skills are built. Indeed, the early use of communicative means (e.g., gaze, gestures, vocalizations, words) shows a strong relationship with later language skills in children with developmental delays (McCathren, Yoder, & Warren, 2000) and those with ASD (Zwaigenbaum, Bryson, & Rogers, 2005). Children in the first year of life typically interact with their caregivers by intently gazing at the adult, and using sounds and oral motor imitations (e.g., wide mouth opening, protruding tongue) that help maintain engagement. In addition, they exhibit fussing and crying behaviors. These behaviors provide the infant with a means to express an emotional response to events or situations and to keep the attention of the adult. Initially, these behaviors are not intentional, but are more reflexive and responsive. Infants at this point are characterized as being in the preintentional stage, as they have not yet learned consistent ways to communicate their needs and wants to their caregivers. For example, infants first cry because they are hungry, wet, or uncomfortable and not because they realize if they do, their caregivers will react. Gradually, as infants begin to recognize that caregivers react when they exhibit particular behaviors, they learn how to communicate for specific purposes.

By the end of the first 6 months, infants consistently use a combination of behaviors across modalities such as vocalizations, facial expressions and visual orienting (Yale, Messinger, Cobo-Lewis, & Delgado, 2003) and they use them reciprocally with their caregivers (Feldman, 2003). Up to this time point, infants have been actively engaged in dyadic interactions with their caregivers where their focus is the caregiver. These face-to-face opportunities encourage sharing affect and attention. Infants begin to respond and participate with their caregivers in social routines such as "peek-a-boo" or "this little piggy" where the child is initially passive, moving toward a more active role, and eventually initiating the social routine. These exchanges are viewed as *joint engagement* rather than *joint attention*, an important distinction particularly for children with ASD. Whereas joint engagement involves the adult and child interacting together, it does not necessarily include the child or adult *actively* drawing the partner's attention to an object or action, although an object may be part of the play. For example, during a game of peek-a-boo, when a mother holds a small blanket in front of her face, the focus is on getting the child to pull down the blanket to find her, not on the blanket itself. In contrast, joint attention includes triadic interaction where one person is purposefully trying to get another person to look at an object or event. For example, when a father points to an airplane in the sky, he wants his child to look at it and enjoy the experience with him. The critical nature of joint engagement to the language learning process is evident as children increase their ability to join in shared communicative interactions with people and objects (Adamson, Bakeman, & Deckner, 2004). In addition, as the child continues to develop, both vocal (e.g., sounds, sound combinations) and nonverbal acts (e.g., facial expressions, and later

gestures) become more consistent and the child gains control over when to produce them. For example, infants may initially produce a "raspberry" sound (blowing out while sticking out the tongue) when spitting out food. As caregivers attend to and perhaps laugh at or imitate the action, the infant eventually with practice produces the act in imitation and later spontaneously, as a means of gaining or keeping the adult's attention. In parallel, as the child is gaining more oral motor control, there is a fairly predictable development of sounds in the child's inventory.

As reported by Smith, Goffman, and Stark (1995), typically developing infants produce reflexive sounds for the first few months, move on to comfort or cooing sounds between 2 and 4 months, begin to produce longer series of syllables and prolonged vowels and consonants with much vocal play between 4 and 6 months, produce reduplicated babbling (e.g., bababa) between 7 and 9 months, and use more varied and complex babbling (e.g., badaba) and their first words somewhere between 10 and 12 months. As children gain additional oral motor control, they are more capable of producing particular sounds and eventually are able to use word approximations ("baba" for bottle) and consistent words.

2.1.1 The Onset of Intentionality

A shift from preintentional to intentional communication is a major milestone for all children and adults and is critical to the development of higher-level communication skills (Brady, Marquis, Fleming, & McLean, 2004; Tomasello, Carpenter, & Liszkowski, 2007). A child's rate of intentional communication is predictive of language outcomes and higher rates of nonverbal intentional communication are related to improved language outcomes (Calandrella & Wilcox, 2000). Typically developing 12-month-olds communicate intentionally about once per minute, whereas 18-month-olds do so about two times per minute, and 24-month-olds communicate intentionally about five times per minute (Wetherby, Cain, Yonclas, & Walker, 1988). Therefore, a slow rate of intentional communication may be indicative of current and future communication deficits. For example, when Stone, Ousley, Yoder, Hogan, and Hepburn (1997) compared the communicative rates of 2½- to 3½-year-old children with ASD or other developmental disabilities (DD), the children with DD had similar rates of communication as typically developing 12-month-olds; however, the children with ASD had significantly lower rates. Rate of communication and parent response contingency have also been associated with higher expressive language in children with disabilities (Brady et al., 2004). Brady and colleagues (Brady et al., 2004; Brady, McLean, McLean, & Johnston, 1995; Brady, Steeples, & Fleming, 2005; McLean, Brady, & McLean, 1996) have suggested that a limited range of communicative functions is related more to an individual's level of prelinguistic development rather than a particular disability.

Although typically associated with very early childhood, for some individuals communicative intent can emerge later in life. Numerous investigations have documented and profiled nonsymbolic intentional communication in preschool-

aged children, adolescents, and adults with developmental disabilities including ASD (McLean, McLean, Brady, & Etter, 1991; Ogletree, Wetherby, & Westling, 1992; Wetherby, Yonclas, & Bryan, 1989). Findings have been mixed on communication rate with some studies reporting rates comparable with normative expectations (Ogletree, Wetherby & Westling, 1992; Wetherby et al., 1989).

The ability to use varied types of communicative functions also plays a role in predicting children's later language skills. Bruner (1981) indicated that infants and toddlers should be using the following major communicative functions by 12 months of age:

- Social interaction: sustaining or initiating a social game or routine, seeking or providing comfort, teasing, showing off.
- Behavior regulation: regulating the behavior of others to obtain an object, getting them to carry out an action, or stopping someone from doing something.
- Joint attention: directing others' attention in order to comment on an object or event, providing information on an object or event, or acknowledging shared attention to an object or event.

Children with typical development show an increase in the number of communicative functions used within these three major areas with increasing age (Crais, Douglas, & Campbell, 2004; Wetherby et al., 1988). For interpreting the current literature, terms such as *imperative* or *instrumental* act to regulate behavior, and *declarative* or *referential* act to gain joint attention, are also often used. In terms of a hierarchy of the emergence of functions, social interaction acts and behavior regulation acts seem interspersed in early development with joint attention acts following closely (Crais et al., 2004). In a longitudinal study of 12 typically developing children from 6 to 24 months, Crais and colleagues (2004) reported that 8 of the infants first produced protests (e.g., physical action like arching the back to resist something or pushing away objects), whereas the other 4 infants either requested an action (e.g., reaching to be picked up) or sought attention (e.g., flapping arms or banging while smiling and looking at the parent).

As infants develop from the middle to end of their first year they begin to share attention to objects and other events with their caregivers and move to triadic engagement (De Schuymera, De Grootea, Strianoc, Stahle, & Roeyersa, 2011; Mundy, Sullivan, & Mastergeorge, 2009). A major skill that develops through triadic engagement is following the gaze of others, which opens up opportunities for the infant to learn from other people about the world around them (Rozga et al., 2011). Attention monitoring is also learned and includes the child shifting attention between the referent and the caregiver so the child can determine whether the caregiver is noticing the referent the child wants and/or the communicative act the child produced.

Another major skill attained during triadic engagement is the use of joint attention. In contrast to requesting, where the child wants the object or action requested, in joint attention the child is communicating to gain social attention from the caregiver. Joint attention acts demonstrate the child's abilities to coordinate attention to both people and objects. Two types of joint attention are highly

critical: first, the child's ability to attend to others' bids for joint attention (response to joint attention [RJA]) and second, the child's ability to initiate bids for joint attention from others (IJA). As observed by McLean and Snyder (1978) and later by Sameroff and Fiese (2000), children learn to respond to and use gestures and words within joint attention acts, thus adding to their understanding and ability to use communication. As suggested by many (e.g., Klin, Jones, Schultz, & Volkmar, 2005; Tomasello, Carpenter, Call, Behne, & Moll, 2005), infants engaging with objects and others is also critical for their development of the ability to understand others' thoughts and goals. Thus, the emergence of RJA and eventually IJA presents major milestones for children with and without disabilities.

Older children, adolescents, and adults who are prelinguistic communicators may vary from young, typically developing children with respect to RJA and IJA. Qualitatively, their responses to the joint attention bids of others may be slow and require increased effort on the part of the communicative partner, while quantitatively IJAs are most often significantly reduced if not absent (McLean, McLean, Brady, & Etter, 1991; Ogletree et al., 1992).

2.1.2 Hierarchy of Gesture Use

Because gestures play a large role in children's early intentionality and their later communication skills (and are often limited or absent in some children and adults with ASD), understanding the developmental emergence of gestures is vital. Gestures are one of the most consistent early indicators of intentionality and, therefore, are instrumental in helping children express their wants and needs to others (Crais et al., 2004). Between 6 and 10 months, children begin to use gestures to communicate with others, such as reaching to be picked up or to gain objects, or pushing away objects (Carpenter, Nagell, & Tomasello, 1998; Crais et al., 2004; Parladé & Iverson, 2010).

Gestures are defined as actions used with *the intent to communicate* and are commonly expressed using the fingers, hands, and arms, but can also include body motions such as bouncing for "horsie" or facial features such as lip pouting (Iverson & Thal, 1998). In contrast, just reaching or grabbing for an object is not considered *communicative* unless the child is using the action to *signal* to someone else their intention. Therefore, acts are typically not considered a gesture unless they are: (a) accompanied by eye contact or a vocalization/verbalization aimed toward another, (b) repeated, (c) used with a body posture oriented toward another, or (d) used within a social exchange (e.g., dyadic interaction like storybook reading) where clear reciprocity has already been established between the child and caregiver (Iverson, Capirici, Volterra, & Goldin-Meadow, 2008).

Iverson and Thal (1998) categorized two primary types of gestures: deictic and representational. *Deictic* gestures call attention to or indicate an object or event, such as pointing to or holding up an object to show someone. As suggested by Iverson and Thal, these gestures are interpreted by their context and can be used

across a range of objects and events. Deictic gestures are frequently divided into two types: contact and distal (Brady et al., 2004). Contact gestures include touching or "contacting" the object or caregiver, such as pulling on an object held by another or pushing away a caregiver's hand, and are considered "early" gestures and appear between 7 and 9 months. Most children as they increase their communicative skills begin to use additional kinds of gestures and forms of communication (words, sentences, signs) and therefore become less dependent on contact gestures.

In contrast, distal gestures do not require contact with the caregiver or the object and include pointing or waving "bye bye" and typically appear later (10–-12 months). One important distinction that needs mentioning, however, is that a few distal reaching gestures (e.g., reaching for an object, reaching to be picked up) actually challenge the typical progression of contact gestures preceding distal gestures. One reason reported by Crais et al. (2004) may be that although reaching is typically considered distal, it is also contextually bound to the actions within which it consistently occurs.

In regard to contact and distal gestures, there are children and adults (e.g., those with intellectual disability or ASD) who continue to use contact gestures (e.g., taking someone's hand to place it on a door knob to signal "going out") well past when other typically developing children stop using them (Paul, Chawarska, Klin, & Volkmar, 2007). For example, as children with language impairment get older, they use gestures more than their typically developing peers and are very likely doing so to compensate for their oral language deficits (Evans, Alibali, & McNeil, 2001). Stone et al. (1997) documented that 3½- to 4½-year-old children with ASD used significantly more contact gestures than did children with DD who were matched on chronological and mental age, developmental quotient, and expressive vocabulary (as well as gender, race, and maternal education). As suggested by Brady et al. (2005), many children with DD use prelinguistic gestures and vocalizations as their main means of communication and do so far into the toddler and preschool years.

In adults with DD, McLean and colleagues (Brady, McLean, McLean, & Johnston, 1995; McLean et al., 1991) documented that those who used distal gestures communicated more often and for a wider range of functions than did the adults who only used contact gestures. Brady and colleagues (Brady et al., 1995; Brady et al., 2004; Brady et al., 2005; McLean, Brady, & McLean, 1996) have also noted that children and adults with disabilities who primarily use contact gestures and vocalizations seldom communicate for joint attention or to make comments. In comparison, children and adults who use distal gestures are more likely to produce comments and requests.

In typically developing children, the first deictic gestures often emerge between 7 and 9 months of age (Carpenter et al., 1998; Crais et al., 2004). They often first appear as ritualized gestures to indicate refusal (e.g., pushing away), open-handed reaching, reaching to be picked up, or consistent attention-getting body movements such as repeated leg and arm flailing (Carpenter et al., 1998; Crais et al., 2004). As reported by Thal and Tobias (1992), deictic gestures comprise about 88 % of the gesture repertoire of young infants and toddlers.

Representational gestures make up the other major type of gestures, and they indicate both reference and a particular semantic content. Iverson and Thal (1998) categorized representational gestures into object-related and conventional gestures. Object-related gestures denote some feature of the referent (e.g., flapping the arms to represent a bird flying) that are often called "symbolic" gestures (Acredolo & Goodwyn, 1988). Conventional gestures are commonly used in a particular culture and are therefore defined by the culture (e.g., waving "bye", finger to lips for "quiet"). They typically represent some action or concept rather than a specific object. Reflecting cultural specificity, some gestures (e.g., the "okay" sign used in the US) may be viewed as offensive in some European countries; therefore knowledge of cultural conventionality is important for users (and assessors). Representational gestures begin to appear around 12 months of age (Acredolo & Goodwyn, 1988) and are typically seen after the emergence of a few deictic gestures (Crais et al., 2004). This kind of gesture typically emerges within familiar routines and games that caregivers use to engage and entertain their child (Goodwyn & Acredolo, 1993; Iverson & Thal, 1998). Games and routines such as "patty-cake" or pretending to eat and blowing to signal "hot food" contain multiple interactive opportunities for children to observe and imitate representational gestures.

Individual variability in the emergence and range of representational gestures between 10 and 24 months has been documented across studies (Crais et al., 2004; Goodwyn, Acredolo, & Brown, 2000). In a longitudinal study of typically developing children from 6 to 24 months of age, Crais et al. documented that the representational gestures used by the children were highly specific to the modeling of their parents. For example, gestures such as "touch down", "high five", "pretending to sleep" or using a forefinger to the lips and saying "sh" (e.g., asking for quiet, pretending a baby doll was sleeping) were only seen in those children whose parents actively demonstrated them. The strong influence of modeling can be seen in one family who never wanted to give their child the impression that they did not want him to talk, therefore they never used the "sh" signal, nor did he. Zinober and Martlew (1985) suggested that compared to deictic gestures, representational gestures are highly dependent on modeling by caregivers, and their use is more reflective of parents' cultural beliefs and practices.

2.1.3 Importance of Gestures to Facilitating Language Skills

Iverson and Goldin-Meadow (2005) have suggested that gestures allow children to communicate ideas that they may have difficulty expressing verbally and therefore, the use of gestures can facilitate language learning. Gestures both precede and are highly related to language development. Indeed, initial gestural representations found in children's early repertoires appear later in the children's verbal lexicons (Iverson & Goldin-Meadow). Similarly, in examining sentences, Iverson and Goldin-Meadow documented that the use of gesture-plus-word combinations predicted the onset of two-word combinations.

In considering why gestures may facilitate language development, Iverson and Goldin-Meadow (2005) argue that firstly, the child's use of gestures may signal to the caregiver that the child is ready for enhanced input. For example, Goldin-Meadow and Singer (2003) documented that adults alter their input to children in response to the gestures produced by the child. Secondly, Iverson and Goldin-Meadow contend that gestures also lessen the demand on memory in that gestures are likely easier to produce than words. It has been hypothesized that gestures are first produced at a time when the child has not yet fully gained control over the oral mechanism in terms of speech production. The third explanation for why gestures facilitate language learning is that gestures may be a way for children to try out new meanings before they are produced in speech, and there is evidence that the act of using a gesture can impact learning a concept (Wagner & Goldin-Meadow, 2004). Thus, if the child can use a representation of the word in gestural form, it may help fill out the meaning of the word while the child acquires the word form.

Gestures can also facilitate labeling by the caregiver and may provide, as Goldin-Meadow, Goodrich, Sauer, and Iverson (2007) suggest, a "timely word-learning model" for the child, and thereby children can elicit input that they need to guide their own learning. Some suggest that commenting by the child (e.g., vocalizing and/or pointing to an object to show it, or verbalizing) has a strong relation to receptive language. When children comment, caregivers usually respond by labeling the object or providing added input to the child (Brady et al., 2005; Tomasello, 1999). Thus, children who comment more often will have increased chances to gain input from caregivers.

In prelinguistic adolescents and adults, gestural forms often occur as part of a broader communicative profile characterized by vocal immaturity (McLean et al., 1991; Ogletree et al., 1992). Accordingly, for these individuals, it would appear that gesture is a less complicated and possibly more effective alternative to intelligible speech.

2.1.4 Links Between Prelinguistic Skills and Current and Later Language Skills

Some prelinguistic skills are also concurrently predictive of a range of skills. For example, early gesture use is strongly related to concurrent comprehension skills in both children with typical language skills (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979) and those with language deficits (Thal & Bates, 1988; Thal, Tobias, & Morrison, 1991). Similarly, gesture use in children with ASD is also associated with current language skills. In particular, joint attention skills are highly predictive of comprehension and production skills in both typically developing children (Slaughter & McConnell, 2003) and those with ASD (Charman et al., 2003). Social interaction acts also are predictive of expressive vocabulary in typically developing

children (Mundy & Gomes, 1998) and children with ASD (McEvoy, Rogers, & Pennington, 1993; Mundy, Sigman, Ungerer, & Sherman, 1986).

Gesture use is also predictive of later language skills. For example, early gestures are strongly related to receptive and expressive production in the second year of life in both typically developing children (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979) and those with disabilities (Thal et al., 1991; Thal & Bates, 1988). Further, a limited variety of gestures in 9-12-month-old children has also been associated with a later diagnosis of ASD (Colgan et al., 2006). Rowe and colleagues (Rowe & Goldin-Meadow, 2009; Rowe, Özçaliskan, & Goldin-Meadow, 2008) have documented in typically developing children that the number of gestures used at 18 months of age was significantly related to the size of the children's receptive vocabularies at 42 months. In addition, frequency of requesting and commenting are predictive of later vocabulary size (McDuffie, Yoder, & Stone, 2005; Mundy, 1987; Sigman & Ruskin, 1999; Stone & Yoder, 2001). Vocabulary comprehension and symbolic play skills are also associated with later language skills (McCathren, Warren, & Yoder, 1996).

For children with Down syndrome, Mundy, Kasari, Sigman, and Ruskin (1995) observed that those who frequently requested using gestures and vocalizations had higher language scores a year later than those who had limited requesting. Mundy and colleagues (Mundy et al., 1995; Mundy & Thorp, 2006) also reported that both IJA and RJA acts were significantly related to later language and social skills. Lower rates of IJA and RJA were also seen in young children with ASD and were not accounted for by a lower number of communicative acts overall (Stone et al., 1997). And in at-risk 12-month-olds (younger siblings of children with ASD) who were themselves later diagnosed with ASD, deficits in RJA, IJA, and requesting acts were documented (Rozga et al., 2011). Rozga and colleagues suggested these deficits may hamper the children's abilities to generate social experiences for themselves--thus leading to deficits in language skills.

Another factor important for later language and social skills is the combination of gestures and vocalizations. As children develop, their nonverbal communications begin to be more varied and more complex, they can communicate for more reasons, and they learn to coordinate gestures and vocalizations to communicate (Wetherby et al., 1988). This ability to coordinate aspects of communication can have important implications for social engagement with caregivers. For example, coordinating nonverbal cues with vocalizations can heighten the salience of and the ability of caregivers to interpret the communication, as well as respond appropriately to it (Stone et al., 1997; Yoder & Warren, 1999). In work by Goldin-Meadow and colleagues (Rowe & Goldin-Meadow, 2009; Rowe, Özçaliskan, & Goldin-Meadow, 2008), the number of gesture-plus-speech combinations the children used at 18 months was a strong predictor of their sentence complexity at 42 months. Further, the first production of a gesture-plus-speech combination has been shown to be predictive of the age of the first two-word combination (Iverson, Capirici, Volterra, & Goldin-Meadow, 2008; Rowe & Goldin-Meadow, 2009). When children (including those with ASD) combine gestures and vocalizations, they can also more effectively share joint attention with their caregivers (Parladé, 2012; Winder,

Woziniak, Parladé, & Iverson, 2013). This vocal-gesture combination can serve as a potent stimulus for the caregiver and can help set up an opportunity for joint attention (Parladé, 2012).

Finally, specific types of gestures can also be predictive. For example, early pointing is predictive of later advanced language skills in typically developing children (Harris, Barlow-Brown, & Chasin, 1995; Morissette, Ricard, & Decarie, 1995), those with Down syndrome (Franco & Butterworth, 1996), and children with ASD (Baron-Cohen, 1989). There also have been links with early pointing and a greater number of different gestures used and greater comprehension (Butterworth & Morissette, 1996). Specifically, the onset of pointing has been correlated to object-name comprehension (Harris et al., 1995). In the work of Stone et al. (1997), few children with ASD pointed, but if they did, their number of request and comment points was very similar. A key feature of communicative pointing is that it not only sets up joint attention with others, but it also impacts what communication partners look at and possibly what they choose to act on and talk about.

For individuals who never acquire many of these early skills or language, terms like "non-linguistic", "nonsymbolic", "minimally verbal" or "emergent symbolic" may best describe their communicative abilities. If these communicators present with ASD, their manifestation of the condition will likely be more severe, and they will often exhibit concomitant significant intellectual deficits. Indeed, Ogletree (2008) has used a categorization of communicative abilities in adults with ASD describing nonverbal, emergent verbal, and verbal communicators. According to Ogletree, nonverbal communicators, though nonspeaking, can have expressive abilities that include nonsymbolic and symbolic means. In contrast, emergent verbal and verbal communicators express themselves with speech of varying complexity and may also use other nonsymbolic and symbolic communication modalities.

Although few research studies have examined the emergent communicative abilities of adolescents or adults with ASD, some early investigations have included these groups in their participant pool. Findings from two large studies shed light on the communicative forms and functions typically observed in these populations. One additional effort describes both expressive and receptive abilities. Brady et al. (1995) sampled the communication of 28 adults with severe disabilities (5 of whom were diagnosed with ASD or a pervasive developmental disorder). Participants were presented with enticing communicative opportunities designed to evoke comments and requests. During communication sampling, participant initiations were followed by experimenter responses suggestive of communication breakdown (e.g., feigning misunderstanding of the participant's intent). Among the participants, all were reported to communicate with intentional nonsymbolic gestures. Participants primarily communicated to request but also commented on occasion. Participants also repaired communicative breakdowns by repeating, recasting, and to a lesser degree adding to communicative acts.

Using surveys, McLean et al. (1996) generated descriptive profiles of 211 adults with severe disabilities. Individuals charged with their care completed

questionnaires for 94 adults who presented with ASD or characteristics consistent with the diagnosis. Responses revealed that only 20 % of the adults were nonsymbolic (only 6 % unintentional) while 80 % used some form of symbolic communication. Sixty-one percent of the participants were described as using combinations of words and symbols.

The studies mentioned above, though not exclusive to adolescents or adults with ASD, bring into focus some general expectations specific to this population's range of expressive abilities. A recent larger study provides more detailed information about both the expressive and receptive communication of adolescents and adults with severe disabilities including ASD. Snell et al. (2010) reviewed 116 intervention studies published between 1986 and 2006 that addressed communication in persons with severe disabilities. Selected research articles included one or more participants with severe disabilities (defined as an IQ of 44 or below and aligned language and chronological ages) and featured intervention efforts specific to one or more areas of communication performance (defined as the ability to understand or produce communication messages). Findings were reported on efforts with 185 participants with intellectual disabilities, ASD, or multiple disabilities. Although some studies did not report the ages of participants, at least 85 were over the age of 12. Of particular interest to this chapter section is Snell et al.'s presentation of participants' pretreatment communication levels, expressive mode use, and receptive communication abilities.

Snell et al. (2010) reported that the majority of participants had pretreatment expressive communication best described as either prelinguistic or characteristic of emerging language. In contrast, a very small number of participants ($n = 7$) used multiple nonecholalic words and slightly more ($n = 11$) used echolalia. Pretreatment expressive modalities included speech, aided and unaided augmentative and alternative communication, and gestures with or without vocalizations. A wide range of pretreatment receptive language abilities were described. For example, participants from some studies were characterized as nonresponsive with receptive language ages (RLA) less than 9 months. In other studies, participants followed simple directions (RLA 9–18 months), understood single words (RLA 18–30 months), and even understood grammar (RLA greater than 30 months).

Snell et al.'s (2010) work is consistent with that reviewed thus far in that it describes a wide potential range of fairly conventional emergent communicative abilities. Those who interact regularly with adolescents or adults with severe disabilities including ASD know that the communicative repertoires of this population often extend beyond conventional expectations. Therefore, unconventional forms are also important to consider.

For decades, persons with ASD (regardless of age) have been recognized for their use of unconventional communication. Specifically, researchers have studied challenging behavior and echolalia as potential means of expression. Many studies have included adolescents and adults with ASD. Challenging behaviors such as self-stimulation, stereotypy, self-injury, physical aggressiveness, and disruptiveness have long been associated with the diagnosis of ASD (Horner, Carr, Strain, Todd, & Reed, 2002). Increasingly, these behaviors have been viewed within

contexts to determine their potential communicative value (Carr & Durand, 1985; Rogers, 2001). While not always used communicatively, challenging behaviors are now recognized as possible means of expressing messages such as the need to escape, protest an action, refuse an object, request an action or object, or draw attention to self or others (Carr & Durand, 1985; Mirenda, 1997).

Another unconventional behavior, echolalia, is also important to take into account. Echolalia has been described as the repetition (including intonation patterns) of others' language (Tager-Flusberg, Paul, & Lord, 2005). Echolalia can be offered immediately after an individual hears the language of others, or it can occur after a period of delay. It has been suggested that echoing in individuals with ASD is evidence of a holistic or gestalt language processing style that may represent initial movement to the development of more generative language (Prizant, 1983). In fact, a number of verbal adolescents and adults with ASD have used echoic speech over their course of language acquisition (Le Couteur, Bailey, Rutter, & Gottesman, 1989). For the purposes of this brief review, it is sufficient to note that echolalia occurs and may serve communicative functions (e.g., requesting, attention getting, and escape) in persons with ASD with minimal generative verbal abilities (Prizant & Duchan, 1981; Prizant & Rydell, 1984). Current research has both explored techniques to quantify echoic speech behaviors (van Santen, Sproat, & Presmanes Hill, 2013) and suggested that some types of echolalia may be related to limited inhibitory control (Grossi, Marcone, Cinquegrana, & Gallucci, 2013). Research has continued to explore the potential meaning of echolalia, but has done so within a broader interactional framework, noting echolalia's role in the accomplishment of limited conversational goals, for example, eluding a conversational partner's injunction, re-directing a partner's attention, or maintaining playful conversational attunement (Sterponi & Shankey, 2014). Thus with this population, analyzing and interpreting their communicative repertories, including unconventional behaviors, may help in both assessment and intervention planning.

2.1.5 Impact of Caregivers on Communication

For both children and adults who are in the prelinguistic stage, caregivers play a large role in facilitating communication skills. Both the characteristics of the child/adult with a disability (e.g., age, output, readability, disability) and those of the caregiver (e.g., education level, income level, parenting style) impact caregiver-child/adult interactions through a transactional process. For example, when a child produces limited vocalizations, caregivers are less responsive in producing vocalizations to the child (Yoder & Warren, 2001) and similar findings are seen with adults (Olney, 2001). As documented by many, as children communicate more, their caregivers have more opportunities to provide input (Calandrella & Wilcox, 2000; Yoder, 2006; Yoder & Warren, 2002). In addition, as children become more competent in their communicative skills with age, caregivers' input typically increases both in frequency and complexity. For example, as infants begin to

babble, caregivers see this as a sign that their child is ready for higher-level language and they increase the complexity of their language (Warlaumont, Richards, Gilkerson, & Oller, 2014). Mothers have been shown to increase both the amount that they talk and the diversity of the words they use as their children age (Rowe, Pan, & Ayoub, 2005). For example, in a study of parent-child interactions at 15 months of age, mothers whose children were most communicative (e.g., sounds, gestures, words) produced more words and diversity of words in response to their children (Abraham et al., 2013). In addition, from a transactional perspective it was assumed the mother's early input had influenced the child's output, and subsequently the reverse was happening. Level of intentionality is also important, as mothers of toddlers with developmental disabilities respond more consistently to their children's intentional communications than they do their preintentional behaviors (Yoder & Munson, 1995). Specifically, when children use gestures such as reaching and pointing, their caregivers respond with additional input that can facilitate their child's language development (Calandrella & Wilcox, 2000; Yoder & Warren, 2002).

Unfortunately, older individuals who are prelinguistic can live in nonresponsive communicative environments where partners are not sensitive to the potential value of less obvious communicative behaviors. Olney (2001) notes the importance of evaluating and responding to even the most nuanced movements within the contexts they are offered to build supportive communicative settings.

Caregiver characteristics such as level of education, income level, and parenting style also impact the child's communication skills (Duncan & Brooks-Gunn, 2000; Hart & Risley, 1995; Rowe et al., 2005). Rowe and colleagues (Rowe et al., 2005) documented that mothers with higher income and educational levels used more diverse and complex language (than did mothers whose education and income were lower) and also had children who exhibited superior language skills. In a study of rural children and their mothers with low incomes, additional factors that impacted the mothers' input were the mothers' knowledge of child development, maternal responsivity, as well as the child's temperament (Vernon-Feagans et al., 2008). In terms of maternal style, mothers who had a more facilitative style (e.g., less directive, more responsive to the child's focus) typically had children who later had larger vocabularies and higher reading skills (Fewell & Deutscher, 2004; Masur, Flynn, & Eichorst, 2005). As noted by Sameroff (2010), parenting styles are a result of multiple factors including the parents' psychological functioning, personality, religion, culture, their knowledge of child development, and the way they were raised by their own caregiver/s.

Caregivers' use of prelinguistic acts can also be influential. For example, maternal gesture input can impact the child's gesture use (Capone, 2007; Iverson et al., 2008) and later language use (Hahn, Zimmer, Brady, Swinburne Romine, & Fleming, 2014). Goodwyn et al. (2000) documented this type of influence by training parents to produce either gestures and words together, or focus on spoken labeling, compared with parents who did not receive any training. At the study's end, parents who used gestures and words together had children whose gesture repertoires were larger than the other two groups of children. Thus, caregivers can

provide their children with input that helps them move from preintentional to intentional communication. As infants (and adults) move out of the preintentional and into the intentional stage, they gain much more control over their environment.

For individuals with ASD, prelinguistic behaviors are critical and recognizing their characteristics and hierarchy of development can be beneficial for researchers and clinicians in assessment and intervention planning. The range of predictors of concurrent and later skills can also be challenging to researchers and clinicians.

2.2 Challenges When Examining Prelinguistic Skills

There are a host of challenges facing researchers and clinicians when examining prelinguistic skills, ranging from assessment context issues to selecting intervention targets. As suggested by Parladé (2012) and Wetherby (2006), measuring social communication behaviors is difficult as there is so much variability in the interaction context, the social partner, the individual child, the information source, and the properties of the assessment tool. One of the challenges that impacts both assessment and intervention decisions is the context of data gathering. Contexts for examining prelinguistic skills have ranged from standardized to non-standardized, examiner administered to parent report, and designs may be longitudinal or cross-sectional. Many studies have included examiner-administered standardized assessments such as the Autism Diagnostic Observation Schedule-2 (Lord, Rutter, DiLavore, Risi, Gotham, & Bishop, 2012), and for young children, the Communication and Symbolic Behavior Scales-Developmental Profile (Wetherby & Prizant, 2002) and Early Social-Communication Scales (ESCS) (Seibert, Hogan, & Mundy, 1982). These tools typically include stimuli such as exciting toys or events (e.g., wind-up toy, balloon, animated toy suddenly activating) that the examiner uses to engage the child (Kasari, Sigman, Mundy, & Yirmiya, 1990; Mundy et al., 1986; Stone et al., 1997; Wetherby et al., 2004). The advantages of using examiner-administered standardized tools are the structured protocol, the similarities across administrations in terms of the type and number of opportunities/prompts for communication, and the standardization sample of children. Standardized measures can also diminish clinician or parent variability that may be more of a factor in observational or parent report measures, respectively. However, the limitations include the unfamiliarity of the examiner and the setting, which can have an impact on the child's performance. Indeed, the work of Fuchs, Fuchs, Power, and Dailey (1985) indicates that although preschool and school-age children without disabilities perform equally with familiar and unfamiliar examiners, children with communication difficulties perform more poorly with unfamiliar examiners.

Other means to examine communication skills may include videotaped examiner-child or caregiver-child interactions, followed by coding of the observed behaviors. Other methods have included caregiver report measures such as the MacArthur-Bates Communicative) Development Inventory (CDI) (Fenson et al., 2007), naturalistic observation or caregiver guided observations or a combination

(Crais et al., 2004). The benefits of using parent report include the potential to gather a more representative sample, as parents spend more time with the child than professionals, are familiar to the child, and provide a familiar context. In addition, the parent has multiple opportunities to see the child across contexts. Naturalistic observation typically involves videotaping the child and caregiver at home during some "usual" interactions such as playing with toys and then coding the behaviors observed (Capirci, Iverson, Pizzuto, & Volterra, 1996; Crais et al., 2004; Iverson & Goldin-Meadow, 2005; Parladé, 2012). Guided caregiver observations may include a checklist of typical gestures along with definitions and examples and detailed instructions about what is and is not a gesture (Crais et al., 2004) and having caregivers document the targeted behaviors and when they see them over some timeframe. The benefits of these measures include familiarity of partner and context, as well as opportunities to see the child in her/his usual surroundings, which may allow the child's full repertoire to be observed. Indeed, there is some evidence that children produce more vocalizations and gestures when at home versus in a laboratory setting (Iverson, Capirci, & Caselli, 1994; Lewedag, Oller, & Lynch, 1994). The drawbacks of naturalistic settings are the lack of structure and ability to control the context, thereby not always having similar numbers of opportunities for some types of behaviors.

A final method of data gathering is the use of retrospective video analysis (RVA). RVA entails gathering home video footage of children before diagnosis or, for some families, even before concerns arise (Baranek, 1999; Colgan et al., 2006; Osterling & Dawson, 1994, Watson, Crais, Baranek, Dykstra, & Wilson, 2013). Most studies include children who are later diagnosed with ASD or another DD and a group of children who are typically developing. Through the use of rigorous guidelines, these videos can be coded by "blind" observers to look for differences across groups. The drawbacks to RVA are that caregivers may select the video footage to capture or avoid (e.g., camera turns off when child becomes fussy or acts in unusual manner); not all behaviors desired may be observed; and sound quality/camera angle may at times make coding difficult. However, the strengths of RVA include the natural setting and familiar adults (or siblings) as well as the range of contexts that can be included (e.g., meal times, outdoor play, floor play).

The challenge in employing only one measurement method may be that children differ in which prelinguistic means they use (and how frequently) in one setting/context versus another. For example, in gesture use, few studies have combined standardized and non-standardized methods, and few have included both parent report and naturalistic means. However, a few studies have used combined methods (Crais et al., 2004; Parladé, 2012; Rowe & Goldin-Meadow, 2009). For example, a recent study by Parladé (2012) included both structured versus naturalistic contexts in examining social communicative behaviors in 14- and 18-month-olds who were at high risk for an ASD diagnosis (younger siblings of children with ASD) or low risk for ASD with a negative family history. As documented by Parladé, there was very little correspondence between the joint attention behaviors (fewer) seen on the ESCS and the larger number of joint attention behaviors displayed in the naturalistic sampling context. As suggested by Parladé, different contexts may afford

differential opportunities for specific functions. For example, more behavior requests than joint attention behaviors were seen in the context of the ESCS with its elicitation probes, whereas in the naturalistic setting behavior requests and joint attention acts were equally represented. As an explanation, Parladé argued that children with ASD may show more "sticky attention" to the kinds of objects often used in elicitation tasks in tools like the ESCS (e.g., bubbles, windup toys) and therefore demonstrate more behavior requests to get the toy activated than joint attention to share interest. Thus, sampling contexts in standardized settings may need to provide additional opportunities for joint attention acts.

The issues of differential responses relative to the familiarity of the partner and context are also important. As discussed by Crais et al. (2004) when considering Carpenter et al.'s (1998) study of 24 typically developing children seen in a lab setting, despite monthly observations and elicitations from 9 to 15 months, 9 of the 24 children never *gave* declaratively, 4 never *pointed* declaratively, 3 never *gave* imperatively, and 9 never *pointed* imperatively. In contrast, in the Crais et al. (2004) study where children were observed monthly in their homes interacting with their caregivers, all 12 children displayed all four of the above gestures. These differences across studies argue for the use of multiple methods for gaining information about children's communicative behaviors, mirroring Tager-Flusberg et al.'s (2005) and Crais, Watson, and Baranek's (2009) recommendations to expand the context of assessment to include more natural communication samples. In addition, as noted by Parladé (2012), combining the results of standardized assessments and parent report with observational data from the home setting improved substantially the diagnostic predictability for the high- and low-risk groups of children studied. For detailed discussions of various assessment approaches for prelinguistic communicators, see Chaps. 5 and 6.

2.3 Implications for Research and/or Practice

From a research perspective, there are a number of frontiers left to explore relative to prelinguistic communication. One is to quantify clear "red flag" boundaries for a range of prelinguistic behaviors in infants and toddlers. For example, although there are rough guidelines to use to determine when smiling should appear, for behaviors such as the range of consonants that should be produced, when first gestures are used, and when joint engagement is consistently used between adult and infant, most have moderate variation across infants. In these cases it is often easier to use "expected ranges" rather than red flags because many prelinguistic behaviors do not have clear guidelines that unequivocally indicate at what point a child is delayed or disordered. Therefore, to help in diagnosis and intervention planning, additional research is needed to define the upper boundaries or absolute red flags across a range of prelinguistic behaviors.

Yet even though we do not know all the boundaries, gathering information about the use of prelinguistic skills can help differentiate between children with and

without disabilities including ASD. Milestones noted previously in terms of social smiling, sound making, babbling, onset and use of intentionality, onset of gestures, communicative functions, frequency and type of gesture use, and the ability to combine means of communication can all be analyzed for signs of delay or disability. In addition, factors such as non-hierarchical development (e.g., multiple words in a child's inventory, but none used functionally; a child learning letter and number names with limited use of gestures) can help in the diagnostic process as well as to identify areas to target in intervention.

In addition, because of certain patterns of gesture use, distinctions can also be made across disability groups. For example, the work of Watson et al. (2013) and Wetherby, Watt, Morgan, and Shumway (2007) has documented that the lower inventory of gestures of young children with ASD is one variable that can help distinguish them from children with other disabilities. As noted, between 9 and 12 months infants later diagnosed with ASD show patterns of similar number (but less variety) of social interaction gestures when compared to children who are typically developing (TD) and DD; whereas by 15–18 months they use fewer of these gestures than children with TD or other DD (Colgan et al., 2006; Watson et al., 2013). For behavior regulation acts at both 9–12 and 15–18 months, infants with ASD use similar numbers of acts as children with DD, but less than those with TD and more contact gestures (Landa, Holman, & Garrett-Mayer, 2007; Watson et al., 2013; Wetherby et al., 2004). The largest difference across groups appears in join attention acts where infants and toddlers with ASD at both 9–12 and 15–-18 months show no or few acts compared with children with DD or TD (Landa et al., 2007; Watson et al., 2013; Wetherby et al., 2004). Thus, gesture frequency, variety, and type can help make distinctions between children with ASD versus another DD.

Object-related or symbolic gestures are also important components of symbolic play acts and are strongly related to language skills. Looking at gesture and play, for both TD children (Bates, Bretherton, & Snyder, 1988) and those with DD (Kennedy, Sheridan, Radlinski, & Beeghly, 1991), higher levels of gestural production and play maturity have been associated with higher levels of comprehension. Thus examining and profiling a child's use of gestures, along with other related communication domains such as comprehension and play, can provide additional information about a child that can be used for clinical decision making. For example, in a study of siblings of children diagnosed with ASD, Mitchell et al. (2006) noted that neither comprehension nor production of words at 18 months had distinguished the high-risk siblings (those who went on to be diagnosed with ASD) from those at low risk (not diagnosed with ASD). However, the use of gestures did differentiate these groups. Therefore, Mitchell and colleagues argued that gesture use can be more informative than language measures at this age. They further suggest that examining gesture use alone cannot be used as a singular screening measure, but can be combined as part of routine developmental surveillance as the delays in gesture use may be one of the earliest indicators of ASD in these children. Thus, as suggested by Sauer, Levine, and Goldin-Meadow (2010), examining early gesture use can provide clinicians with a mechanism to identify children who may eventually have

persistent language deficits, before the delays are seen in the child's speech. Gestures in turn become a target of any intervention strategy developed to address current and possible future delays in communication skills.

Finally, using prelinguistic behaviors in combination is another means that can be used to identify children with potential disabilities including ASD. As documented by Wetherby et al. (2004), the lack of coordination of eye contact, facial expression, gestures, and vocalizations can be used as a red flag for toddlers with ASD. In addition, Goldin-Meadow and colleagues (Goldin-Meadow, 2008; Rowe & Goldin-Meadow, 2009) observed that gesture-plus-speech combinations predicted the age at which children produced two-word combinations. And Parladé (2012) has recommended examining the ability to combine vocalizations with eye gaze or gestures, and specific gestures such as showing and pointing that my help differentiate young children before the age of 12 months who may be struggling with communication challenges.

For children or adults in the prelinguistic stage of communication, facilitating their use of prelinguistic means in terms of frequency, variety, and types of functions should be a major focus of their educational goals. In addition, as suggested by Brady et al. (2004), facilitating their partners' use and modeling of these means can improve partner interactions thereby enhancing the communication skills of these prelinguistic individuals.

2.4 Conclusion

This chapter has highlighted a range of prelinguistic skills important for individuals in the prelinguistic stage of communication development. For individuals in this stage, acquiring a range of these behaviors is critical to current and later communication development. In addition, as the acquisition of many of these skills can enhance the individual's immediate communication effectiveness and efficiency, the transactional effect on communication partners can further advance the individual's skills as partners can be more responsive, providing more models and additional opportunities for the individual to communicate. Thus, clinicians and researchers can and should target these behaviors within both the assessment and intervention context.

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Chapter 3
Prelinguistic Communication and Joint Attention

Barbara Braddock and Nancy C. Brady

Abstract This chapter reviews prelinguistic communication and joint attention in infants with typical development and in individuals with autism spectrum disorder who have minimal verbal skills. Joint attention is described as triadic coordination or sharing between self, communication partner, and an object or event. From early on, infants show developmental progression in joint attention abilities. Joint attention in infancy can be classified into two types, depending on if infants are responding to others' joint attention bids (by following another person's eye gaze and/or points) or spontaneously initiating joint attention overtures with others (by producing triadic gaze shift, pointing and/or showing gestures). By 13 months of age, young children with typical development enter into sustained episodes of coordinated joint engagement. Individuals with autism spectrum disorder have differences in both joint attention and sustained joint engagement. Joint attention abilities relate to concurrent and later language development in individuals with autism spectrum disorder. Teaching joint attention, symbolic play, and imitation may affect other areas of development. Clinical implications for promoting joint attention in individuals with or at risk for autism spectrum disorder are discussed.

The diagnosis of autism spectrum disorder (ASD) is based on a constellation of symptoms, to include qualitative differences in or a complete absence of joint attention (American Psychiatric Association [APA], 2013). Joint attention is defined as attending to both communication partner and referent (an object, person, or event) during shared interactions (Mundy & Newell, 2007). Joint attention involves the integration of mutual eye gaze, prelinguistic gesture, and vocalization in young children developing typically prior to the onset of first words. Interest in joint attention stems from the fact that it is a recognized deficit in the

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communication behaviors of children with ASD, and deficits in mutual eye gaze and prelinguistic gesture are often observed from the earliest ages of identification. Indeed, qualitative differences or a complete absence of joint attention are among the early "red flags" used to identify ASD. Beyond diagnosis, responding to or initiating joint attention relates to long term outcomes in social communication development in individuals with ASD.

Joint attention has been targeted in early interventions for children with ASD (Kasari, Freeman, & Paperella, 2006; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Whalen & Schreibman, 2003). Kasari and others (2006, 2010) measured joint attention as an important outcome for interventions targeting other skills such as play. Joint attention is a particularly important variable for the approximately 30 % of children with ASD who have minimal verbal skills—those who use no or few consistent words at age 5 years (Anderson et al., 2007; Kasari, Brady, Lord, & Tager-Flusberg, 2013). The purpose of this chapter is to describe prelinguistic communication and joint attention in children with ASD and reference these developments to benchmarks in typical development. (Joint attention in typical development has been reviewed more completely in Chap. 2). Our emphasis will be on prelinguistic gesture and joint attention behaviors as important variables in assessing and treating individuals with ASD.

3.1 Development of Joint Attention

There is a predictable developmental progression in joint attention in infants with typical development (TD) over the first 2 years of life. The following section describes development of two types of joint attention—responding to and initiating bids for joint attention with another person.

From a developmental perspective, between 0 and 6 months of age, infants with TD begin to use and respond to caregiver behaviors to establish primary intersubjectivity (Trevarthen & Aitken, 2001). Primary intersubjectivity reflects a system that promotes the infants' tendency to use and respond to caregivers' eye contact, facial affect, vocal behavior, communicative gestures, and body posture (Westby, 2010). From these early experiences, infants with TD display secondary intersubjectivity that involves conscious awareness of both self and others as sharing an experience (Tomasello, 1995). To develop intersubjectivity, infants must engage in joint attention or shared experiences with others. Often these shared experiences involve an object or event of shared interest.

In young children, joint attention interactions may take place during routine situations with caregivers, or in recurrent activities that are part of the infants' daily experiences, such as playing, eating, bathing, and diaper changing (Carpenter & Tomasello, 2000; Fiske, 2010). For example, in the game of peek-a-boo, infants may look and vocalize in response to their caregivers' eye gaze, touch and hand movements, and spoken words. The described interaction is dyadic (with focus on self and communication partner), yet the interaction provides the information and

experience for infants to develop a representation of themselves and others as having both distinct and shared affective experiences (Westby, 2010).

As early as 6 months of age to the end of the first year, infants develop joint attention abilities (Bakeman & Adamson, 1984). Joint attention is described as triadic coordination or sharing of attention between self, communication partner, and an object or event (Bakeman & Adamson, 1984; Leekam & Moore, 2001). For instance, coordinated eye gaze emerges as the earliest nonverbal joint attention skill in children with TD around 6 months of age and becomes more intentional by 12 months (Paparella, Stickles Goods, Freeman, & Kasari, 2011).

3.1.1 Types of Joint Attention

Joint attention behaviors in infancy can be classified into two types, depending on if infants are responding to others' joint attention bids or spontaneously initiating joint attention overtures with others. In the literature, "responding to joint attention (RJA) refers to the infants' ability to follow the direction of the gaze and gestures of others in order to share a common point of reference" (Mundy & Newell, 2007, p. 269). In RJA, a young child may shift attention from his or her communication partner's face to look at an object of interest such as a passing airplane *after* his communication partner gazes at, points out, and/or labels the referent as "airplane."

Developmental changes are apparent in infants' RJA. Older infants appear to be visually connected to the outside world, and respond to gaze shift to share a common point of reference with another person. For example, Brooks and Meltzoff (2005) found a developmental difference in how infants of varied ages respond to the visual cue of their communication partners' eyes. Ten- and 11-month-old infants followed an experimenter's head turn and gaze shift significantly more often when the experimenter's eyes were open than when the experimenter's eyes were closed. Nine-month-old infants, however, were equally likely to follow the experimenter's head movement whether or not the experimenter's eyes were open. These results show a developmental shift in infants' social cognition for RJA; specifically, 10- and 11-month-old infants recognized that an experimenter's looking with open eyes was an important behavioral signal and was something noteworthy to look at, but 9-month-olds did not differentially respond to this cue.

Similar developmental changes have been observed in initiating joint attention (IJA). IJA "involves infants' use of gestures and eye contact to direct others' attention to objects, to events, or to themselves" (Mundy & Newell, 2007, p. 269). IJA involves infants' spontaneous use of prelinguistic, socially motivated communicative behaviors, such as triadic eye gaze (looking from partner to referent then back to partner) in addition to the use of gestures such as showing and pointing. For example, a young child may point and gaze at a passing airplane, look at their communication partner's face, and then shift their gaze back to the airplane using a triadic or three-point gaze shift. In this example of IJA, the child is able to initiate shared interest in the passing airplane.

Table 3.1 Behavioral forms of RJA and IJA

RJA behaviors	IJA behaviors
Following (with eye gaze/head turn or body orientation) another person's eye gaze (distal)	Coordinated gaze shift (the individual looks from an object to another person, then back to the object; or the individual looks at another person, to the object, then back to the person)
Following another person's point (proximal and distal)	Pointing gesture (proximal and distal)
Following another person's head orientation or head turn	Showing gesture (object in hand)

Some of the earliest means to convey triadic eye gaze appear to be through eye gaze shifts. For example, researchers have documented that children as young as 6 months will look from an object of interest to an adult and then back to the object of interest in a short period of time (seconds or less) (Salley & Brady, 2015). With this rapid gaze shift, the infant appears to be both checking in with the adult to see if the adult also sees the object of interest, and indicating his or her own interest by looking back at the object.

Soon after, deictic gestures, such as showing and pointing, are used to establish reference by calling attention to or indicating an object or event of interest. Typically developing infants begin to point out things to others several months before they use words to refer to objects (Bates, 1976), and continue to use gestures to support their verbal communication after the emergence of first words (Acredolo & Goodwyn, 1988; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Iverson, Capirci, & Caselli, 1994; Iverson & Goldin-Meadow, 2005; Morford & Goldin-Meadow, 1992). The showing gesture can serve the same communicative function as pointing. For example, a young child may orient or place an object where it can be seen by his/her communication partner for the purpose of joint attention, as if to share or comment (i.e., "look at this"). Developmental data from typically developing infants suggest that all these behaviors are apparent by 12 months of age (Carpenter, Nagell, & Tomasello, 1998).

Gestures for showing and pointing emerge in a predictable sequence starting at about 10 months of age, and show a marked increase in their occurrence after 11 months as more primitive gestures, such as reaching, decline (Bates, Camaioni, & Volterra, 1975; Bates et al., 1979). Table 3.1 highlights the behavioral forms of joint attention for both responding to and initiating joint attention, to include skills such as pointing, showing, and coordinating looks between objects and people.

3.1.2 Joint Engagement

Joint engagement is another term that is similar to joint attention but refers to how the child is engaged with both his or her communication partner and salient events

in the environment over an extended time (Bakeman & Adamson, 1984). Joint engagement involves the development of attention states needed to mutually sustain shared attention with others. Initially, caregivers scaffold and support the cognitive and attentional demands required for joint attention in interactions with young children (Bakeman & Adamson, 1984). During this *supported joint engagement*, children are actively engaged but do not give explicit attention to caregivers through visual referencing. For example, a mother and child might concurrently focus on a toy while playing with the toy and showing positive affect through laughing.

By 13 months of age, children with TD enter into sustained episodes of coordinated joint engagement with their communication partners (Bakeman & Adamson, 1984). These episodes are characterized by children actively shifting their eye gaze between communication partners and objects of interest at key moments over an extended interaction (see Bottema-Beutel, Yoder, Hochman, & Watson, 2014). When caregivers infuse symbols into joint engagement using words, gestures, manual signs, pictures, and other referential symbols, they provide children with contexts for learning the meaning of these symbols (Adamson, Bakeman, & Deckner, 2004).

3.1.3 Prelinguistic Communicative Function

The term joint attention has also been used to refer to a communicative function. At a basic level, Tomasello (2008) describes communicative function as an evolutionary process because individuals need communication for survival. Researchers propose that survival and personal safety are guaranteed if: (a) individuals can solicit help from the environment for their basic needs, (b) individuals feel accepted and taken care of by their environment, and (c) the environment is willing to exchange information that will make individuals more independent and able to protect themselves (for a review see Loncke, 2014). To meet these survival and personal safety needs, individuals communicate for behavioral regulation, social interaction, and joint attention. In initiating joint attention, communication exchange is built on showing (e.g., *look at that*) or spontaneously seeking to share interests or experiences (e.g., *what do you think?*). In this way, two individuals might use communication exchange around a shared referent when facing danger.

In contrast, other communication functions include behavior regulation acts such as requesting and protesting, and social interaction acts such as greeting or showing off (e.g., waving or clapping) (Bruner, 1981). The importance of distinguishing between these functions for individuals with ASD will become clear when reading the following section on joint attention in ASD. It is important to note the different ways in which these terms have been used in research in order to interpret findings. Hence, consumers of research should consider whether the term joint attention is being used to describe a particular form of communication

such as triadic eye gaze or pointing, *or* the communicative function of communicating a shared interest.

3.2 Joint Attention and Autism Diagnoses

There is substantial evidence that individuals with ASD have persistent and pervasive deficits in joint attention skills (IJA, RJA and the communicative function joint attention [JA]). Both joint attention skills and sustained joint engagement are impaired in individuals with ASD, and deficits range from qualitative differences to a complete absence of joint attention.

According to the DSM-V diagnostic criteria, ASD is defined as persistent deficits in social communication and social interaction across multiple contexts, to include more limited triadic communication skills, such as understanding and using gesture, and responding to and initiating joint attention (American Psychiatric Association [APA], 2013). Symptoms are present in early development. Thereby, deficits in joint attention are a key component in the profile of individuals with ASD that may distinguish them from children with intellectual disability or TD (Dawson et al., 2004), and from children with only developmental language delay (Loveland & Landry, 1986). The following paragraphs describe how research has demonstrated that deficits in both RJA and IJA contribute to the behavioral profiles associated with an ASD diagnosis.

3.2.1 RJA and Autism

RJA is an important variable in the screening of ASD symptoms and is predictive of later ASD diagnosis. In one prospective study, RJA was examined at 14 and 24 months in a group of later-born siblings of children with ASD (Sullivan et al., 2007). RJA was measured using standard testing procedures for look only (Butterworth & Jarrett, 1991), and look + point items taken from the Communication and Symbolic Behavior Scales Developmental Profile (CSBS) (Wetherby & Prizant, 2002) and Autism Diagnostic Observation Schedule (ADOS) (Lord, Rutter, DiLavore, & Risi, 1999). ASD characteristics in the high-risk group were examined at 3 years of age. Results showed that children's RJA performance at 14 months predicted ASD diagnoses at 3 years of age, and children who received an ASD diagnosis at age 3 had made little improvement in RJA between 14 and 24 months.

Using more comprehensive testing procedures, Yoder, Stone, Walden, and Malesa (2009) also found that initial levels of RJA (when examined at an average age of 15 months) predicted ASD diagnosis at about 34 months of age in later-born siblings of children with ASD. The joint attention cues provided in the Yoder and colleagues' study varied along a continuum from very subtle cues—such as gaze to object alone—through more obvious cues—such as calling the child's name,

pointing and gazing to the object. Responses to these various cues were tallied and participants' total scores were found to be predictive of later autism diagnosis.

In sum, deficits in RJA appear to be an early marker for ASD as well as for significant delays in language and/or social development (Sullivan et al., 2007). Care should be taken to examine a full range of social orienting and joint attention behaviors in children at risk for ASD because instability in RJA performance is also apparent in young children with TD. From a practical standpoint, appropriate screenings, evaluations and/or interventions should follow to address early concerns about a child's RJA.

3.2.2 IJA and Autism

In the examination of IJA, researchers and clinicians distinguish between gestures and vocalizations produced for shared attention (e.g., protodeclarative points) and those produced for requesting (e.g., protoimperative points; see Paparella et al., 2011). Descriptions of communication forms and functions are needed because young children with ASD are found to communicate predominantly for behavioral regulation rather than for the function of commenting or sharing attention with another person (Shumay & Wetherby, 2009). Relative to comparison groups, young children with ASD have been found to communicate at reduced rates and produce lower proportions of deictic gesture types, such as pointing and showing (Shumay & Wetherby, 2009).

A good amount of information about protodeclarative gesture is available from videotaped reviews of children's early development (Watson, Crais, Baranek, Dykstra, & Wilson, 2013). Relative to comparison groups (i.e., one group of children with TD and another group with other developmental disabilities), children at 9 and 12 months who were later diagnosed with ASD were less likely to produce gesture for the communicative purpose of joint attention. Along these same lines, when home videos of children at 15–18 months were examined, relative to children with other developmental disabilities, children with ASD were less likely to produce gestures for the communicative purposes of joint attention or social interaction.

Videotaped reviews of first birthday parties are a particularly good context for this type of analysis because there is an almost universal script for activities that occur at a first birthday party (within mainstream cultures in North America). For example, a lighted birthday cake emerges, everyone sings, packages are unwrapped, and the birthday boy or girl is the center of attention. Researchers have found that, while most typically developing children will share the positive affect of those at the birthday party, show gifts and shift their gaze between the birthday cake and guests, children with ASD display fewer social and joint attention behaviors, including pointing, showing objects, looking at the face of others, and orienting to name (Osterling & Dawson, 1994).

Recent prospective research has sought to identify early deficits in joint attention by comparing development in children born into families that have a child already diagnosed with ASD. Because of the large degree of inheritance in ASD (Ozonoff et al., 2011), siblings of children with diagnosed ASD have been followed since birth in order to identify early deficits, or "red flags" associated with ASD. Children in these studies are followed longitudinally and then comparisons are made between early occurring behaviors in children who later receive a diagnosis of ASD in comparison to those who do not receive this diagnosis (see also Landa, Holman, & Garrett-Mayer, 2007).

In one such study, Mitchell and others (2006) found that children diagnosed with ASD at 24 months of age were previously reported by caregivers to understand fewer phrases and to produce fewer gestures than typically developing siblings or low-risk controls as early as 12 months of age. In this study, deictic gestures (for giving, showing, pointing) and conventional gestures (such as lifting arms to signal wanting to be picked up, shaking or nodding head) were examined on the MacArthur-Bates Communication Development Inventory-Infant Form: Words and Gestures (MCDI) (Fenson et al., 1994).

Additionally, Winder, Wozniak, Parladé, and Iverson (2013) examined spontaneous communication initiations in young children at heightened risk for ASD (i.e., infant siblings of children with ASD). They determined that at both 13 and 18 months, relative to low-risk infant controls, infants at heightened risk for ASD initiated lowered rates of spontaneous communications including show and point gestures. These findings are important to clinical practice because deficits in early gesture use may be among the earliest red flags for ASD. The underlying lack of reciprocal engagement and joint attention is apparent in gesture use even before first words are expected.

3.3 Joint Attention and Language

Research consistently documents that joint attention relates to both concurrent and later language development in children with ASD (Mundy, Sigman, & Kasari, 1990; Wetherby, Watt, Morgan, & Shumway, 2007). A high level of joint attention in children with ASD at 20 months of age was positively associated with language gains at 42 months of age (Charman et al., 2003). In this work, a high level of joint attention was defined by children's gaze shifting between remote control toys and the experimenter (or parent) for at least 67 % of trials. Receptive language gains (but not expressive language gains) were significantly positively associated with performance on the joint attention task at 20 months.

Joint attention remains relevant to language at older ages as well. For example, Sigman and colleagues (1999) found that joint attention behavior in 4-year-old children with ASD predicted long-term expressive language gains through ages 10–13 years (Sigman et al., 1999). In related longitudinal research, Bopp and Mirenda (2011) followed children diagnosed with ASD beginning around age

4 years. They found that IJA gestures predicted later language comprehension and production up to 5 years later. Bopp and Mirenda also found that "games and routines" (such as peek-a-boo, play patty cake, "so big", chase games, sign and dance) were predictive of language production over the 4- to 5-year period. This finding is not surprising because games and routines frequently involve joint attention with a caregiver.

In sum, early RJA and IJA are positively related to language outcomes in both preschool-aged (Charman et al., 2003) and school-aged children (Sigman et al., 1999). The consistent findings linking RJA and IJA to language suggest that these early occurring behaviors may be foundational to later language, and may be appropriate targets for intervention.

3.3.1 Joint Engagement and Language

As discussed previously, joint engagement is a term that has been used to describe interaction patterns between adults and infants. It is closely tied to joint attention, but a separate literature has linked joint engagement to language outcomes. In 1 year-long study, for example, researchers examined children's development of joint engagement with caregivers, and related joint engagement experiences to language outcomes in three study groups: 30-month old children with ASD, 30-month old children with Down syndrome, and 18-month old children with TD (Adamson, Bakeman, Deckner, & Romski, 2009). For all groups, *symbol-infused joint engagement* experiences in which caregivers provided support for children to use verbal language contributed to children's receptive and expressive vocabulary growth, over and beyond initial language level.

Supported joint engagement, in which caregivers scaffold interaction to promote joint engagement and reciprocal play, has also been linked to language outcomes in children with ASD who initially had minimal verbal skills. For instance, Bottema-Beutel et al. (2014) found that children's higher collaborations with primary caregivers in toy play along with caregivers' use of "follow-in" utterances in synchrony with children's current focus of attention predicted higher social communication and language abilities at 8 month follow-up. These findings have clinical implications because primary caregivers may be taught to provide the contextual support and social motivation necessary for increased language and social communication growth (see Brady, Warren, & Sterling, 2010).

3.4 Challenges in ASD

Why do individuals with ASD lag behind so significantly in the development of joint attention? It may be that individuals with ASD fail to find social stimuli inherently motivating. Further, individuals with ASD may engage in highly

restrictive interests or routines that in turn limit social reciprocity with others. The following paragraphs describe behavioral characteristics of ASD, or core ASD features in social interaction and restricted and repetitive behavior (APA, 2013), that may relate to deficits in joint attention as described in earlier sections of this chapter.

3.4.1 Social Interaction

Shared affective experiences generally accompany joint attention episodes and other communicative acts in social interactions with others. It stands to reason that children with TD may attend to and engage in joint attention with others because the social communication exchange itself is inherently motivating. However, persons with ASD may appear affectively unresponsive and direct fewer smiles or facial expressions to their communication partners in social exchange (Gangi, Ibanez, & Messinger, 2014; Joseph & Tager-Flusberg, 1997). Further, children with ASD are more likely to reject or appear unaware of caregivers' bids for joint attention and sustained engagement (Adamson, McArthur, Markov, Dunbar, & Bakeman, 2001; Osterling & Dawson, 1994). In all, these challenges in social interaction require caregivers to "work harder" to motivate individuals with ASD to participate in episodes of joint attention. Therefore, caregivers must develop strategies to jointly engage children with ASD in everyday activities for longer periods of time.

3.4.2 Restricted and Repetitive Behavior

Individuals with ASD may exhibit repetitive and restrictive behaviors such as repetitive sensory-based actions and/or insistence on sameness (APA, 2013). An individual's strong attachment to particular objects or other highly fixated interests may challenge his/her communication partner and limit joint attention and engagement (Williams, Costall, & Reddy, 1999). Research has shown that, relative to peers with TD, children with ASD spend more time in object engagement, and less time in coordinated joint engagement with caregivers (Adamson et al., 2009).

Specifically, 12-month-old infants who were later diagnosed with ASD were found to explore objects in atypical ways (Ozonoff et al., 2008). Atypical object exploration included spinning objects, rotating objects, and unusual visual exploration of objects. Atypical object exploration or abnormal object use may compete with an individual's abilities to shift his or her focus of attention from object to communication partner for joint attention and/or sustained engagement.

3.5 Implications for Research and Practice

In addition to being a core symptom of ASD, the failure of some individuals to direct communications to others may be related to various social communication outcomes. Therefore, research and practice emphasizes improving joint attention through intervention. Improved joint attention may lead to stronger communication and intellectual function in preschool- and early school-aged years (Poon, Watson, Baranek, & Poe, 2012). Because joint attention behaviors are related to the ability to talk and socially interact, we review ASD-specific intervention research in the final section of this chapter and discuss generalization of skills to related areas. In addition, we highlight joint attention as an important screening index and discuss ASD-specific evaluation tools in children at risk for ASD.

3.5.1 Intervention in Joint Attention

Joint attention can be increased by teaching the component behaviors of RJA and IJA. The teaching of specific RJA and IJA behaviors using approaches grounded in applied behavior analysis has resulted in improved joint attention in preschool-aged children with ASD (Jones, Carr, & Feeley, 2006). For instance, Jones et al. conducted a series of studies using a single-subject, multiple baseline design by teaching RJA and IJA behaviors in young children with ASD. Children in the studies mastered RJA and IJA with teachers or parents as communication partners in the interventions. Even more, when expressive language was measured, results showed an increased number and variety of vocalizations during episodes of joint attention. In another intervention study, when young children with ASD were taught to initiate joint attention by showing and pointing, they also demonstrated increased imitation, play, and spontaneous speech (Whalen, Schreibman, & Ingersoll, 2006). These findings showing collateral improvement in expressive language support the view that teaching joint attention skills can result in a positive spreading effect to other developmental domains not specifically targeted in the intervention.

Joint attention behaviors have also been demonstrated when interventions have focused on increasing imitation in children with ASD. Ingersoll and Schreibman (2006) found that teaching object imitation skills to young children with ASD resulted in improvements in joint attention, pretend play, and language abilities. Imitation may be a powerful tool in the context of naturalistic play intervention to target gesture imitation for IJA (see Ingersoll, Lewis, & Kroman, 2007). This outcome is likely due to the fact that in order to imitate actions with objects, the participants needed to attend both to the objects and the experimenter, thus increasing opportunities for joint attention.

Interventions targeting joint attention and play have shown positive results in children with ASD at 3 and 4 years of age (Kasari, Freeman, & Paparella, 2006; Kasari, Paparella, Freeman, & Jahromi, 2008). For example, children randomized

to the joint attention intervention improved significantly relative to a control group, demonstrating more showing and RJA during structured assessments, and IJA during mother-child interactions. Analyses of data from follow-up assessments on these children completed 6 and 12 months after intervention found differential effects based on language skills at entry to the study. Children who had the lowest language at the beginning of the study showed better language outcomes if they had received the joint attention intervention, whereas children with higher initial language responded best to the symbolic play intervention (Kasari et al., 2008).

In another joint attention intervention study, 3- to 5-year-old children who were minimally verbal participated in an intervention that targeted joint attention, symbolic play, and self-regulation (JASPER) (Stickles Goods, Ishijima, Chang, & Kasari, 2013). Relative to a comparison group of children who received treatment as usual, children who received JASPER for an hour a week over 12 weeks demonstrated greater play diversity on standardized assessment and more communicative gestures during free-play activities. Kasari and colleagues also found that combining JASPER with augmentative and alternative communication (AAC) (specifically, a speech-generating device) resulted in significant gains in joint attention and language outcomes (Kasari et al., 2014). These results are significant because interventions in joint attention and play, and including symbols into episodes of joint engagement in play, may improve core deficits in individuals who function largely at the prelinguistic communication level.

Although the exact mechanism of change is not fully understood in teaching joint attention, increased reciprocal social interactions and affective exchange between two individuals may motivate learning and provide learners with opportunities to practice responding to and initiating socially-directed communication. Both joint attention and play contexts provide the learner with opportunities to imitate motor and vocal productions, and to explore and act on objects. Skills of parents and/or treatment providers, treatment dosage, and/or additional therapies received also play a role in child response to treatment (see Kasari et al., 2010).

3.5.2 Screening and Evaluation

Given that joint attention is an important screening and early intervention target, professionals continue to review optimal practices to identify infants and toddlers at risk for ASD. To aid in early identification of ASD, the American Academy of Pediatrics, in a 2006 policy statement, recommended administering a standardized ASD-specific screening tool to all children at the 18-month preventive care visit (Council on Children with Disabilities, 2006). The recommendation was later expanded to screen at 24 and 30 months to identify those children who may regress in social communication skills after 18 months of age. Well-known screening instruments include items examining RJA and IJA (e.g., M-CHAT-R/F: Robins et al., 2014). Referral to audiology to examine hearing sensitivity may also be

indicated for young children who fail early autism-screening measures, and early intervention services can be initiated as concerns are identified.

Further, professionals must refine ASD-specific evaluation methods to examine joint attention abilities in individuals with severe communication disability (see Brady et al., 2012). To examine joint attention at any age, the Autism Diagnostic Observation Schedule (ADOS) is considered the gold standard for behavioral observation of ASD symptoms (Lord et al., 1989). The entire ADOS has recently been updated to the second revision, called the ADOS-2 (Lord et al., 2012), to include a module for toddlers under 3 years of age. The ADOS-2 provides examiners with opportunities to observe RJA and IJA and other behaviors related to the diagnosis of ASD.

For young children under 3 years of age, joint attention may also be examined using developmental and language assessment tools centering on items that examine early social-emotional and pragmatic communication development, such as the CSBS (Wetherby & Prizant, 2002), Rossetti Infant-Toddler Language Scale (Rossetti, 2006) and Ages and Stages Questionnaires: Social-Emotional (Squires, Bricker, & Twombly, 2002). Researchers have developed a protocol, known as the Early Social Communication Scale (ESCS) (Mundy et al., 2003) to systematically examine early social communicative acts, to include both IJA and RJA, in children between 8 and 30 months of age. The ESCS has application for examining early social communication behaviors (for joint attention, requesting behaviors, and social engagement) in infants with typical development and in young children at risk for or with ASD and related neurodevelopmental disorders.

3.6 Conclusions

Joint attention is important because it is an early marker for ASD, and evidence shows close relations between joint attention, language, and gestural communication development. Further, teaching joint attention, symbolic play, and/or imitation has positive effects for communication outcomes as well as other developmental areas for individuals with ASD. Given that joint attention is the "prototype" for any information sharing between two people, interventionists must work closely with families to promote joint attention and address challenges associated with ASD that limit ongoing social, cognitive and communicative development.

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Chapter 4
Transitions to Intentional and Symbolic Communication in Typical Development and in Autism Spectrum Disorder

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Abstract We begin by reviewing research focused on the way in which the emergence of new forms of intentional and symbolic communication alters the typically developing child's communicative environment. Our central thesis is that these alterations not only change the nature of the input that the child receives but also influence the availability of opportunities for learning that support future development. We then review what is known about delays and atypicalities in the development of intentional and symbolic communication in individuals with autism spectrum disorder. Based on these data, we suggest that these communicative delays and atypicalities have far-reaching, cascading effects that extend beyond the individuals themselves to impact the behavior of social partners, the communicative environment more broadly, and the course of subsequent development. We then present a conceptual framework that identifies ways in which delays in the emergence of basic, early emerging communicative behaviors – eye contact, gesture, and vocalization – may lead to delays in the emergence of the individual's ability to initiate instances of joint attention and impact the caregiver's sense of the child's developmental level. These changes in turn may lead to a reduction in shared topics for communication and, therefore, to a reduction in instances in which linguistic input adapted to moments of shared attention is most effective in

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facilitating the early development of language. Finally, we conclude with some recommendations for research and clinical practice suggested by this framework.

4.1 Introduction

An 8-month-old is sitting on the floor playing with toys. He looks intently at a shiny red car and vocalizes, and his mother says, "there's the car!" An 11-month-old is sitting in her highchair eating a snack while her father watches. Looking at him, she reaches for her cup and holds it up for him to see. When he responds, "That's your cup," she resumes eating. A 16-month-old visiting the zoo spots a lion, points excitedly and vocalizes. His father says, "Do you see the lion over there?" A 20-month-old, playing in the clean laundry, picks up her father's t-shirt and holds it up for her mother to see while saying "Daddy." Her mother says, "Yes, honey, that's daddy's old black t-shirt."

These examples are illustrative of two crowning developmental achievements of the first 2 years of life: the emergence of intentional (i.e., directed at a communicative partner) and symbolic (e.g., using gesture, sign, or word to stand for a specific referent) communication. Both have been widely discussed in the literature because they represent major advances in social communicative and cognitive development (e.g., Bates, 1976; Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Bloom, 1993). However, as illustrated by the parent responses in these examples, the emergence of intentional and symbolic communication is also remarkable because it impacts the communicative environment in which very young children are immersed and the individuals with whom they interact.

While typically developing (TD) infants produce the sorts of communicative acts described above frequently and seemingly without effort, many individuals with autism spectrum disorder (ASD) struggle to communicate with others. For some, intentional and symbolic communication eventually emerges on a delayed timetable. For others, both types of communication may be relatively limited or very infrequent. Delays and atypicalities in the development of intentional and symbolic communication are a hallmark of ASD.

Discussions of developmental delay typically take the perspective that delay is a characteristic of the individual; a great deal of research effort has been devoted to identifying earlier-appearing individual factors that predict subsequent delay, along with relations between delayed development and the emergence of more sophisticated behaviors at later time-points. While these are worthwhile endeavors, they result in a quite limited picture of the way in which delay emerges over time and impacts subsequent development. Our central thesis is that delays and atypicalities in the development and use of intentional and symbolic communication have far-reaching, cascading effects that extend beyond the individual to impact the behavior of social partners and the communicative environment more broadly.

Over time, these effects may fundamentally alter both the nature of the input that the communicator receives and the availability of opportunities for learning that may support future advances.

Our defense of this proposal will proceed in the following way. We begin by reviewing research on TD infants and toddlers indicating that the emergence of new forms of intentional communication impacts caregiver responding, and that these alterations occur in ways that support the development of more advanced communication skills. Following a brief discussion of the impact of the emergence of symbolic communication on the communicative environment, we provide a general overview of the delays and challenges in communicative development that are generally characteristic of individuals with ASD. We then use this overview as a starting point for discussing a conceptual framework that identifies ways in which delays in a set of basic, early emerging communicative behaviors – eye contact, gesture, and vocalization – can impact the social and communicative environment and thus the development of intentional and symbolic communication. Finally, we conclude with some recommendations for research and clinical practice suggested by this framework.

Before proceeding with this discussion, however, we would like to note that although many of the examples to be discussed in what follows will come from childhood, we recognize that individuals with ASD of all ages face challenges in using intentional and symbolic communication. Although a substantial portion of the content presented here is taken from research on children, and the conceptual framework that we present is grounded in early development, we believe that the principles of cascading developmental effects are relevant for individuals across a wide range of ages.

4.2 Current Research on the Topic

4.2.1 Intentional and Symbolic Communication in Typical Development

4.2.1.1 How Does the Transition to Intentional Communication Impact the Communicative Environment?

Communication is said to be *intentional* when there is clear behavioral evidence that the message being conveyed is directed toward a communicative partner. In preverbal individuals, the behavioral evidence is typically of two types. The first type involves the pairing of a communicative behavior (e.g., a gesture, a vocalization) with eye contact with the partner (or alternating gaze between the referent of the communicative act and the partner). The second type involves the communicator's behavior following the communicative act. Intentional communication is typically followed by a pause, during which the communicator waits for a response or acknowledgement from the social partner. If the partner fails to respond, the

signal may be repeated, this time supplemented with additional behavioral cues (e.g., vocalization) to ensure that it is recognized as a communicative signal (Iverson & Thal, 1998).

It is important to note here that although evidence of intentionality need not necessarily come from the presence of eye contact with a communicative behavior, eye contact has become the *sine qua non* of intentional communication, such that it is often required in order for communicative behaviors to be considered acts of communication. However, this criterion may underestimate the communicative abilities of preverbal individuals with ASD, for whom eye contact occurs significantly less frequently and may be more effortful than for neurotypical peers (Akhtar & Gernsbacher, 2008). This is an issue to which we will return below.

Vocalizations From the first moments of life, infants vocalize. They cry; they also produce a wide variety of non-cry sounds that are considered to be precursors to the sounds of spoken language (e.g., Oller, 2000). Although these early pre-speech vocalizations are not intentionally communicative according to the above criteria, caregivers and adults respond to them as though they are (e.g., Snow, 1977). It is perhaps for this reason that TD infants appear to have expectations about the social value of their vocalizations from a relatively young age.

One demonstration of this expectation comes from research using the face-to-face-still-face (FFSF) paradigm (e.g., Tronick, Als, Adamson, Wise, & Brazelton, 1978). In this classic methodology, infants and caregivers are seated facing one another and caregivers are instructed to interact as they typically would, usually for a period of 2 min. Next, caregivers are asked to stop responding to the infant and to assume an expressionless face. This manipulation disrupts the reciprocity of the interaction, and numerous studies have examined changes in infants' social behaviors (e.g., smiling, eye contact) over the course of the still-face period, reporting that initially, infants increase efforts to re-engage the caregiver, and then gradually begin to spend more time looking away and fussing. Results such as these have been interpreted as indicating that infants have expectations about the inherently reciprocal nature of social interactions (e.g., Adamson & Frick, 2003; Moore, Cohn, & Campbell, 2001; Striano, 2004; Tarabulsy et al., 2003).

In a recent study, Goldstein, Schwade, and Bornstein (2009) examined 5-month-old infants' rate of production of non-cry vocalizations in the FFSF paradigm. While vocalizations provide an opportunity for infants to receive a response from a caregiver, the contingency between infant vocalization and caregiver responses is imperfect (i.e., not every vocalization that infants produce receives a response). They thus hypothesized that if infants have learned about the contingency between their own vocal behavior and caregiver responses and appreciate the value of their vocalizations as social signals, they should exhibit an extinction burst (a hallmark of learning from imperfect contingencies) at the beginning of the still-face period, with rate of vocalization initially increasing relative to the prior face-to-face interaction phase and then declining over time. Data were consistent with this prediction: overall, vocalizations peaked after 75 s and then declined across the rest of the still-face episode, and this pattern was evident in the production of 37 of

38 infants in the sample. Thus, by 5 months of age, infants appear to have learned that their vocalizations elicit reactions from others and have social value.

At around 8 months, TD infants begin to integrate eye gaze with vocalizations (e.g., Bates et al., 1979; Golinkoff, 1986), which some authors have termed *directed vocalizations*. One type of directed vocalization involves the infant vocalizing while looking at an object that is either held or within reach. These object-directed vocalizations (ODVs) appear to provide valuable opportunities for interactions that advance word learning. The best evidence for this relationship comes from experimental work conducted by Goldstein and colleagues (Goldstein, Schwade, Briesch, & Syal, 2010). In a pair of experiments, they recorded vocalizations produced by infants as they explored novel objects. Results indicated that: (a) 12-month-old infants' learning of the visual features varied in relation to ODV production, with features being learned for objects that elicited the most ODVs but not for those that elicited the fewest ODVs; and (b) 11.5-month-old infants successfully learned object-word associations when the label was paired contingently with an ODV. Learning did not occur when the label was paired with a look alone. In a subsequent study, Goldstein and Schwade (2010) demonstrated that adult responsiveness to the ODVs of 9-month-old infants predicted vocabulary size at 15 months. Overall, these findings suggest that ODVs may be indicative that an infant's attention is focused on a particular object and serve as a salient index of interest to an adult, who is likely to respond with timely input about the object (i.e., its label). This type of input may contribute to infants' growing awareness of sound-object links.

A second type of directed vocalization involves the coupling of a vocalization with looking at the caregiver. There is surprisingly little research on caregiver-directed vocalizations, but the existing findings suggest that for caregivers, eye gaze is a powerful cue for interpreting infants' intentions, and that this information shapes their responses to these vocalizations (e.g., Golinkoff, 1986). Consistent with this view, Gros-Louis, West, and King (2014) studied caregiver-directed vocalizations longitudinally in a sample of 12 mother-infant dyads observed every 2 weeks from 8 to 14 months. Although ODVs occurred more frequently than mother-directed vocalizations, they found that mothers were more likely to respond to mother-directed vocalizations (range .55-.68 across sessions) than to ODVs (range .38-.52 across sessions). This simple difference in relative frequency of responding may be sufficient to provide infants with valuable information about the impact of their vocalizations on caregiver behavior. This possibility is supported by the finding that the likelihood of providing a contingent response focusing on an object currently in the infant's visual line of regard predicted growth in infants' mother-directed vocalizations in subsequent months.

Gros-Louis et al. (2014) also asked whether mother-directed vocalizations were related to developmental change in infant vocal complexity and to word production at 15 months. Interestingly, while mother-directed vocalizations were not related to word production at 15 months, maternal responses to mother-directed vocalizations were positively and significantly associated with an increase in infant production of vocalizations containing consonant-vowel (CV) clusters. Thus, infants who

received proportionately more responses to their mother-directed vocalizations exhibited a larger increase in production of CV vocalizations from 8 to 14 months. This is important because CV vocalizations are considered to be more developmentally advanced and "speech-like" than those containing only vowel sounds, and prior research has indicated that caregivers respond differentially to CV vocalizations, providing more imitations and expansions than they do to vowel-only vocalizations (Gros-Louis, West, Goldstein, & King, 2006).

In sum, the research reviewed above indicates that there is a dynamic developmental cascade unfolding over time in the interplay between infant vocalization and caregiver response and suggests the operation of powerful social learning mechanisms. By the end of the first 6 months of life, infants appear to appreciate that their vocalizations have social value, presumably because active, attentive caregivers frequently attribute intentionality to those vocalizations. Once infants begin to combine vocalizations with eye gaze toward an object or a caregiver, attentional focus can provide caregivers with additional information regarding the potential function and meaning underlying the vocalizations, information that may guide the responses caregivers provide. Differences in both the frequency and nature of responses to ODVs and caregiver-directed vocalizations may then influence patterns of developmental change in the two types of vocalizations, and changes of this sort are highly likely to influence subsequent patterns of caregiver responding.

Gestures As noted previously (see Chap. 2), first gestures generally appear in TD infants between the ages of 8–14 months (see also Bates, 1976; Bates et al., 1979). The emergence of gestures marks a key transition in the development of intentional communication because gestures provide a more explicit means for establishing reference. Gestures such as giving, showing, requesting, and pointing (collectively termed *deictic gestures*) are the first to emerge, with pointing generally the last to appear (Bates et al., 1979). Collectively, these gestures serve to indicate the object of an infant's interest and to draw another's attention to it.

While the appearance of deictic gestures represents a significant advance in communicative development, these gestures enjoy a long developmental history prior to their emergence as communicative signals. Thus, for example, requesting initially occurs as a response to adult behavior (e.g., reaching for a toy that is being extended by the adult), but gradually it becomes less tightly linked to the specific contexts and action patterns in which it occurs. An early form of the reaching gesture might consist of an exaggerated reaching movement toward an inaccessible object accompanied by fussing or intense vocalization. Over time, infants begin to produce a more abbreviated reach toward the desired object while looking at the caregiver (e.g., Bruner, 1977). Reaching therefore changes in both form and function, progressing from being a signal of difficulty in obtaining an object to one that indicates a particular interest in that object.

Similarly, components of the pointing gesture are observed in the spontaneous behavior of very young infants. Two-month-olds extend their index fingers reliably during social interaction, although the movement is not object-directed, nor is it paired with arm extension or eye gaze (Fogel & Hannan, 1985). Six-month-olds

will spontaneously point toward an object that attracts their attention in a social context (without extending the arm or looking at the caregiver); older infants will point at an object while inspecting it closely (e.g., see the lovely series of detailed observations of pointing-for-self reported in Bates, 1976). It is not until around the first birthday that pointing shifts from a self-directing attentional device that appears to help infants highlight their current focus of attention for themselves to a social gesture used to direct the attention of others to an object of interest. Evidence of this shift comes from the coordination of pointing with eye contact: infants will point to an object while looking back at an adult, as though to check that their social partner has located the referent of the gesture and is now attending to it (e.g., Bates, 1976; Masur, 1990).

Not only does the emergence of gestures impact infants as communicators; it also affects the language-learning environment. Deictic gestures provide caregivers with clear, salient, and relatively precise cues as to the child's current focus of interest to which they can provide a well-tailored response. Such responses can in turn provide rich opportunities for word learning because the child is already focused on the object while the caregiver is speaking, conditions that are known to be prime for acquiring a new word (e.g., Tomasello & Farrar, 1986).

One way in which adults can tailor their responses to infants' gestures is by translating the referent of the gesture (Golinkoff, 1986; Masur, 1982). For example, when an infant points to a dog, a caregiver might translate the referent of the pointing gesture by saying, "Yes, do you see the dog? I see it too." In a longitudinal study of ten children, Goldin-Meadow, Goodrich, Sauer, and Iverson (2007) identified all referents that infants referred to only in gesture and never in speech (e.g., infant points to a ball but never says the word "ball") and classified them according to whether mothers translated (e.g., "let's go get your ball!") or never translated the gestures into speech. To determine whether these translation responses affected word learning, they then examined the likelihood that the verbal equivalents of the gestures in these two categories entered children's word vocabularies. Data indicated that verbal equivalents of child gestures were significantly more likely to enter children's word vocabularies when mothers provided translations of the gesture than when they did not. Gestures thus appear to provide valuable signals to adults about a child's current state of interest, and this information allows calibration of adult input to the young language learner in ways that appear to support word learning.

4.2.1.2 How Does the Transition to Symbolic Communication Impact the Communicative Environment?

Communication is said to be *symbolic* when it involves the use of a particular form (e.g., gesture, sign, word) to refer to a specific referent. The relation between form and referent can vary along a continuum of complexity, ranging from relatively transparent (e.g., holding the hand to the ear as though talking on the telephone) to highly abstract (e.g., the relation between most words and their referents). In

addition, the form-referent relation remains constant despite variation in the characteristics of the referent and across changing contexts (e.g., the word "cat" refers to all cats regardless of their size or color and whether they are in the kitchen, sleeping, or lying on the windowsill).

Most TD infants demonstrate a newly emerging symbolic ability at around the age of 12 months, when they begin to say their first words (Bates et al., 1979).[1] However, these early words do not have fully symbolic status because they are usually only produced in highly specific contexts. For instance, a child might say the word "byebye," but only when his older sibling leaves for school in the morning. These early word-like productions co-exist with non-word vocalizations and gestures. Over time, however, words become decontextualized and used in a more flexible manner to refer to a variety of different exemplars of the referent and in multiple contexts (e.g., Werner & Kaplan, 1963).

Despite the importance of first words as an index of cognitive advance and for the impact that they have on proud parents, to our knowledge there is no existing research that has examined the impact of first words on the communicative environment. This may be due at least in part to the methodological difficulties inherent in reliably identifying first words and distinguishing them from other non-word vocalizations (e.g., see Vihman & McCune, 1994) and to the fact that, at least initially, they occur relatively infrequently.

Indirect evidence that the transition to symbolic communication influences the communicative and linguistic environment comes from studies examining the ways in which very young children combine single words with gestures. Gesture-word combinations are widely observed among one-word speakers (e.g., Capirci, Iverson, Pizzuto, & Volterra, 1996; Iverson & Goldin-Meadow, 2005; Özçalışkan & Goldin-Meadow, 2005). When children verbally label an object to which they are simultaneously gesturing (e.g., pointing at a car while saying "car"), they reinforce the meaning conveyed by their gesture. Relative to gestures produced alone or with a non-word vocalization, the addition of a word to a gesture may provide caregivers with an even clearer and more salient cue as to the child's current focus of attention; this may in turn enhance the richness of the linguistic response.

Children also combine words and gestures that convey distinct but related meaning about the referent (e.g., pointing at the car while saying "byebye"). These *supplementary* combinations appear in children's production just prior to the transition to two-word speech and reliably predict onset of two-word combinations (e.g., Iverson & Goldin-Meadow, 2005). From the caregiver's perspective, however, supplementary combinations convey more information (*car* and *byebye*) than do reinforcing combinations (*car*), and they may therefore provide adults with opportunities for producing more complex responses that may be especially

[1] Although there is some work on symbolic and representational gestures and their development between 9 and 12 months of age (e.g., Acredolo & Goodwyn, 1988; see Capone & McGregor, 2004, for a review), and children exposed to a sign language from early in life readily acquire language in the manual modality (e.g., Meier & Newport, 1990), we focus our discussion of the transition to symbolic communication on the emergence of words.

beneficial for learning. Work by Goldin-Meadow et al. (2007) supports this possibility. They compared mean length of utterance for sentences mothers produced in response to supplementary versus reinforcing conditions and found that sentences produced in response to supplementary combinations were significantly longer than those produced in response to reinforcing combinations. In addition, mothers' sentences were longest when they incorporated information from the child's word *and* gesture. In sum, these results suggest that the incorporation of a symbol (a word) into an act of intentional communication (a gesture), particularly one that adds meaning to that conveyed by the gesture, impacts the communicative environment in ways that further enrich the quality and complexity of caregiver response.

4.2.2 Intentional and Symbolic Communication in ASD

Unfortunately, there is very little research in the ASD literature directly addressing the impact of the child's changing communicative abilities on the communicative environment. There is, however, evidence in individuals with ASD for the existence of developmental delays and atypicalities in the behaviors (vocalizations, gestures) and behavioral coordinations (e.g., vocalization with gesture, gesture with eye gaze) that signal intentional communication. Given the likelihood, as discussed above, that these delays and atypicalities alter the nature of the communicative environment and, therefore, exert an impact on the emergence of symbolic behavior, we will review the nature of the research findings on vocalization, gesture, and vocalization-gesture coordinations (gesture-eye gaze coordinations, which are presumed to index states of joint attention, are discussed elsewhere in this book). This will provide the basis for a schematic process account of the way in which these early delays and atypicalities can exert an impact on the communicative environment and through that impact lead in turn to a cascading series of developmental effects.

Vocalizations The few studies that exist on vocalization in ASD fall, roughly speaking, into three categories. The first consists of studies focusing on the frequency of vocal production (i.e., volubility); the second on atypicalities in vocal quality; and the third on the frequency of communicative coordinations involving vocalization. Results from studies of all three types provide evidence for delays and atypicalities in vocalization of individuals with ASD. With regard to the first, for example, Patten et al. (2014) retrospectively examined vocalization during home videos taken at 9–12 and 15–17 months in 23 children later diagnosed with ASD. In comparison to 14 infants with no such diagnosis, vocalization rates of the infants with ASD were significantly reduced. In addition, vocal quality, specifically low rates of canonical babbling (which is usually well in place in typical development by 10 months), was atypical in the infants with ASD.

The finding of reduced frequency of canonical babbling is consistent with other research showing that older children with ASD exhibit deficits in the production of well-formed syllables and frequent production of unusual sounds. Thus, for example, two studies of preverbal children with autism have reported excessive production of atypical vocalizations (e.g., trills, clicks, growls; Wetherby, Cain, Yonclas, & Walker, 1988) and vocalization with atypical phonation (e.g., falsetto, breathy voice; Sheinkopf, Mundy, Oller, & Steffens, 2000), accompanied by significantly lower rates of occurrence of well-formed syllables and marginally higher proportions of syllables with overlong vowels. Similar difficulties with syllable production have been noted in a case study from birth to 2 years of an infant later diagnosed with autism. Dawson, Osterling, Meltzoff, and Kuhl (2000) reported that at 9 months, the infant's vocal responses were "...primarily limited to guttural sounds with few, if any, recognizable consonant or labial sounds..." (p. 302). Although these data are taken from a single infant, the relative absence of these sounds is clearly deviant from patterns reported for typically-developing infants in this age range, for whom labial sounds (e.g., [b], [m]) tend to be among the most frequently produced (e.g., Davis & MacNeilage, 1995).

With regard to the frequency of communicative coordinations involving vocalization, data come primarily from three studies of infants who are at heightened biological risk for ASD (Heightened Risk; HR; because they have an older sibling with an autism diagnosis) and who also eventually receive an ASD diagnosis themselves (HR/ASD). Ozonoff et al. (2010) examined the co-occurrence of vocalization with eye gaze to the experimenter's face during longitudinal administration of the Mullen Scales of Early Learning (MSEL) (Mullen, 1995) when children were 6, 12, 18, 24, and 36 months. Results indicated that the HR/ASD infants coordinated vocalization with eye gaze at levels comparable to a comparison group of children with no known ASD risk (Low Risk; LR; and no follow up ASD diagnosis) only at the earliest age. From 12 months on, frequency of vocalization-gaze coordinations was lower in the ASD group than for TD comparison infants and while this frequency increased significantly over time for the TD infants, it decreased sharply for those in the ASD group.

In a second study of HR infants, Winder, Wozniak, Parladé, and Iverson (2013) coded the spontaneous production of vocalization coordinated with either eye contact or a gesture as these were produced by 15 HR and 15 LR infants at both 13 and 18 months during in-home naturalistic interaction. Although these data should be interpreted with caution since only three children in their HR sample received an eventual ASD diagnosis, at both 13 and 18 months, these three children coordinated non-word vocalizations with eye gaze and gesture at far lower rates than did either LR infants or those HR children who did not eventually receive an ASD diagnosis. Finally, Parladé and Iverson (2015) compared communicative coordinations in nine HR infants later diagnosed with ASD, to those of 13 HR infants with language delay, 28 HR infants with no diagnosis, and 30 LR infants. Hierarchical linear modeling analyses indicated that HR/ASD infants exhibited significantly slower growth in coordinations overall and in gestures coordinated

with vocalizations than children in the other groups, even relative to HR infants with eventual language delay.

In summary, although there is only a small body of research on vocalization in ASD, findings have been generally consistent. Whether researchers have examined frequencies of vocal production, atypicalities in vocal quality, or frequencies of communicative coordinations involving vocalization, they have generally reported delays and/or atypicalities in the vocal behavior of individuals with ASD.

Gesture Since publication of the DSM-III-R (American Psychiatric Association, 1987), impaired gesture (failure to gesture, abnormal gesture use in initiating or modulating social interaction, deficits in understanding and use of gestures) has been among the central diagnostic criteria for ASD. In addition, items assessing gesture atypicalities figure prominently in major diagnostic and screening instruments such as the ADOS-G (Lord et al., 2000), ADI-R (Lord, Rutter, & Le Couteur, 1994), and M-CHAT (Robins, Fein, Barton, & Green, 2001). It is surprising, therefore, that research to date on gesture production in individuals with ASD has been somewhat limited. Several factors may account for this. First, many studies have focused solely on differences between ASD and other clinical groups in the frequency of gesture production. Second, ASD gesture research has often been contextualized within the context of interest in joint attentional impairments in autism and has, therefore, been heavily and sometimes solely focused on pointing; and third, studies have varied widely in the ages and severity levels of participants, in methods of data collection (e.g., retrospective video analysis, online interaction coding) and in coding schemes and terminology.

Nonetheless, the preponderance of the evidence suggests that across a wide variety of ages, individuals with autism produce fewer gestures overall than various typical and clinical comparison groups (e.g., Pedersen & Schelde, 1997; Töret & Acarlar, 2011; Winder et al., 2013; but see also Attwood, Frith, & Hermelin, 1988; and Capps, Kehres, & Sigman, 1998 for failure to find overall frequency differences) and their gesture repertoires are less varied than those of their peers (Colgan et al., 2006; Winder et al., 2013). Individuals with autism are relatively more likely to produce gestures to regulate the behavior of others (e.g., "reaching" to have someone provide a desired object) than for purposes of social interaction (e.g., waving "hi," or "bye bye," shaking head "yes" or "no") or joint attention (e.g., pointing while making eye contact with the interlocutor to share interest in an object or event, Carpenter, Pennington, & Rogers, 2002; Töret & Acarlar, 2011). Indeed, pointing to establish joint attention is often found to be virtually or completely absent (e.g., Camaioni, Perucchini, Muratori, Parrini, & Cesari, 2003; Curcio, 1978; Pedersen & Schelde, 1997; Wetherby & Prutting, 1984), somewhat rare even for requesting (Töret & Araclar, 2011), or atypical in form (e.g., "taking aim with one eye closed"; Hobson, García-Pérez, & Lee, 2010). Furthermore, at varying ages, gestures subserving all three functions but especially joint attention have been found to be less common in children with ASD than comparison peers (Landry & Loveland, 1989; Watson, Crais, Baranek, Dykstra, & Wilson, 2013). Evidence for joint attention deficits is discussed in detail elsewhere in this book.

In summary, research on gesture in ASD has, like research on vocalization, been somewhat limited. In addition, results in this area have not always been consistent. Nonetheless, the weight of the evidence suggests that in comparison to TD peers, individuals with ASD produce fewer, less varied gestures overall and are more likely to employ these gestures for purposes of behavior regulation than for social interaction or to establish joint attention.

4.3 Challenges

Thus far, we have seen that advances in the development of intentional and symbolic communication engender changes in the learning environment that appear to support further advances in these skills. We have also seen that delays and atypicalities in the development of intentional and symbolic communication are characteristic of individuals with ASD. Although, as indicated earlier, there is little research directly addressing the impact of delays and atypicalities in children's communicative behavior on the learning environment, it seems likely that such effects exist, that they may occur in ways that do not support further development, that they may be magnified over time, and that they may impact development in domains removed from communicative behavior. In other words, early-appearing disruptions in the emergence of intentional and symbolic communication may have far-reaching, cascading effects on development. A schematic illustrating such a developmental cascade is depicted in Fig. 4.1.

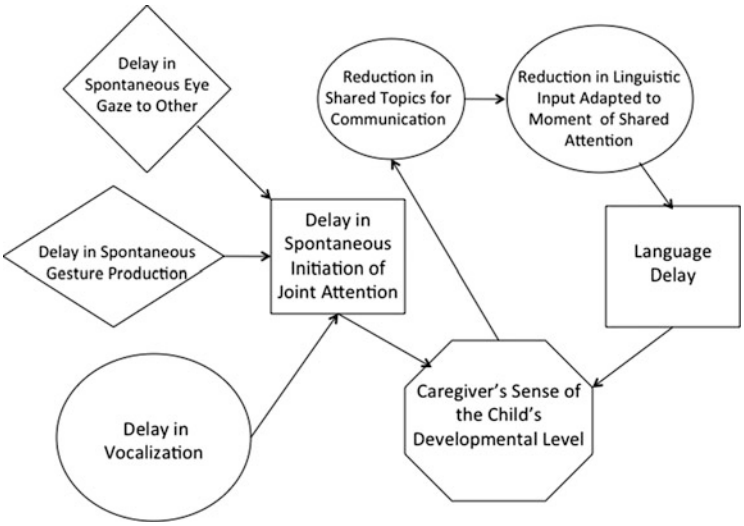

Fig. 4.1 Cascading developmental effects of early communicative delays on the learning environment

The fact that from early in development, individuals with ASD demonstrate clear disruptions in the emergence of three primary communicative behaviors – eye gaze, gesture, and vocalization – is depicted on the left side of Fig. 4.1. Because joint attention as it is currently conceptualized involves the coordination of eye gaze with either a gesture or a vocalization, and because disruptions in any of the component behaviors will obviously impact the likelihood with which they will be coordinated with one another (e.g., Iverson & Thelen, 1999; Parladé & Iverson, 2011), joint attention behaviors will be impaired as well. Infrequent initiation of joint attention will in turn have significant implications not only for opportunities that social partners have for responding, but also for their perceptions of the communicator. These factors are illustrated on the right side of Fig. 4.1.

Thus, communicators who initiate interactions and shared moments of attention less frequently than same-aged peers are likely to be perceived as delayed by caregivers and social partners. This perception can influence the social partner's expectations of and behavior toward the communicator. One way in which this effect may be manifested is in a reduction in the range of potential shared topics for communication. Thus, for example, in dyads with a TD child, control of conversational topics appears to shift as children become more sophisticated communicators. When children are very young and relatively less skilled, adults initiate most topics of conversation. Over time, as their language abilities become more sophisticated, children begin to initiate topics more frequently, and these child-initiated topics are then continued in adults' speech (e.g., Hoff-Ginsberg, 1987). However, some research indicates that in dyads with a child with early language difficulties (i.e., Developmental Language Delay, or late talkers), proportions of topic initiations by caregivers are significantly higher than those for caregivers of TD children and do not show a comparable developmental shift (van Balkon, Verhoeven, & van Weerdenburg, 2010).

Communicative interactions are by definition bidirectional, and successful communication requires reciprocity between participants. When reciprocity is compromised because one participant initiates communication and shared attention only infrequently, the burden of maintaining the interaction falls on the other participant (e.g., see Rescorla, Bascome, Lampard, & Feeny, 2001, for an example from caregivers of late talkers). The consequence of this is a reduction in shared topics for communication; with one partner constantly taking the lead and receiving relatively few communicative initiations from the other participant, topic choice is primarily left to the leader of the interaction, and topics may therefore not be shared.

Reductions in initiation of joint attention and shared communication topics likely impact the nature of the input received by individuals with ASD as well as opportunities for learning more broadly. This could happen in at least two ways. First, fewer initiated communicative acts on the part of the communicator give social partners fewer opportunities to provide responses, and responses are important because the meaning conveyed is often related to that expressed by the communicator. Work reviewed above and that of others provides strong evidence that caregiver responses (particularly contingent responses) scaffold prelinguistic

skills (e.g., growth in caregiver-directed vocalizations; Gros-Louis et al., 2014) and relate to later advances in language (e.g., vocabulary growth; e.g., Tamis-LeMonda, Bornstein, & Baumwell, 2001). Reductions in opportunities to respond could therefore negatively impact the development of these skills.

Second, a hallmark of caregiver response to joint attention episodes initiated by the communicator is that they typically provide input that is well tailored to the communicator's current focus of attention (e.g., Goldin-Meadow et al., 2007). Moments such as these are "magic moments" for language learning: as the communicator's attention is focused on an object of interest, the caregiver labels the object. Work with TD infants indicates that they are more successful at learning new words under these conditions than when a label is provided for an object to which they are not currently attending (Tomasello & Farrar, 1986). Although this effect has not been directly assessed in children with ASD, Siller and Sigman (2008) have provided indirect evidence to suggest that a similar mechanism may be operating. In a longitudinal study designed to examine predictors of language growth in children with ASD, these researchers found parent communication responsive to the child's attention and ongoing activities (i.e., synchrony) during early play sessions to be positively related to the child's rate of language growth.

Thus, vocalizations and gestures accompanied by eye gaze (i.e., intentional communication) create opportunities for caregivers to respond, and to respond in ways that are beneficial for learning. Consider now the case of an individual (child or adult) who does not produce communicative bids of this sort, or who does so relatively infrequently. Opportunities for caregiver responses would be much less frequent overall, and over time, this could significantly limit access to input that is linked in time and content with the referent. For the communicator who is already disadvantaged due to delays and vulnerability in communication and language development, this type of alteration in communicative input – which reflects environmental and caregiver adaptation to the communicator's skill set and perceived developmental level – may not be optimal for advancing development.

In a recent study of caregiver responses to infant gestures, Leezenbaum, Campbell, Butler, and Iverson (2014) demonstrated just such a cascading effect. They studied two groups of infants who were observed in free play at home with a primary caregiver at ages 13 and 18 months. The first group included infants who had an older sibling with ASD (HR infants) but who did not themselves receive an ASD diagnosis at 36 months. HR infants were the focus of the study because of the extensive variability observed in communicative and language development among HR infants as a group, with many exhibiting significant delays in both of these domains (e.g., Jones, Gliga, Bedford, Charman, & Johnson, 2014). The second was a group of infants who had a typically-developing older sibling (LR infants). Overall, HR infants were delayed relative to their LR peers in the production of showing and pointing gestures, producing significantly fewer of these gestures even by 18 months. Examination of caregiver responses to infant gestures revealed that mothers of HR and LR infants were equally responsive to their infants' gestures, and that they were more likely to translate the referent of the infant's gesture when the gesture was a show or a point, rather than a request or give. Thus, because HR

infants produced significantly fewer show and point gestures that were most likely to elicit a translation response, they received fewer translations, which are precisely the type of response that is effective for promoting word learning.

Returning now to the schematic presented in Fig. 4.1, it is important to consider the implications of the notion of cascading developmental effects on how we conceptualize communicative and language delay. This will in turn affect our agendas for research and practice (see below). There is a great deal of research aimed at identifying early predictors of communication and language disorder, and while this is an important endeavor, it has set the stage for models of the emergence of delay that are entirely focused on the communicator (e.g., delayed joint attention is a characteristic of the individual and, therefore, so are language difficulties). While it is certainly of value to know that delays in joint attention are a reliable predictor of delayed and/or disordered language development, the communicator-centered model ignores the dynamic interplay between the communicator, the communicator's current social and communicative/linguistic abilities, and the environment and individuals who interact with the communicator. It also does not account for the potential cascading effects of delays in early-appearing skills on the subsequent emergence and development of more complex abilities both within and beyond the communicative and linguistic domains (see Iverson, 2010, for additional discussion and examples).

4.4 Implications for Research and Practice

The illustration in Fig. 4.1 highlights the dynamic nature of the relationship between the communicator and the social environment and underscores the fact that communicative behavior is a joint product of an individual's available skills and what the environment provides at a particular moment in time. This conceptual framework has several implications for assessment and treatment. Two brief examples must suffice here.

With regard to assessment of individuals with communication and language challenges, it is of paramount importance to create a supportive context within which to elicit communication. If the environment does not provide presses for communication that are interesting and salient to the communicator, the likelihood of occurrence of a communicative behavior in response to the press will be quite low. Currently, there are several widely used observational measures of nonverbal social communication that have been developed for toddlers and young children (e.g., Early Social Communication Scales, Mundy et al., 2003; Communication and Symbolic Behavior Scales, Wetherby & Prizant, 2002) and involve the use of items such as bubbles and windup toys that appeal to this age group. However, normed observational tools that permit a detailed, systematic assessment of communication skills that are developmentally appropriate for older individuals are virtually nonexistent. One exception to date is the Communication Complexity Scale (Brady et al., 2012), which permits substantial flexibility in the choice of objects/

events that can be used as opportunities for communication. This flexibility enhances the likelihood of providing a supportive communicative environment, and therefore of obtaining a representative sample of the communicative repertoire and the ways in which it is utilized by the communicator.

With regard to treatment, we began this chapter with a review of research on TD infants indicating that although caregivers initially respond to virtually any signal produced by their infant (even burps and sneezes) as though it is intentional, over time and with the emergence of increasingly sophisticated infant behaviors, adults gradually become more selective in the types of behaviors to which they respond and in the types of responses that they provide to these behaviors. The implication of this growing selectivity is that over time, communicative forms that are earlier emerging and less advanced may begin to receive progressively fewer responses, particularly those of the sort that can be beneficial for development.

For individuals who are delayed in the emergence of intentional and/or symbolic communication and for whom the window for use of earlier-emerging communicative forms (e.g., eye contact alone, vocalization alone) may be temporally extended, such changes in caregiver responding could create a further disadvantage for an already vulnerable communicative system. Recall, for example, Leezenbaum et al.'s (2014) findings that mothers were significantly more likely to translate their children's show and point gestures than they were give and request gestures and that even at 18 months, HR children produced four times as many gives and requests as they did shows and points. The implication of these findings is that although HR children were communicating intentionally, because they were doing so in a way that was less developmentally advanced, they were much less likely to receive translation responses. From a treatment perspective, it may be worth encouraging the caregivers of individuals with communication delays and challenges to broaden their patterns of responding so that they respond consistently and contingently to communicators' gestures and non-word vocalizations, regardless of their developmental level or social salience.

The framework illustrated in Fig. 4.1 also has at least two major implications for research on intentional and symbolic communication in ASD. In particular, it suggests a need for modifications to our current definition of intentional communication and to the paradigms and measures we use for studying developmental transitions and the emergence of new skills. With regard to the first of these, as noted earlier, eye contact is generally considered to be the *sine qua non* of intentional communication. In much of the existing literature, children are not credited with producing an act of intentional communication unless they combine a communicative behavior (gesture or vocalization) with eye gaze directed to the social partner. It is widely assumed that TD children spend a great deal of time looking at the social partner while communicating in social interactions. However, recent research has called this assumption into question. Using head-mounted eyetracking in a naturalistic parent-child play session, Yu and Smith (2013) reported that 12-month-old infants rarely looked at their parent's face (only about 11 % of the time), and that hand actions were actually more effective in eliciting a partner's looking than was direct gaze following. This finding strongly suggests that

while gaze to the social partner may be sufficient for establishing intentional communication, it may not be necessary (see Akhtar & Gernsbacher, 2008, for additional discussion).

Along these lines, Gernsbacher and colleagues (2008) have reviewed evidence indicating that when individuals with ASD are not required to perform an overt response such as turning the head to make eye contact, but can instead attend covertly (i.e., use peripheral vision, or "look out of the corner of their eye"), they readily attend to social stimuli, performing as well as children who do not have ASD on tasks that require, for example, following the direction of another's gaze. Gernsbacher and colleagues propose an intriguing hypothesis, namely that individuals with ASD may utilize other behaviors (e.g., peripheral eye gaze) to initiate intentional communication, albeit in atypical and unconventional ways. To date, however, this hypothesis remains unexamined. It is worth noting that the idea that a broad variety of behavioral forms could be utilized for purposes of intentional communication is not new. Indeed, research on very young congenitally blind children has documented a wide range of ways in which behaviors other than eye contact are employed for intentional communicative purposes (e.g., Bigelow, 2003; Iverson, Tencer, Lany, & Goldin-Meadow, 2000). To our knowledge, this type of descriptive, observational approach has not been taken in ASD research. Work of this sort would take the field beyond the by now well-replicated findings of group differences in frequency and quality of intentional communication; it would permit the identification of cues that signal intentionality and provide us with new and valuable insights into how and under what circumstances intentional communication is achieved by individuals with ASD.

Finally, studying the emergence of new skills at developmental transitions and understanding their impact on the broader communicative and social environment requires a methodological approach that goes beyond assessments of the communicator's behavior alone averaged across an observation period. Understanding how transitions to more sophisticated forms of communication impact the environment requires dense, longitudinal sampling of behavior prior to, at, and following the emergence of the new skills, ideally at frequent intervals. Observation schedules of this sort permit the precise identification of the first appearances of new skills and the detailed description of ways in which they change over time.

Understanding how developmental transitions impact the larger social and communicative environment also requires broadening our lens to include a focus on the social unit participating in the interaction (e.g., a dyad) and the inclusion of measures that permit rigorous examination of the communicative interplay between participants, rather than focusing exclusively on the behavior of the communicator and/or the responses of the interlocutor individually. For instance, Northrup and Iverson (2015) examined dyadic vocal interactions during a free play observation recorded when HR and LR infants were 9 months old and found that individual measures of vocal behavior (infant or caregiver) were not predictive of later language development. The only significant predictor of expressive language in the third year was a variable measuring the extent to which members of the dyad coordinated their response latencies (i.e., the intervals between the offset of one

participant's vocalization and the onset of the other participant's subsequent vocalization). Children from dyads with larger differences in response latency tended to have lower expressive language scores in the third year of life. Thus, examining an individual's ability to coordinate intentional or symbolic behavior with a social partner may provide information about the stability and flexibility of the skill that is not provided by simple frequency counts alone.

4.5 Conclusion

We began this chapter with the proposal that delays and atypicalities in the development and use of intentional and symbolic communication have far-reaching, cascading effects in development that extend beyond the individual to impact the behavior of social partners and the communicative environment more broadly. In typical development, the emergence of intentional and symbolic communication impacts caregiver responding in ways that support the development of more advanced skills. The conceptual framework that we have presented suggests that when these behaviors fail to emerge, emerge on a delayed timetable, or appear in atypical form, as in individuals with ASD, the environment may respond in ways that may negatively impact the development of communicative skills. Although future research is needed to characterize the nature of this environmental response and the ways in which it plays out developmentally, it is clear that improving our understanding of communicative delays of the sort observed in ASD and developing effective intervention methods requires an approach that goes beyond the individual to consider the constant, complex interplay between the developing communicator and the social communicative environment.

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Part II
Assessment of Prelinguistic and Minimally Verbal Communication

Chapter 5
Standardized Assessment of Prelinguistic Communication

David Trembath and Teresa Iacono

Abstract The assessment of individuals with autism spectrum disorder (ASD) at the prelinguistic stage of communication development requires a comprehensive approach. Standardized assessments can contribute valuable information to the evaluation of each individual's strengths and needs, from screening through to diagnosis, treatment planning, and treatment evaluation. However, using standardized assessments with this population can be challenging, given that many assessments require the individual to have symbolic communication skills. In this chapter, we outline the components of a comprehensive assessment, discuss the ways in which standardized assessments can inform clinical decision making, and provide recommendations to address the common challenges associated with using standardized assessments with prelinguistic individuals with ASD.

5.1 Current Research on the Topic

5.1.1 Standardized Assessment

Standardized assessments have been designed to elicit the same targeted information across a range of individuals in a consistent manner: that is, the procedures have been manualized for administration in a *standardized* way (Kaplan & Saccuzzo, 1997). This approach, which is commonly referred to as *formal assessment*, helps to reduce bias that may otherwise cloud the assessment process (Neisworth & Bagnato, 2004) by ensuring validity and reliability (American Speech Language and Hearing Association, 2006). Many standardized assessments are norm referenced, providing population norms against which to compare the performance on the test by an individual; others may allow for comparison against developmental norms. Such norm-referenced assessments are used largely as

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(a) screening tools to enable problem identification, providing acceptable levels of sensitivity (detecting individuals who will go on to receive a diagnosis) and specificity (excluding individuals who would not receive a diagnosis if they were further tested); and (b) diagnostic tools to identify or confirm a problem and differentiate its nature (e.g., autism spectrum disorder [ASD] from other forms of developmental delay), a process that determines eligibility for services (American Speech Language and Hearing Association, 2006).

Although the concept of *standardization* implies that these assessments should all be administered in a similar way, there is in fact a great deal of between-test variation. Neisworth and Bagnato (2004) described a continuum of assessment contexts reflecting the differences in administration procedures across standardized assessment tools. They suggested that, on a continuum from highly contrived to naturalistic, the *clinical context* is characterized by test administration involving highly scripted examiner and examinee behavior (Roid, 2003) in clinical or laboratory settings, which provide the most decontextualized assessment settings. Moving along the continuum, in the *simulated* context, the clinic room is furnished in an attempt to make it more homely, clinicians are instructed to build rapport, and there is some provision for modifying administration procedures (e.g., using the individual's name in questioning, substituting a child's toy instead of a similar item in the test kit). Child assessments (e.g., Bayley Scales of Infant and Toddler Development – 3rd Edition – Bayley, 2006) need not be conducted at a table, and target behaviors are observed during play-based interactions. Further along the continuum, the *analog* context involves arranging the individual's natural environment to create opportunities for target behaviors to occur. Communicative temptations and/or scripted routines are used to help ensure consistent administration and equal opportunities to produce the target behaviors (e.g., Communication and Symbolic Behavior Scales – Wetherby & Prizant, 2001). Finally, the *natural* context involves the use of consistent processes for observing and recording behaviors (e.g., Pediatric Evaluation of Disability Inventory [PEDI] – Haley, Coster, Ludlow, Haltwanger, & Andrellos, 1992). The examiner does not engineer the environment and only natural behaviors in the individual's everyday environment are recorded.

Traditionally, standardized assessments have been criticized for failing to provide information essential for goal setting and intervention planning, especially for individuals who have not demonstrated linguistic behaviors[1] (Crais, 1995). Olswang, Bain, and Johnson (1992), for example, argued that, in assessing static knowledge, standardized assessments provide little information about learning potential and scaffolding needs. These criticisms have been countered by arguments about the role of standardized assessments within more varied assessment protocols that provide comprehensive profiles of skills, learning preferences, and

[1] Throughout this chapter, we refer to children as *prelinguistic*, with the assumption that linguistic skills are still to emerge, and adults as lacking linguistic communication, thereby avoiding a developmental assumption.

communication contexts for both children and adults, including those with ASD who are pre- or nonlinguistic (Iacono & Caithness, 2009). To properly consider the strengths and limitations of standardized assessments, it is necessary to reflect on the purposes and recommended elements of comprehensive assessments for individuals with ASD.

5.1.2 Standardized Assessment Within a Comprehensive Framework

There has been consensus demonstrated within the scientific and clinical literature about what makes a good assessment for individuals with ASD, irrespective of their age and level of communication skills. According to the National Autism Plan for Children (NIASA, 2003), individuals who demonstrate signs of ASD should receive assessments that (a) identify their individual health and educational needs, including consideration of differential diagnosis; (b) consider the potential implications of the condition so that appropriate intervention and support strategies can be put in place; and (c) address their needs in the family context, in a way that promotes the capacity of family members to support one another. Given the multifaceted nature of ASD, input, to varying degrees, from speech-language pathologists, psychologists, occupational therapists, educators, and medical professionals has been recommended (AMAZE, 2009; Ozonoff, Goodlin-Jones, & Solomon, 2005). These professionals should have expertise in ASD but also expert knowledge of human development and related conditions, to ensure accurate differential diagnosis and appropriate treatment planning (Filipek et al., 1999; Kasari, Brady, Lord, & Tager-Flusberg, 2013; NIASA, 2003). Further, the central role of communication partners, especially family members, within the assessment team in providing comprehensive information of relevance to the person's social contexts has been highlighted (Crais, 1995; Iacono & Caithness, 2009).

The tools chosen for assessments will vary according to their purpose. Given the importance of early identification to early access of appropriate services, screening and diagnostic tools require strong psychometric properties, as demonstrated through measures of validity and reliability (American Speech Language and Hearing Association, 2006). For the purpose of identifying intervention targets and developing strategies that will maximize a person's functioning across contexts and potential for learning across developmental domains, assessment tools that examine and profile an individual's unique strengths and needs as demonstrated across his or her full range of life activities at home and in the community are required (Iacono & Caithness, 2009; Roberts & Prior, 2012). Iacono and Caithness recommended that assessment provides information on the preferences and priorities of an individual and his/her key communication partners to ensure that assessment findings and recommendations are arrived at, understood, and acted upon in a collaborative and respectful manner. Such an approach requires good

communication between all parties, the selection of appropriate assessment tools, and sufficient time to complete the process

Given the complex nature of ASD and the need to account for functioning in everyday environments, rarely can communication development in prelinguistic/nonlinguistic communicators be considered in isolation of all other areas of development and functioning. In fact, in most cases the information required for effective goal setting and intervention will be garnered from the assessment of the individual's broader adaptive living skills, interactions with others, and current levels of participation in daily activities. Comprehensive assessment for individuals with ASD requires (a) collecting all relevant existing information, such as previous assessment reports; (b) obtaining a thorough developmental and medical history with emphasis on characteristics relevant to the differential diagnosis of ASD; (c) ascertaining the needs, preferences, and priorities of those seeking the assessment; (d) direct assessment of the individual's social, communication, and cognitive skills; (e) assessment of mental health and adaptive behavior; (f) medical assessment to rule out underlying problems that may impede learning or development; (g) structured observation of behavior across multiple settings; (h) liaison with other professionals to elicit information for diagnosis, goal setting, and/or evaluation; and (i) accurate, tailored, sensitive, and timely sharing and reporting of the outcomes to individuals, families, and other key stakeholders (Filipek et al., 1999; NIASA, 2003; Ozonoff et al., 2005). Within this framework, the conscientious and judicious use of standardized assessments has the potential to contribute to an accurate diagnosis, and comprehensive understanding of the learning profile and needs of individuals with ASD.

We note that there are existing excellent reviews of assessment tools available for administration to individuals with ASD (e.g., Filipek et al., 1999; Kasari et al., 2013; Ozonoff et al., 2005). Rather than provide another review, the focus here is to discuss the role of standardized assessments in screening, diagnosis, goal setting, and intervention planning, with reference to examples of assessments that are commonly used in practice and research. Our approach is not to focus solely on assessments commonly used by speech-language pathologists to examine communication skills, but rather to consider what can be learned from the use of standardized assessments across all domains of development and at each stage of the process, commencing with screening.

5.1.3 What Can We Learn from Standardized Screeners?

With increasing recognition of the importance of early identification and intervention for children with ASD has come increasing use of standardized screening assessments. To illustrate, Soleimani, Khakshour, Khayat, Ghaemi, and Golchin (2014) completed a narrative review, documenting the use of 28 screening assessments in ASD research published from 1992 to 2014. These assessments include

routine development surveillance as well as ASD-specific screeners for young children showing signs of ASD (Filipek et al., 2000).

Both developmental surveillance and ASD-specific screeners can contribute useful preliminary information to the process of assessment and diagnosis, as well as to goal selection and treatment planning for prelinguistic communicators. Most screeners involve parents, health professionals, or educators reporting on the behaviors they see in the child's everyday natural environments; hence, they have strong ecological validity. The BRIGANCE Early Childhood Screen III (Curriculum Associates, 2015), for example, is a norm-referenced standardized development surveillance screener that is commonly used by health and education professionals to assess fine motor, gross motor, expressive language, receptive language, social-emotional, and self-help skills. Receptive and expressive communication skills include the prelinguistic behaviors of responding to sounds, babbling, imitating sounds, giving objects on command, pointing, and using gestures (e.g., waving goodbye), all of which are relevant to profiling a child's prelinguistic communication development. The availability of normative data enables the clinician to consider not just the presence, absence, frequency, and quality of behaviors of interest (e.g., use of gestures), but also how the child's skills compare to those of other children his or her age.

Screeners designed specifically to identify young children requiring further assessment for ASD, such as the Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (M-CHAT-R/F) (Robins, Fein, & Barton, 2009), focus on behaviors that most reliably distinguish children with ASD from children with other developmental concerns, such as language delay. For instance, caregivers are asked to reflect on whether their children point to ask for things or to get help, in order to gather preliminary evidence regarding their children's use of intentional communication and gestures. Furthermore, a question regarding whether children give and show objects to others to share interest, not just to request, provides information about the functions (e.g., to request, share, comment, negate) served by the children's communication. Accordingly, the information gained from the M-CHAT can contribute to building a social-communication profile of the child that could lead to further assessment and also inform intervention planning.

The Childhood Autism Rating Scale – Second Edition (CARS-2) (Schopler, Van Bourgondien, Wellman, & Love, 2010) is another frequently used screener that comprises two 15-item questionnaires, one of which is completed by clinicians following observation of a child and the taking of a thorough developmental history. The Standard Version rating scale (CARS2-ST) is for use with children under 6 years of age who present with communication and learning difficulties. The High-Functioning Version rating scale (CARS2-HF) is for use with children over 6 years of age and with estimated average or above average intellectual ability. A parent-caregiver questionnaire (CARS2-QPC) is also included to assist in gaining a broader understanding of each child's skills and needs. For prelinguistic communicators, the Standard Version rating scale can provide a useful summary of the child's verbal and non-verbal communication, as well as social and behavioral skills relevant to a diagnosis of ASD. The CARS-2 has been normed on a

population of children with ASD, and provides cutoff scores, standard scores, and percentiles for comparing the profile of the child being assessed with those of other children with ASD.

In contrast to the availability of tools appropriate for children, there are relatively few screening assessments for adolescents and adults with ASD, and they have limited applicability to pre- and nonlinguistic communicators. For instance, the Social Communication Questionnaire *lifetime form* (Rutter, Bailey, Lord, & Berument, 2003) is used for screening individuals over 4 years of age and comprises 40 yes/no questions relating to social-communication skills and behavior. A few questions have limited utility in profiling the skills and needs of pre- and nonlinguistic communicators, such as those referring to whether a child ever used a person's hand as a tool, or used gestures other than pointing and pulling a person's hand to express wants and needs. However, most adolescent and adult pre- and nonlinguistic communicators will have received comprehensive assessments as children, negating the need for screening tools.

Developmental surveillance and ASD-specific screeners provide an important source of preliminary information about a child's development (in some cases with respect to normative data), which can then be corroborated with more comprehensive assessment across cognitive and communication domains. These screeners can provide insights into the child's social and cognitive skills that are foundational to the development of symbolic communication and evidence for the impact of any developmental delays or atypical behaviors on everyday activities that may ultimately become the focus of intervention. Given that screeners are used prior to a formal diagnostic assessment, they enable caregivers and professionals to contribute information at an early stage of the child's assessment, thereby affording them the opportunity to inform the selection of the tools for use in subsequent stages of assessment. In this way, caregivers can become integral members of the assessment team early in the assessment and intervention planning process.

5.1.4 What Can We Learn from Standardized Diagnostic Tools?

Prior to the introduction of standardized assessments, the diagnostic process for individuals with ASD was based predominantly on subjective observations and clinical impressions (Filipek et al., 1999; Klinger & Renner, 2000). The introduction of standardized diagnostic tools including the Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1989), the Autism Diagnostic Interview (ADI) (Le Couteur et al., 1989), and the Gilliam Autism Rating Scale (GARS) (Gilliam, 1995) heralded the beginning of a new era in which structured observation and interviewing, combined with scoring algorithms capturing core ASD symptoms, could be used in combination with non-standardized information gathering to

inform differential diagnosis. These assessments, which have since been revised (GARS-3 – Gilliam, 2013; ADI-R – Le Couteur, Lord, & Rutter, 2003; ADOS-2 – Lord et al., 2012), have the potential to contribute valuable information to the assessment of prelinguistic communication skills in children with ASD.

The ADOS-2 (Lord et al., 2012) is a clinician-administered standardized assessment of an individual's social-communication skills and behavior. The clinician selects from five available modules, designed to cater for children as young as 12 months who are not yet talking, to adolescents and adults using fluent phrase level speech (and hence, excludes adults who are nonlinguistic). The assessment is administered in a semi-structured manner according to standardized procedures with age-appropriate materials and involves the examiner engineering the materials and environment to administer *presses* for behaviors that are characteristic of ASD. The ADOS-2 takes approximately 30–60 min to administer, at which point the clinician scores the behaviors of interest using an algorithm. Cut-off scores for *Autistic Disorder* and *Autism Spectrum Disorder* are provided. These scores are used, in conjunction with other sources of information and with reference to the diagnostic criteria (e.g., American Psychiatric Association, 2013; World Health Organisation, 1992), to assist in differential diagnosis.

Given that the ADOS-2 is essentially a direct observation of behavior, it offers an excellent context in which to examine the learning skills, needs, and profile of prelinguistic communicators (i.e., children, rather than adults). To illustrate, the Toddler Module provides an opportunity to observe (a) the communication modalities the child is using, including vocalizations, gestures, physical actions, and words; (b) the functions his or her communicative behaviors serve, including requesting, negating, and sharing information; (c) the child's frequency and social quality of initiations of interactions, including joint attention; (d) his or her response to the initiations of others; and (e) his or her functional and symbolic play skills, imitation skills, and sense of shared enjoyment. Accordingly, the social-communication and behavior sample elicited during the ADOS-2 should provide the clinician with a clear indication of the child's current forms and functions of communication – regardless of whether or not the child is intentional and/or symbolic – as well as insight into the foundations of linguistic communication, including joint attention, imitation, and the emergence of symbolic play. Unlike an unstructured or informal play-based communication sample, the semi-structured standardized nature of the ADOS-2 increases the likelihood that the child's repertoire of behaviors relevant to a diagnosis of ASD will be observed during the relatively brief assessment.

The Autism Diagnostic Interview – Revised (ADI-R) (Le Couteur et al., 2003) is administered through a structured interview with parents or significant others and focuses on aspects of development and current functioning that are critical to differential diagnosis of ASD. The ADI-R scoring algorithms have been shown to be valid for use when assessing children and adults with a mental age above 2 years. Therefore, the algorithms will not be sensitive for many pre- or nonlinguistic communicators from a diagnostic point of view, thus leading to recommendation against its use for these populations (Ozonoff et al., 2005). However, the questions

asked in the interview mirror those contained in a standard comprehensive developmental interview, and the qualitative information gained through this type of interview is likely to be relevant to assessment and treatment planning for prelinguistic communicators, irrespective of age and intellectual functioning. Of particular relevance to the assessment of pre- or nonlinguistic communicators are questions on the ADI-R relating to communicative intent, use of other's body to communicate, use of gestures, spontaneous imitation of actions, imaginative play, social initiations and responses, and functions of communication. The systematic approach to questioning was designed to help interviewees reflect on the individual's early development and current functioning, thus establishing a comprehensive picture of skills, needs, and developmental trajectory. Furthermore, items inviting interviewees to "describe the person" and to share their "current concerns" provide a useful means to gather qualitative data about the individual and his or her family that are likely to be crucial to goal selection and intervention planning.

The Gilliam Autism Rating Scale – 3rd Edition (Gilliam, 2013) is a 56-item assessment completed by parents, professionals, or educators (for those at school). Designed for use with individuals aged 3–22 years, the GARS-3 includes questions relating to use of gestures, imitation, initiation of interactions, reciprocal social interaction, and the functional use of objects. Unlike the ADI-R, which takes approximately 2–3 h to complete, the GARS is designed to be completed in 5–10 min and so may be considered to be both a screener and diagnostic tool. Irrespective of its use as a screener or for diagnosis, the GARS is intended to contribute to a comprehensive assessment process including a detailed interview and observations. The use of the ADI-R or a similar structured interview (e.g., Diagnostic Interview for Social Communication Disorders – Leekam, Libby, Wing, Gould, & Taylor, 2002) can be supplemented with additional questions designed to further examine factors relevant to the emergence of linguistic communication. Such an approach improves both the efficiency and accuracy of the assessment process by ensuring a comprehensive profile of the individual's skills and needs across domains is developed, without the need for a separate interview focused solely on communication.

5.1.5 What Can We Learn from Standardized Assessments of Developmental Domains?

In order to complete the diagnostic assessment and plan intervention, diagnostic tests require supplementation with those designed to examine the individual's skills across a range of areas of development and functioning. For pre- and nonlinguistic communicators, relevant domains are cognitive development and behaviors, adaptive behavior, and social-communication skills with a focus on pre- or nonlinguistic communication. Norm-referenced standardized assessments are particularly

relevant to the evaluation of cognition and adaptive behavior, and can also be valuable in assessing pre- and nonlinguistic communication skills, including joint attention, imitation, and, for children, play skills (Kasari et al., 2013). Other areas for investigation as part of a comprehensive assessment may include repetitive and ritualistic behavior, mental health and physical health, vision and hearing, and genetic testing (see Filipek et al., 1999), all of which may influence the assessment team's understanding and interpretation of communication development in children who are prelinguistic communicators and skills in adults who are nonlinguistic. Here, we focus on the three areas (i.e., cognition, adaptive behavior, and communication) that are directly relevant to the assessment of all pre- and nonlinguistic communicators.

Cognition Standardized cognitive assessments can provide insight into an individual's attention, concentration, memory, visual processing, and problem solving, each of which is central to learning, thus impacting communication development (Organization for Autism Research, 2003). Cognitive assessments also assist in the process of differential diagnosis, whereby differences in an individual's social-communication skills, play skills (in the case of children), and behavior may be attributed to ASD, intellectual disability, both ASD and intellectual disability, or one or more other disorders (Filipek et al., 1999). Furthermore, cognitive development has been found to be a strong and consistent predictor of communication, and other developmental and educational outcomes, thus making information about an individual's cognitive skills essential to intervention planning and counseling caregivers of young children regarding prognosis (Kasari et al., 2013).

The Mullen Scales of Early Learning (MSEL) (Mullen, 1995) and the Bayley Scales of Infant and Toddler Development (current edition, Bayley-III– Bayley, 2006) are two cognitive assessments commonly used with children with ASD. Both tests evaluate cognitive skills (e.g., pattern matching, visual understanding, puzzle completion), expressive and receptive communication, and motor skills. The Bayley-III also includes a parent-completed questionnaire examining social-emotional development and adaptive behavior. Ozonoff et al. (2005) suggested that the MSEL has two key advantages over the Bayley-III: (a) a wider age range (0–68 months versus 1–42 months), and (b) the inclusion of five scales allowing for separate assessment of non-verbal and verbal abilities. Further, they noted that both assessments include standard and age-equivalent scores, thus allowing testing of older children with significant learning needs for whom administration of tests designed for their age range may be inappropriate.

Focusing on the MSEL, a review of individual scale items reveals the inclusion of a range of items relevant to the assessment of prelinguistic communicators. These include items assessing object permanence, cause-effect, and object associations in the visual reception scale, each of which is fundamental to language development. The communication scales include items examining response to sounds and words, social response to others, vocalizations, babbling, and use of gestures. Therefore, the individual items and raw scores associated with these may

be useful in determining skills and needs, as well as in monitoring progress in young prelinguistic communicators (Kasari et al., 2013). For older nonlinguistic communicators, these items arguably hold less meaning, given that the administration procedures and target behaviors are based on typical child development (e.g., baby sitting in mother's lap as clinician attempts to make the baby smile). Furthermore, the fact that some behaviors (e.g., babbling) appear at around 6 months in typically developing children but then reduce in frequency with the emergence of words from 12 to 18 months can make it difficult to assess and award credit for items appropriately to a 4-year old child who is no longer babbling, but not yet using words. Given the complexity of administering items and interpreting responses, it is imperative that clinicians have appropriate qualifications and training in the administration of these tests.

For older children and adults with ASD who are nonlinguistic, the Differential Abilities Scales (DAS-II) (Elliot, 2006) and The Leiter International Performance Scales – Revised (Roid, Miller, Pomplum, & Koch, 2013) have both been recommended (Filipek et al., 1999). Kasari et al. (2013) noted that the DAS has the advantage of assessing both intellectual and academic skills, as well as the option of "out of range" testing for older students with ASD who have significant learning needs. A key advantage of the Leiter scales is that it does not directly assess receptive or expressive language skills and is appropriate for individuals with a mental age of 2 years or higher, thus making it a good assessment of non-verbal cognition (Kasari et al., 2013). Assessing pre- and nonlinguistic communicators with ASD using non-verbal intelligence tests, where the intention is to reduce the potential impact of social and communication difficulties on an individual's ability to follow test instructions, may provide a more accurate reflection of his or her cognitive abilities (Organization for Autism Research, 2003). Furthermore, the use of non-verbal intelligence tests can help reduce, although not alleviate entirely, the linguistic challenges associated with administering and interpreting language-based assessments for individuals who are culturally and linguistically diverse (Rhodes, Ochoa, & Ortiz, 2005), including those with ASD.

Adaptive Behavior The results of cognitive assessments must be considered with reference to the individual's adaptive behavior: that is, his or her social, communication, motor, academic, and daily living skills in everyday environments of home, school, work, and/or the community. Adaptive behavior assessments document an individual's level of functioning and help to establish the impact of his or her learning difficulties. When combined with information about the social and environmental factors (e.g., family support, funding for services) pertinent to the individual's circumstances, an overall understanding of his or her level of disability (World Health Organisation, 2001) can be gained. Accordingly, the information gained from the adaptive behavior assessment is crucial to identifying goals for intervention planning (Ozonoff et al., 2005).

A frequently used adaptive behavior assessment for individuals with ASD is the Vineland Adaptive Behavior Scales, which is currently in its second edition (VABS-II) (Sparrow, Cichetti, & Balla, 2005). The VABS-II is administered via

an interview with parents, teachers, or significant others, or via a parent-completed or teacher-completed survey form. The VABS-II is appropriate from birth to 90 years and assesses adaptive skills across five domains: communication, socialization, daily living skills, motor skills, and maladaptive behavior. The domain scores (except maladaptive behavior) are combined to generate an Adaptive Behavior Composite, a broad measure of adaptive functioning in everyday environments. The VABS-II yields raw score, standard scores, percentiles, descriptive severity levels, and age-equivalent scores.

For pre- and nonlinguistic communicators, aside from documenting the presence and magnitude of developmental delay in adaptive behavior, the VABS-II is likely to yield information that is more relevant to goal setting, intervention planning, and outcome evaluation than to ascertaining the social-communication skills and needs of the individual. The reason is that while few items on the socialization and communication scales address development in the prelinguistic period, the daily living skills domain provides a useful insight into the individual's participation, independence, and support needs in daily activities. To illustrate, the expressive communication domain includes nine items relating to behaviors seen in the prelinguistic period, including production of vocalizations and gestures, while the receptive communication domain includes only three items. However, from a descriptive perspective, the information garnered from these is likely to add little to what can be collected in a brief communication screener (e.g., the M-CHAT-R/F– Robins et al., 2009). The daily living skills domain, however, provides information about the individual's personal skills (e.g., eating, drinking, dressing, personal care), domestic skills (e.g., looking after personal possessions, participating in household chores), and community skills (e.g., following household rules, road safety). The development of these skills is likely to become a key focus, and ultimately the most socially valid outcome measure, of intervention success.

Communication Communication development is routinely examined as part of diagnostic, cognitive, and adaptive behavior assessments, but warrants additional detailed examination in the case of pre- and nonlinguistic communicators. These assessments are within the purview of qualified speech-language pathologists with expertise in working with individuals with developmental disability, and include examination of (a) each person's functions of communication (e.g., to comment, request, negate); (b) the communication modes he or she uses (including vocalizations, gestures, eye gaze, physical actions, and idiosyncratic strategies); (c) the frequency, social quality, and effectiveness of verbal and non-verbal communication modes used; (d) his or her coordination of communication modes (e.g., coordinated use of eye gaze and gesture to make a request); and (e) atypical communication patterns, such as echolalia and use of words without apparent communicative intent (Filipek et al., 1999; New York State Department of Health, 1999; NIASA, 2003). An audiological examination is also required to rule out the possibility of hearing impairment (New York State Department of Health, 1999). Such a comprehensive assessment necessarily involves collecting information from multiple stakeholders and across multiple settings, with the use of a range of

assessment tools. Here we focus on the contributions of standardized assessments to this process.

Given that all typically developing children go through a prelinguistic phase of communication development, a common approach to the assessment of prelinguistic children with ASD is to administer a standardized speech and language assessment that caters for children under 12 months of age. The Preschool Language Scales – 5th Edition (PLS-5) (Zimmerman, Steiner, & Pond, 2011), for example, is a norm-referenced assessment of auditory comprehension and expressive communication in children from birth to 7 years 11 months of age. It was not designed for, nor is it suitable for, older children or adults who are nonlinguistic communicators (Zimmerman et al., 2011). The assessment takes approximately 25–35 min for children up to 11 months of age and up to 60 min for children aged 3–4 years; it yields standard scores, percentile ranks, age equivalents, and growth scale scores designed to assist in tracking changes in children's communication development over time (Zimmerman et al., 2011).

With its focus on typical development, the PLS-5 can provide insights into a child's prelinguistic skills, such as his or her response to sounds and instructions, functional and symbolic play, use of vocalizations and gestures, and communication for behavioural regulation and social purposes. However, comprehensive speech and language assessments, such as the PLS-5, cover a broad developmental period and arguably fail to provide fine-grained measurement and analysis of behaviors that occur during the prelinguistic period. In addition, the items relevant to the prelinguistic period of communication development become less appropriate as the child grows older, where assessable behaviors such as babbling and mouthing objects are less relevant. Instead, assessments that focus on the prelinguistic period of development may be more suitable in assessing the communication strengths and difficulties of these children.

The Communication and Symbolic Behavior Scales (CSBS) (Wetherby & Prizant, 2001) was designed to assess communication skills, social-affect, and symbolic abilities in children with a functional communication age of 8–24 months (Wetherby & Prizant, 2003). It assesses non-verbal social-communicative behaviors that correlate with language development through a standardized, semi-structured approach to sampling the child's behavior through activities including (a) creating communicative temptations to entice communication, (b) shared book reading, (c) symbolic and constructive play tasks, and (d) language comprehension probes. These activities take approximately 1 h to complete and the session is video recorded for coding and analysis. A parent questionnaire is used to gain additional information about the child's social-communication skills in everyday situations at home and in the community. Wetherby, Allen, Cleary, Kublin, and Goldstein (2002) noted the importance of supplementing direct testing in the CSBS with parent report, given that a child's performance on the day of testing may be influenced by a range of factors, including attention, interest, fatigue, familiarity with the setting, and general comfort.

A distinct advantage of the CSBS over other norm-referenced standardized assessments that include communication domains (e.g., Mullen Scales of Early Learning) is the information it can provide regarding the social-cognitive underpinnings of linguistic communication development. To illustrate, within the *communication scales*, not only is the presence of verbal and non-verbal communicative behaviors examined; the rate, coordination, and functions of these behaviors (behavior regulation, joint attention, social interaction) are also examined. The frequency and quality (e.g., positive, negative) of social affect is examined, as is social reciprocity and the child's use of repair strategies. Within the *symbolic scales*, the child's progress towards development of symbol use (i.e., words) is considered with reference to his or her language, functional and symbolic play skills, communicative intent, imitation, and tool use. This approach to examining the building blocks of linguistic communication means that intervention planning can proceed in a tailored fashion by targeting the constituent skills of linguistic development. To illustrate, a child with good social reciprocity but a limited range of communicative functions can be supported to expand his or her use of communication for behavior regulation, social interaction, and joint attention. In contrast, a child who demonstrates a range of communicative functions but poor social reciprocity may be supported by engineering the environment to increase the number of communicative opportunities with communication partners ready to wait and look expectantly at the child. Examples of strategies such as these were outlined in the test manual to facilitate goal setting and intervention planning (Wetherby & Prizant, 2003).

At present, there are no standardized assessments designed specifically for nonlinguistic adults with ASD. Clearly, the materials used in the assessments described are inappropriate for adolescents and adults with ASD, nor were these assessments designed for or normed with this older population in mind. Aside from gathering information about communication from standardized diagnostic, cognitive, and adaptive behavior assessment as part of the broader evaluation process, non-standardized assessment is currently the only option available (see Chap. 6). Furthermore, irrespective of whether the assessment is for a child or adult, standardized assessments alone do not provide the information necessary to form a comprehensive profile of individuals skills, needs, and functioning, either in terms of setting goals or intervention planning; instead they should be used in conjunction with other assessment tools (NIASA, 2003).

5.1.6 Standardized Assessment of Outcomes

At present, there is no single best intervention for all individuals with ASD, and parents, clinicians, and educators are unable to predict the outcomes of interventions selected (Trembath & Vivanti, 2014). Accordingly, it is imperative that the response of each child and adult to the interventions provided be carefully assessed and monitored. This information is relevant not only to individual clinicians,

clients, and families, but also to researchers and service providers in the field of ASD tasked with improving the efficiency and effectiveness of interventions provided.

There is very limited information available about the use of standardized assessments to monitor intervention progress for individuals with ASD as part of everyday service provision. However, the picture regarding the use of these assessments in research examining intervention outcomes is both clear and consistent over time. Matson and Rieske (2014) reviewed measures of treatment outcome used in early intensive behavioral intervention (EIBI) research published from 1987 to 2013. They found that of the 25 studies that included measurement of treatment outcomes, 22 employed standardized assessments of cognition and adaptive behavior, including assessments mentioned above (e.g., VABS-II, Bayley Scales of Infant Development, Leiter International Performance Scale). Five studies included a direct standardized assessment of speech and language development (i.e., MacArthur-Bates Communicative Development Inventories – Fenson et al., 2007; Reynell Developmental Language Scales – Reynell & Gruber, 1990; Preschool Language Scales – Zimmerman et al., 2011). Matson and Riske expressed support for the trend towards inclusion of standardized measures in research, which provide a consistent method for evaluating outcomes within and across studies. Given the goal of developmentally-focused EIBI programs is to return children with ASD to a typical developmental trajectory with respect to adaptive behavior, the ability to measure changes in cognitive and adaptive behavior, including communication, is an important attribute of norm-referenced standardized assessments.

However, in considering the merits of standardized assessments for evaluating treatment outcomes, it is noteworthy that of the standardized speech and language measures used in studies reported by Matson and Rieske (2014), the Reynell Developmental Language Scales is not suitable for children under 2 years of age, the McArthur Bates Communicative Development Inventories assesses the use of words and gestures only (and not other relevant prelinguistic communicative behaviors described above), and the Preschool Language Scales provides limited coverage of the prelinguistic period. The key risks in relying on standardized assessments to measure treatment outcomes for prelinguistic communicators are that they may not be sensitive to change, and cannot be re-administered within a short time frame without violating the standardized administration requirements. Accordingly, Matson and Rieske noted the importance of supplementing standardized assessments with direct non-standardized measurement of operationally defined target behaviors. For pre- and nonlinguistic communicators with ASD, these could include the number, form, and function of nonlinguistic intentional communicative acts.

5.2 Challenges

Despite the benefits of standardized assessments outlined above, there are a number of issues that impact their use and appropriateness for individuals with ASD, particularly those who are pre- and nonlinguistic communicators. To this end, Kasari et al. (2013, p. 12), following their review of assessment tools for minimally verbal children with ASD (i.e., children with fewer than 20 functional words), noted that ". . .most of the measures have serious limitations for use with minimally verbal children, which have severely impeded progress in both research and clinical practice." These issues must be understood and accounted for when selecting, scoring, administering, and interpreting the results of standardized assessments.

5.2.1 Selecting Standardized Assessments

As discussed previously, a serious shortcoming in the use of standardized assessments for prelinguistic individuals with ASD is the lack of appropriate tools. In terms of communication-specific tools, few exist for children and there are currently no dedicated standardized communication assessments for nonlinguistic adolescents and adults with ASD. There are standardized measures of cognition and adaptive behavior that include communication skills, which we have argued can inform the process of supporting the communication skills of children and adults with ASD, including assessment, treatment planning, and evaluation. However, there is a lack of research comparing assessments (Ozonoff et al., 2005) and no evidence base from which to determine the most valid assessments for individuals with ASD, irrespective of whether they are linguistic or pre- or nonlinguistic communicators (NIASA, 2003). Compounding the problem, Matson and Smith (2008) noted that measures of the same construct may vary considerably within and across studies, meaning that two or more assessments of purportedly the same construct (e.g., IQ, adaptive behavior) may yield different results. When considered together, these findings indicate that clinicians are currently forced to work with a limited selection of assessments that are likely to yield different results even when measuring the same construct, and at the same time have a lack of evidence on which to select from those available.

5.2.2 Administration

Concerns regarding the challenges of administering standardized assessments to individuals with ASD have been well documented in the literature. Neisworth and Bagnato (2004), for example, argued that standardized testing procedures conducted in clinical settings according to strict administration procedures are

decontextualized from the child's everyday routines and unlikely to capture an accurate representation of his or her functional abilities. Instead, they argued that only authentic or alternative forms of assessment are needed that are (a) useful for intervention; (b) acceptable to clients, carers, and clinicians; (c) conducted in natural contexts; (d) adaptable; (e) sensitive to change; (f) useable and interpretable by multiple professionals; (g) designed to foster parent-professional collaboration; and (h) relevant to the individual being assessed. Concerns have also been raised that standardized assessments may not yield accurate results or information that is relevant if administration is heavily reliant on the individual's verbal ability, auditory processing, and ability to follow commands (Indiana Resource Centre for Autism, 2015). As noted above, some assessments, such as non-verbal intelligence tests, go some way towards addressing this issue through the inclusion of tasks that are not reliant on language. However, even tasks that do not require language to complete (e.g., matching objects) invariably rely on the individual following some form of instruction, and hence, receptive language ability, in order to complete the task (Paynter, 2015).

The testing environment and standardized procedures may also be problematic for individuals with ASD, thus limiting the accuracy and relevance of the results. Standardized testing generally requires the individual to interact with an unfamiliar examiner in an unfamiliar environment, in an activity outside his or her normal routine (Indiana Resource Centre for Autism, 2015). These aspects of assessment are likely to result in mild anxiety for typically developing children and adults without disability, with the potential to be amplified for individuals with ASD for whom social interactions and changes in routine are particularly anxiety provoking (Matson & Smith, 2008). For pre- and nonlinguistic communicators, who are likely to have significant auditory comprehension difficulties, the challenges associated with standardized assessments are likely to be compounded. Ozonoff et al. (2005) noted that atypical use of language, frequent off-task behaviors, high levels of distractibility, and variable motivation to complete tasks may all present challenges to the use of standardized assessments. Bagnato and Neisworth (1995) surveyed 250 psychologists servicing over 7000 children in the United States regarding their use of standardized assessments with children with ASD. They reported that approximately 60 % of children would have been deemed untestable by the psychologists if not for their modifications of the administration procedures.

Koegel, Koegel, and Smith (1997) conducted an experiment in which they examined the impact of motivation and attention on standardized test performance amongst six children with ASD. In total, the six children completed 44 standardized assessment testing sessions under two conditions. In the first condition, the assessments were delivered as per the instructions provided in the manual. It the second condition, child behaviors that were likely to impact on test performance were identified through parent interview and child observation, and then accommodated by using tailored strategies for each child. To illustrate, one child reportedly screamed when asked to sit at the test table. Consequently, in the second condition, the test was administered on the floor. The results indicated that children consistently scored higher when motivation/attention issues were addressed across

receptive vocabulary, receptive language, verbal intelligence, and non-verbal intelligence tests. Koegel et al. (p. 241) suggested that "...standardized testing may be measuring the child's test-taking disability rather than intellectual or verbal ability." This concern is consistent with that of Matson and Smith (2008, p. 69) who noted that marked changes in IQ scores following 12 months or less of intervention, as reported in some studies, "...are likely due to compliance to test taking itself versus real changes in IQ."

5.2.3 Scoring and Interpretation

The challenges associated with using standardized assessments extend beyond administration to scoring and interpretation when working with individuals with ASD. In particular, there has been strong debate regarding the relevance and validity of normative data. Neisworth and Bagnato (2004) suggested that comparing the results of children with ASD against normative data is generally flawed for tests that have been neither designed nor field validated for this population. In contrast, Perry, Condillac, and Freeman (2002, p. 65) argued that commonly cited concerns regarding the relevance of standardized assessments to individuals with ASD, including the impact of motivation and verbal instructions, are "...little more than myths, unsubstantiated by or frankly inconsistent with the data and with best practices." They suggest that an individual's lack of verbal communication should not preclude use and scoring of items requiring receptive and expressive language, because these items form part of the construct of intelligence being measured (Perry et al., 2002).

In response to concerns regarding comparing individuals with ASD to general population norms, ASD-specific norms have been developed for the Vineland Adaptive Behavior Scales (Carter et al., 1998). Perry et al. (2002) questioned the clinical relevance of these norms, suggesting that little can be learned from knowing where along a spectrum of need a person lies within a population of people with the same need. However, Carter et al. argued that the norms can be useful in educational and vocational planning, where evaluating progress over time may be best done by comparing an individual with ASD to other persons with ASD, rather than the general population. They suggested that using the national standardization sample in treatment planning may lead to unrealistic and unattainably high goals. Irrespective of the approach taken, or the presence or absence of normative data from individuals with ASD, there is an evident need for clinicians and educators to carefully consider the challenges of both administration and interpretation of standardized assessments for pre- and nonlinguistic communicators with ASD.

5.3 Implications for Research and Practice

Considerations of both benefits of using standardized assessments to inform screening, diagnosis, treatment planning, and evaluation for pre- and nonlinguistic communicators with ASD and their serious challenges, lead to implications for clinicians and researchers working with this population. Here, we present these implications as recommendations drawn from the clinical and research literature. Many of the recommendations are consistent with requirements for a good assessment for all individuals with ASD, as outlined at the start of the chapter. Furthermore, the recommendations are consistent with the principles of the Individuals with Disabilities Education Act (IDEA), which governs the provision of services to children and youth with disabilities in the United States, and stipulates that all children with disability should have access to non-biased comprehensive assessment of skills and needs (U.S. Department of Education, 2015). Our aim here is to highlight the specific implications for assessing pre- and nonlinguistic communicators with ASD.

5.3.1 Determine the Purpose of the Assessment

The first step, prior to considering the use of standardized assessments, is to define the purpose of the assessment. Will the assessment be conducted for diagnostic, goal setting, intervention planning, or evaluation purposes? Will the results be used for clinical decision making, as part of research, or both (Kasari et al., 2013)? The answers will help to determine whether a brief assessment or full battery will be required and whether the assessments will need to be repeated over time to monitor the individual's progress (Paynter, 2015). If repeat administration will be required, the test will need to be sensitive to change in pre- and nonlinguistic communicators, without violating procedural requirements, and cater for the individual's age at both the initial and follow-up assessments (Paynter, 2015). For children with ASD who are prelinguistic communicators, an assessment such as the CSBS that focuses specifically on the development of skills within the prelinguistic period (e.g., joint attention, non-verbal communicative acts) may be more sensitive to change than a standardized speech-language assessment targeting a broader developmental period from 0 to 6 years (e.g., PLS-5).

The second step is to consider the information that is already available to avoid unnecessary duplication of assessments that could invalidate the tests used, be inefficient, and most importantly, place unnecessary burden on the individuals being assessed and their families. It is recommended that all relevant stakeholders, including individuals with ASD wherever possible, discuss the options for assessment available and work together to identify the elements for a comprehensive and appropriate battery that is most likely to yield relevant and meaningful information. For example, when assessing an adult with ASD presenting with nonlinguistic

communication skills for the purpose of treatment planning, it is very unlikely that there would be a need to administer a cognitive assessment if this has been done previously, given the fact that IQ has been found to be stable over time (Howlin, Savage, Moss, Tempier, & Rutter, 2014) and any minor change in scores is unlikely to lead to a meaningful shift in intervention approach. By carefully considering the purpose of the assessment and collating all existing relevant information, the standardized assessments that are most appropriate and informative will become evident, and the skills and expertise within the team required to administer and interpret them will be identified (Kasari et al., 2013).

5.3.2 Use Multiple Sources of Information

Obtaining multiple sources of information enhances assessments for any of the following purposes: (a) better understanding of the individual and their family, (b) obtaining or clarifying an initial diagnosis, (c) documenting an individual's diagnosis and support needs in order to access services, or (d) intervention planning and evaluation (Perry et al., 2002). In this way, the assessment process will yield both quantitative and qualitative information about the individual's communication strengths, needs, and participation level across his or her full range of everyday interactions and environments (Texas Statewide Leadership for Autism Training, 2013). Ozonoff et al. (2005) highlighted the risks associated with not using multiple sources of information. They noted that because diagnostic observation measures (e.g., Autism Diagnostic Observation Scale) rely on assessment of current behavior, they may not account for behaviors that occur in other environments, or occurred previously in the individual's developmental history that are relevant to current diagnosis (e.g., regression of communication skills). Similarly, some behavior relevant to assessment may occur too infrequently to be observed during the assessment session. Therefore, parent report will be critical to identifying and understanding these behaviors (Ozonoff et al., 2005). For children who are prelinguistic communicators, for example, this could include the parents' observation of the frequency, forms, and functions of communicative acts that the child produces at home in relation to familiar objects and activities (e.g., requesting favorite DVD by handing it to mum, pointing to a photo of the family dog on the fridge and then to the dog) that are unlikely to occur in the clinic.

But what should a comprehensive assessment of communication skills in prelinguistic individuals with ASD include? In 2006, the National Institute of Deafness and Other Communication Disorders brought together a group of researchers to develop guidelines for evaluating communication development in young children with ASD. The group recommended that assessments include information from three key sources: naturalistic language samples, parent report, and direct standardized assessments (see Tager-Flusberg et al., 2009). They noted that although standardized assessments can be used to assess phonological, grammatical, lexical, and pragmatic aspects of language, very few are available for

children under 2 years of age, while naturalistic language samples will likely yield the most valid information. The group did not consider the availability of standardized communication assessments for nonlinguistic adolescents and adults with ASD, but, as outlined previously, few options are currently available. It would seem then that the use of standardized assessments with prelinguistic communicators with ASD requires supplementation with non-standardized naturalistic methods of assessment, as described in Chap. 6.

5.3.3 Adapt Assessments If Appropriate

In selecting, administering, and scoring standardized assessments, careful consideration is needed of the potential value of adapting administration procedures, keeping in mind that these will invalidate the use of comparative norms. Surprisingly, despite the widespread use of standardized assessments in the ASD research literature and general acknowledgement of the challenges, to date few researchers have provided specific examples of the challenges faced in administering standardized assessments to individuals with ASD or suggested practical adaptations for doing so. An exception was provided by Matson and Smith (2008, p. 69) who noted

> . . .we have anecdotally had considerable difficulty in obtaining usable IQ data at initial intake for many children with ASD that we assessed. Children often will not make eye contact, do not show the necessary level of compliance with the task, and in other ways fail to comply with testing. It is doubtful that we are the only researchers who have encountered this problem.

Fortunately, there is growing acknowledgement of the issue. Paynter (2015), for example, put forward a series of recommendations for adapting standardized assessments with children with ASD. The following is a summary of her recommendations:

- Prior to the assessment:
  - Select a time and location for testing that is most likely to best "fit" the individual's and his or her family's needs, preferences, and routine. The goal here is to cause minimum disruption to regular activities so as to avoid or reduce anxiety that may impact on the assessment experience and outcomes.
  - Consider the assessment environment, including avoiding any sensory sensitivities (e.g., fluorescent lights, busy waiting rooms) the individual may have. Note that if the purpose of the assessment is to diagnose ASD, the presence of these behaviors will be relevant to diagnosis and so should be managed rather than avoided completely.
  - Provide the individual with a social story prior to the assessment that explains, using pictures, what will occur during the session.
  - Prepare assessment materials (e.g., toys in the test kit) in a way that will reduce the time between administration of each item.

- During the assessment:
  - Use a visual work schedule to help support the individual's comprehension of what will happen during the assessment. Reinforcers for on-task behavior and completing work can be provided at regular intervals, but should not be provided contingent upon the child's response to test items.
  - If necessary, reduce or remove distractions in the assessment room (e.g., pot plants, pencil holders) and arrange the furniture to help organize and settle the individual (e.g., placing table against a wall to create a natural barrier on one side).
  - If necessary, ask a parent, teacher, or significant other to be responsible for managing any off-task or challenging behavior so that the assessor can focus on item administration. Agreement will need to be reached prior to testing on what this person is and is not able to do during the session, to avoid providing prompts that may invalidate the assessment.
  - Given that an individual with ASD may not be motivated to complete test items in order to please the examiner, identify reinforcers that are specific to the individual that are likely to motivate him or her to complete test items. However, it is recommended that these items not be related to special interests or highly desirable items that the individual may not be willing to relinquish in order to complete the next item.
  - Use breaks within the assessment to reward on-task behavior, rather than waiting for challenging behavior to occur.
  - Encourage the individual to assist with packing away test items, to avoid distraction between administering items and consider using a "finished box" to signal the completion of items.
  - In situations where the assessor (or parent/significant other) suspects that the individual being assessed may respond to an alternative administration of the item (e.g., by simplifying language or using a phrase used at home instead of that stipulated in the administration booklet), consider first administering the item according to the manual, and then administering the adapted instruction.

Perry et al. (2002) also proposed adaptations that may be appropriate when administering standardized assessments to individuals with ASD that they consider to be valid. These include (a) allowing parents and significant others to be present during testing; (b) administering the assessment on the floor, table, or elsewhere in the room; (c) starting at the point in the scale that is most likely to increase participation in testing rather than determining the basal in the prescribed manner; (d) providing the instruction as per the manual, and then an adapted instruction, to "test the limits"; (e) replacing an object in the test kit with a preferred object to increase motivation and compliance, in cases where the individual's action on the item is relevant rather than the object itself; (f) providing gentle physical prompts to encourage the individual to engage with the test stimulus (e.g., helping child form pointing finger in a picture identification task); (g) teaching the process of completing the task through several repetitions with reinforcement prior to administering the items; and (h) completing testing over multiple sessions.

Perry et al. (2002) argued that such adaptations are valid because they enable the assessor to determine if the individual has the skill rather than if she or he can produce the skill under a set of specific conditions. Further, the use of adaptations reduces the impact of irrelevant and arbitrary factors (e.g., sensitivity to fluorescent lights) that are not relevant to the assessment of the skills in question. By giving the individual every opportunity to demonstrate the skill under both standardized and adapted conditions, Perry et al. suggested that parents and significant others may be more accepting of the validity of the results, thereby making them more socially relevant. Furthermore, they suggested that this approach to assessment ensures that clinically useful information about the person's skills and needs, the level of support required to complete tasks, and responses to teaching, is collected. For pre- and nonlinguistic communicators with ASD who may struggle to complete standardized assessments, this ecologically valid and clinically relevant information is likely to be the most useful information to arise from the assessment for the purposes of intervention planning.

5.3.4 Interpret Results Accurately

Paynter (2015) and Perry et al. (2002) both emphasized that adaptations to the standardized administration procedure should be recorded, with items administered in an adapted manner possibly excluded from scoring, and that results need to be interpreted accordingly. Yet, even if no adaptations are used, the interpretation of standardized assessment results for pre- and nonlinguistic communicators with ASD requires substantial expertise. Clinicians require a sound knowledge of psychometric testing principles as well as the knowledge, skills, and experience necessary to translate findings into clinically relevant findings and recommendations.

According to Kasari et al. (2013), it is important not to place too much emphasis on standard scores when interpreting the test results of minimally verbal individuals with ASD, including those who are pre- or nonlinguistic. They noted that an individual may perform differently on two tests of the same construct (e.g., IQ), depending on the skills they have been taught, such as in their early intervention program (e.g., being taught to follow instructions using Applied Behavior Analysis), and the test requirements (e.g., whether it requires the child to follow a series of instructions or to engage in semi-structured play with materials). Instead, they suggested that raw scores may be more useful in charting progress over time, as long as these pertain to clinically relevant behaviors (e.g., number of words produced, as measured by the McArthur Bates Communicative Development Inventories). Both pros and cons have been reported regarding the use of age-equivalent scores for determining the extent of developmental delay and measuring progress for individuals with ASD. A benefit of age-equivalent scores is that they provide a descriptive index for a child's development, even in situations where a child does not obtain a proper basal (Paynter, 2015). However,

age-equivalent scores are inappropriate for older children, adolescents, and adults, and it appears to have been generally accepted that they should not be entered into statistical analyses (Kasari et al., 2013; Paynter, 2015; Perry et al., 2002).

Central to the need for accurate interpretation is the importance of providing accurate, timely, sensitive, and informative feedback on assessment results to parents, caregivers, and significant others. Due to the challenges of using standardized assessments with pre- and nonlinguistic communicators, the assessment process can be difficult for parents and caregivers. Standardized assessments tend to highlight the difficulties the person is experiencing, the structured environment may lead to an increase in challenging behaviors, and parents and caregivers may question the validity and relevance of the tools being used. Consequently, it is imperative that parents and caregivers collaborate on the selection of assessment tools; that the purpose, benefits, and limitations of each assessment tool be discussed prior to administration; and that results be interpreted and translated into clinically-relevant terms. The presentation of test results, whether they be standard, raw scores, or age-equivalent scores, or some form of growth score, requires consideration with reference to the individual's use of the behaviors in question in everyday contexts.

In order to consider the real-life implications and meaning of assessment results, multiple sources of information are required. However, Ozonoff et al. (2005) noted that there may be disagreement in the findings across these multiple assessments with regard to the individual's strengths, needs, current functioning, and level of participation. To illustrate, parents might report that a child uses a verbal label for a favorite toy at home, even though childcare center staff have never heard it. Similarly, parents might report more frequent episodes of challenging behavior if they are experiencing personal stress at home, than are reported by staff in an early intervention center. Ozonoff et al. suggest that these should be treated as separate pieces of information that are all equally relevant in establishing a comprehensive and accurate picture of the individual being assessed.

5.4 Conclusion

Standardized assessments have an important role to play in assessing the learning needs and outcomes for prelinguistic and nonlinguistic individuals with ASD. They have the potential to improve screening and diagnosis accuracy, to help build a detailed picture of each individual's learning strengths and needs, and to contribute to treatment decision making and evaluation. However, for individuals with pre- and nonlinguistic communication, a number of issues need to be considered regarding the selection, administration, interpretation, and reporting of information gained through standardized assessments. A key challenge facing clinicians is the lack of standardized assessments for nonlinguistic adolescents and adults with ASD. It is recommended that, where available, the use of standardized assessments should form just one aspect of a holistic and collaborative assessment, conducted with a

clear purpose and requiring (a) multiple assessment tools, (b) the involvement of all key professionals and stakeholders, and (c) to the extent possible, the direct involvement of the individual with ASD. Such an approach is likely to lead to a well-informed, respectful, and ultimately successful approach to promoting the learning, independence, well-being, and social participation of each individual with ASD and his or her family.

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Chapter 6
Individualized Assessment of Prelinguistic Communication

Nancy C. Brady and Deb Keen

Abstract One of the tenets put forth by the National Joint Committee for the Communication Needs of Persons with Severe Disabilities (NJC) is that all people communicate (ASHA Suppl 23:73–81, 2003). This is a powerful statement that shapes assessment and intervention practices for individuals communicating at the prelinguistic communication level. It is powerful because it puts the onus on practitioners to learn how each individual communicates. This premise can shift attention away from documenting one's communication limitations and toward describing extant communication behaviors. These extant behaviors often include idiosyncratic and socially undesirable behaviors that serve communication functions. The focus of this chapter is on discussing strategies that have been developed and implemented to describe communication in individuals with Autism Spectrum Disorders (ASD) who communicate primarily with prelinguistic forms, including gestures, vocalizations, and idiosyncratic forms of communication.

Three complementary assessment strategies will be discussed. The first strategy is *informant report*—an invaluable strategy that capitalizes on learning about how an individual communicates from those who interact with the individual on a regular basis and therefore know her or him best. The second strategy is *direct observation* of the learner in naturally occurring contexts in order to confirm and supplement information gained through informant report. The third strategy presented will be *structured observation* designed to probe a variety of communication responses. This third strategy could include functional analysis of communication behaviors; however, this strategy is discussed more completely in Chap. 7 in this volume. Therefore we will not repeat information on functional analysis here. Following discussion of all three strategies, examples of how using each strategy led to development of a profile of communication strengths and needs for two children with autism will be presented.

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6.1 Current Research on Assessment Strategies

6.1.1 Informant Report

Informant report is a strategy that has been used extensively to evaluate early communication behaviors (Brady & Halle, 1997; Dale, 1996; Rowland & Fried-Oken, 2010; Wetherby & Prizant, 1989). One of its main benefits is efficiency. Caregivers and other communication partners who frequently interact with the learner have extensive knowledge about how she or he communicates across a variety of situations. Questionnaires and interviews have been developed that help guide responses to provide maximum information about an individual's communication. Several specific instruments that have been used with children with autism will be highlighted in this section.

In addition to efficiency, an added benefit to informant report is that it enlists the help of caregivers and other communication partners and thus initiates a collaborative approach to intervention. Through participation in an interview or questionnaire, informants such as parents and caregivers learn about the behaviors that are viewed as potentially communicative, and start to recognize and respond more to these behaviors. In addition, by asking caregivers to provide this essential information, professionals demonstrate respect for caregivers' unique knowledge that has been gained over years of experiences. The process can contribute to building a relationship between professionals and caregivers that leads to collaborative construction of socially valid goals.

The Inventory of Potential Communication Acts (IPCA) (Sigafoos et al., 2000) is one example of an informant interview that has been used with individuals with autism. The IPCA was designed to obtain information about potentially communicative behaviors in individuals with severe disabilities. These individuals often have sensory limitations and physical limitations in addition to cognitive limitations. Their communication may take idiosyncratic, nontraditional forms including forms that are deemed inappropriate or challenging. The 54 questions on the IPCA are worded in such a way that it encourages those completing the interview to indicate how individuals respond to different real-life situations. For example, one question asks, "Please describe how (*name of individual*) greets you or others." At the conclusion of the interview, the assessor compiles the various responses into a grid that organizes the behaviors according to 10 different communicative functions: *social convention, attention to self, reject/protest, requesting an object, requesting an action, requesting information, comment, choice making, answer*, and *imitation*. The behaviors are considered as potentially communicative because they may represent consistent responses to communicative situations that are not always described as communication in the traditional sense. For example, someone may tense their body, rock and hum loudly when favorite objects are taken away. This response would be listed as a potential communication act that serves a protesting function for the individual.

The IPCA has been used in research studies that included children with autism (e.g., Braddock et al., 2013; Keen, Sigafoos, & Woodyatt, 2001; Keen, Woodyatt, & Sigafoos, 2002). Braddock and colleagues (2013) used the IPCA to describe nonverbal communication in a group of 17 young children with ASD. According to the parent-completed IPCAs, the children in this study most often communicated with informal motor behaviors including body movements and gestures during communicative situations.

Studies by Keen and colleagues specifically compared information from the IPCA to information gained from other sources in an attempt to validate the IPCA. Keen et al. (2002) compared teachers' responses obtained with the IPCA to researchers' observations of participants' communicative forms and functions, as well as participant responses to structured communication probes (e.g., choice-making opportunities). Across the eight participants, a low degree of overlap was found between IPCA information gathered from teachers compared with data gathered through researcher observations and structured communication probes. The range of verified behaviors (communicative forms and functions) for direct observation was 4–19 %, although when a more lenient standard of partial overlap in communicative behaviors was used, the range of verification was 23–85 %. The authors concluded that as only some of the teachers' interpretations of behaviors as communicative could be verified, use of tools such as the IPCA should be supported by additional information gained through observational data to provide a more comprehensive profile of a child's communicative behavior.

It is not particularly surprising that there would be discrepancies between reported and observed communication, however. While some caregivers may be highly attuned to potential communicative responses and report many behaviors as being potentially communicative, other caregivers may not be as attuned and thus may provide fewer examples in their responses to the IPCA. Also, since many different forms may be used to convey the same function (e.g., someone can reject by pushing away, shaking head to signify "no", screaming, etc.) and the same form may be used for different functions (e.g., shaking one's head can mean "I don't want it" or "that's not right"), it would be rare that information from informant interviews would overlap entirely with direct observation or scripted interactions. Instead, one may consider the different sources of information as providing complementary information, as in a triangulated model of assessment (Brady & Halle, 1997; Ogletree & Fischer, 1996; Siegel-Causey & Bashinski, 1997). To illustrate, consider the situation where a caregiver reports that a child protests by withdrawing to his/her bedroom, whereas a teacher reports that the same child protests by screaming. Communicative forms can be highly context specific, as this case demonstrates, and the child may need to acquire a number of different forms to communicate the same function across a variety of settings. Consequently, gathering information from a range of settings, from multiple informants and by using a variety of data-collection procedures can provide a more complete picture of the child's communicative behavior.

Another questionnaire that is frequently used with families who have a child with autism is the Caregiver Questionnaire that accompanies the Communication

and Symbolic Behavior Scales Developmental Profile (CSBS DP™). The CSBS DP is a comprehensive assessment tool that includes a behavior sample and checklist in addition to the questionnaire The CSBS DP was standardized with very young children (6–24 months) but the information from the questionnaire may also be valuable with older prelinguistic communicators. It contains 41 multiple choice items and 4 open-ended questions, reflecting seven different language predictors: emotion and eye gaze, communication, gestures, sounds, words, understanding and object use. It should take most parents about 15–20 min to complete.

Several examples illustrate different ways in which information from the CSBS DP Caregiver Questionnaire has been used in clinical autism research. Green and colleagues (Green et al., 2010) used raw scores from the Caregiver Questionnaire as an outcome measure and showed that children who participated in a clinical trial of their parent-mediated early intervention showed significant gains on these scores compared to a control group (Green et al.; Keen, Couzens, Muspratt, & Rodger, 2010). Similarly, Keen et al. showed significantly more gains on scores from the Caregiver Questionnaire by children with ASD who had a professionally-supported, as opposed to self-directed, intervention. Paul and colleagues (Paul, Campbell, Gilbert, & Tsiouri, 2013) used participants' scores on the "words" section of the questionnaire as a means of showing the level of word productions by participants in their intervention study. These studies illustrate how scores from the CSBS DP Caregiver Questionnaire could also be used in clinical settings, to document current communication and potentially reflect changes over time from the perspective of the parent.

The Communication Matrix is another tool available to obtain communication information from informants (Rowland, 2011; Rowland & Fried-Oken, 2010). Like the other instruments mentioned, the Matrix also relies on caregiver information, but uses technology to gather and summarize information. Parents or other familiar caregivers answer a series of questions on a computer and the answers are then organized into a profile that shows how the individual currently communicates according to a developmental continuum. Responses are organized by communicative functions: *refuse, obtain, social* and *information*. Based on the responses obtained, the computer program generates a profile that indicates the individual's current stage of communication according to one of seven levels: Level I is pre-intentional behavior, Level II is intentional behavior, Level III is unconventional communication, Level IV is conventional communication, Level V is concrete symbols, Level VI is abstract symbols and Level VII is language. Responses are also summarized according to how frequently they occur. For example, results from the Matrix might indicate that an individual *frequently* communicates with pre-intentional means such as body rocking to express discomfort, and *sometimes* will use gestures to communicate requests or protests. In this case, it could be said that the individual had "mastered" the level of pre-intentional behavior and was at an "emerging" level for intentional communication. This information can be very helpful in terms of educational programming because the educational team can identify goals that aim at increasing the use of emerging behaviors across multiple

environments, as well as goals aimed at helping individuals learn new communication behaviors.

When parents or other caregivers complete a Communication Matrix, the information is logged in to a centralized database. Recent reports have summarized data from this database for children with autism (Rowland, 2011; Rowland & Fried-Oken, 2010). Approximately 23 % of the 12,500 Matrices completed and entered into their database were from individuals with autism. The authors compared profiles generated for children with autism to individuals with Down syndrome (DS) and deaf-blind individuals. The patterns for the children with autism and DS were similar for many functions, but both of these groups had very different profiles from children with deaf-blindness. Some interesting differences between the individuals with autism and those with DS were that children with DS had higher levels demonstrated for *requests new objects, greets people, offers/shares, directs attention* and *names things/people*. These differences correspond to strengths and weaknesses reported in the literature for these two populations (Brady, Bredin-Oja, & Warren, 2008; Singer-Harris, Bellugi, Bates, Jones, & Riossen, 1997; Wetherby, Prizant, & Hutchinson, 1998). In particular, deficits in joint attention behaviors have been consistently observed in children with ASD, resulting in the use of fewer social communicative functions (Mundy, Gwaltney, & Henderson, 2010).

Bruce and Vargas (2007) also used the Communication Matrix to describe expressive communication levels in their 17 participants — two of whom had autism. These authors reported the highest level for the children with autism to be between Levels III and V for one child and between VI and VII for the other. Level III (unconventional communication) includes body movements, vocalizations, facial expressions and gestures such as tugging on people. Level IV, conventional communication, includes pointing and looking from a person to a desired object. Levels V-VII indicate variations in symbolic communication from concrete symbols that physically resemble their referents to abstract language use. The variations in scores reported by Bruce and Vargas reflect differences in levels used for different communication functions. This study illustrates how the levels captured by the Communication Matrix provide useful information about the communication levels reported by parents in authentic contexts. Consumers of this research would know that these participants were still using unconventional communication for some functions but using conventional communication forms such as natural gestures or even language for other functions.

In summary, the instruments summarized in the preceding section provide socially valid information in an efficient manner. However, as illustrated in the results of the Keen et al. (2002) study, informant data do not always mirror data from other sources. Therefore additional strategies are needed to provide a complete picture of a child's communication abilities and needs, providing guidance regarding intervention planning.

6.1.2 Direct Observation

Directly observing an individual in her or his own environments can provide invaluable information about how the individual communicates within those environments, leading to further analysis about how contextual variables influence communication. For example, caregivers may identify a number of ways in which someone communicates with prelinguistic gestures and vocalizations, but the individual may only produce these behaviors under certain conditions (e.g., Day, Horner, & O'Neill, 1994; Haring & Kennedy, 1990). Direct observations can help identify where, when and with whom someone communicates.

Direct observations require considerable time and resources; hence, this practice may be more likely to occur in research studies than in actual practice. For example, Brady and colleagues (Brady, Herynk, & Fleming, 2010) completed direct observations of 30 children's communication across 2 hours of classroom instruction, dispersed across 2 days and across different activities to obtain a sample of communicative behaviors across typical activities. Eleven of the children had autism and all of the observations occurred within their preschool classrooms. Using a hand-held computer, trained observers recorded the communication acts directed to the child by teachers as well as communication by the students with minimal verbal skills. Results showed that children infrequently initiated communication during classroom activities — mean initiation rate was once every 10 min. When child initiations were recorded, however, teachers usually responded. Child responses to adult initiations were observed more frequently — once every 2 min — indicating that most communication exchanges were initiated by the adult and responded to by the child. Live observations were used in this study and observers were not able to reliably determine the functions of interaction using this method.

In contrast, videotaped observations were analyzed in several research studies focusing on children with autism. As discussed above, Keen et al. (2001) directly observed four students with autism and compared the communication acts observed during snack time, toy play or small group situations, to the information provided in teacher-completed IPCAs. In another study, Keen, Sigafoos, and Woodyatt (2005) also followed IPCA assessments with direct observation, but this time with the goal of determining the degree of teacher responsiveness to prelinguistic communication acts. Eight children with autism were included in the study and researchers observed communication during 10-min segments across three different activities for each child (e.g., music, gross motor). This was repeated across 3 days, yielding a total of 90 min of direct observation. Their results indicated a great deal of variability across the different observations, with a range of 3–62 % child communication acts responded to by their teacher. Responses included verbal acknowledgements as well as compliance acts (e.g., giving an object to the child following a reach request). It was interesting to note that, although there was substantial variability, there was some consistency in the functions to which teachers responded. The function responded to most often was *social convention*, whereas the function least often responded to was *protest/reject*. While Keen

et al. demonstrated variability across different observations, Meadan, Halle, and Kelly (2012) also found variability across different observers. They examined judgments made by groups of observers of the communicative intent of three young children with ASD in relation to the functions of requesting and rejecting. They found observers who were familiar with the child and had formal knowledge of communication and language development were more accurate and confident in their judgments than those unfamiliar and without this formal knowledge.

Another technique that has recently been developed to collect communication data is the Language ENvironment Analysis (LENA^{TM}) system. LENA consists of a Digital Language Processor (DLP) and language analysis software. The DLP is a small, lightweight (2.5 oz) device that records the language environment and the vocalizations of the person wearing the device. The DLP can be secured inside a vest or T-shirt that can then be worn by children with ASD. Adults can also be assigned a DLP in order to capture more broadly the adult language within the child's environment. Once recordings have been made, the LENA software is used to analyze the audio file, providing data on child vocalizations, adult vocalizations and vocal interactions. A number of studies have successfully used the LENA system with young children who have ASD (see Brady et al., 2015; Dykstra, Sabatos-DeVito, & Irvin, 2013; Warren et al., 2010). While prelinguistic communication behaviors that involve non-speech vocalizations or non-verbal communicative forms are not readily captured by LENA, this technology may still be beneficial. Used in conjunction with other assessment approaches, the LENA system could provide useful information about the child's language environment. It may also help to improve our knowledge and understanding of what is occurring for children during the transition from prelinguistic to more intentional and symbolic forms of communication.

Information from direct observations could be used during staff training to alert teachers to the many missed opportunities to respond to student communication acts. For example, Sigafoos, Kerr, Roberts, and Couzens (1994) first documented baseline rates of communication opportunities for children in special education classrooms based on direct classroom observations. Few opportunities were initially observed. Interventions included consultation with teachers during which teachers and researchers jointly generated ways to use three evidence-based intervention strategies in the classroom: missing-item, interrupted-chain, and delayed-assistance. These strategies were reviewed prior to each intervention observation. Following the observations, feedback was provided to each teacher about the number and types of opportunities just observed. Results showed that each teacher increased the number of communication opportunities they provided during intervention, when compared to baseline rates.

These examples illustrate how direct observation can provide valuable information that adds to the overall assessment data. Results from direct observations in authentic contexts are likely to differ from the information obtained through informant reports, partly because there is a limit to the contexts that are observed. Caregivers and teachers provide information based on knowledge they have from a multitude of contexts that they engage in throughout the day, but direct

observations typically sample within contexts where communication is likely to occur at school or at home. The following section describes how a third strategy, *structured observation,* further adds to the picture of communication abilities derived from assessment.

6.1.3 Structured Observation

As stated above, directly observing individuals in their natural environments requires considerable resources. It also involves a bit of luck and careful timing to observe the range of different possible communication functions. For example, individuals request when there is something that they want. Similarly they communicate joint attention when there is something novel or noteworthy to comment upon. If opportunities for these and other functions are not present during the naturalistic observation, those specific communication functions will not be observed. The question remains, however, if individuals would produce these behaviors, given the opportunities.

The purpose of structured observations is to provide opportunities for specific communication functions, thus increasing the chances of observing a variety of communication functions. A number of scripts for different types of structured observations have been developed and used to assess individuals with minimal verbal skills (see Kasari, Brady, Lord, & Tager-Flusberg, 2013, for a description). In this section we will describe the basic principles of structured interactions and highlight a few that have been used with individuals with autism and minimal verbal skills.

Within structured observations, opportunities are provided for intentional, initiated communication acts by creating motivating contexts for communication. Opportunities for requests are often provided through environmental arrangement (Hwang & Hughes, 2000; Kaiser, Hancock, & Nietfeld, 2000). For example, an individual may be given something enticing that is in a difficult-to-open container. This presents motivation for the individual to request help (often through "give" gestures). Another strategy to promote requests is to offer a choice among two or more objects or events (Carter, 2001; Houghton, Bronicki, & Guess, 1987; Stephenson & Linfoot, 1995). In contrast, the hallmark of an opportunity to initiate joint attention is to provide an object, activity, or event that is worth commenting on. For example, the president of the United States recently visited our city and the occurrence of the motorcade motivated verbal and gestural comments by many in the campus community because of the novelty of the event. Within an assessment paradigm, however, it can be very difficult to provide authentic, sincere opportunities for joint attention because novelty or unusualness is likely to differ across individuals. In addition, communicating joint attention is predicated on a desire to share the information with someone. Thus, the communicator must be motivated by the novelty as well as the desire to share the novelty with their communication partner. Brady and colleagues have created numerous tasks designed to provide

opportunities for joint attention, including providing unusual musical instruments, placing food in plastic bags with an imprinted realistic looking bug, and covertly initiating movement by a toy hanging from the ceiling behind the experimenter. Typically, the goal is to ensure that the individual sees the event while the assessor pretends not to notice it, otherwise there is no need to draw attention to the event. We have gone to great lengths to try to provide authentic opportunities for joint attention, partly because lack of joint attention is one of the hallmark characteristics of individuals with autism. Therefore it is essential to document that an adequate opportunity was provided in order to evaluate reaction to the opportunity.

Social validation measures can help determine how effective a particular task is for evoking these different communication functions. Early on, when developing different activities to include in our structured interaction protocols, we "tested" the activities out with individuals of similar ages who had slightly more advanced communication skills than our target population (Brady, McLean, McLean, & Johnston, 1995; McLean, McLean, Brady, & Etter, 1991). If these social validation participants communicated, we considered the tasks to be valid (Wolf, 1978). Even so, individual preferences and interests lead to differential responding across participants. Therefore, we provide multiple opportunities for different functions in hopes that participants will be interested in and motivated by at least a subset of these opportunities.

In research studies, structured observations are typically videotaped for later scoring. There are different ways to score and summarize communication behaviors during structured observations. For example, Kasari and colleagues score each communication response observed during the Early Social Communication Scales (a specific structured observation context described below), then summarize the rates of different forms and functions of communication (Kasari et al., 2014). Brady and colleagues have also employed this strategy and then compared the rates of communication across subgroups, such as those who communicate with some words and distal points versus those who communicate solely with contact gestures such as 'gives' and hand-over-hand gestures (Brady et al., 1995; Brady, Marquis, Fleming, & McLean, 2004).

Recently, we began employing a different strategy to summarize and score responses to scripted opportunities using the Communication Complexity Scale (CSS) (Brady et al., 2012) The CCS was developed to summarize and reference communication according to a developmental continuum. Assessors watch the videotaped scripted opportunities and first identify the highest form of communication that occurs during the activity. Next, the assessors assign a code for that behavior according to the 12-point scale we developed, with 1 reflecting a bodily reaction (such as a startle) and a 12 indicating a two-word/sign/symbol construction that is appropriate for the context and not imitated. Scores between 0 and 5 are pre-intentional (or perlocutionary); scores of 6–10 are intentional (illocutionary) but presymbolic; and scores of 11–12 are intentional symbolic communication acts. After a score is assigned for each activity, we average the highest three forms used to communicate behavior regulation and the highest three forms used to communicate joint attention. At this point in development of the CCS, we do not know if

this average score is better than other types of summary scores such as an overall mean or median score. However, we settled upon this way to average scores because of the fact that some participants only like or respond to a subset of the materials, and we wanted to capture optimal performance during this limited observation.

The behavioral temptations portion of the CSBS (Wetherby & Prizant, 2002; Wetherby & Prizant, 2003) is another structured assessment protocol commonly used with children with autism. Specific opportunities to produce behavior regulation communication acts (e.g., requests), joint attention communication acts (e.g., comments) and social interactions such as greetings are embedded within play activities that are similar to those described for the Brady et al. protocols (2008, 2012). Keen et al. (2010) used the CSBS to assess expressive communication observed in children with autism who participated in one of two types of intervention — parent mediated or professionally mediated. Gains in raw scores were reported following intervention for participants in both interventions. Presumably, the raw scores represented the totals across different areas of communication, including rates of communication, gaze shifts, use of sounds in communication, word use, and language comprehension. Positive gains in these raw scores indicate gains made in at least some of these areas, relative to individual starting points. Although both intervention groups showed positive gains on the CSBS behavior sample, the group differences were not significant. In contrast, scores on the CSBS Caregiver Questionnaire did show significant group differences, with more gains found for the professionally supported group. This may reflect differences in observed communicative behaviors across different contexts and communicative partners, as the CSBS behavior sample is conducted by a clinician within a clinical setting. Even though activities and play contexts are designed to encourage a range of communicative functions, this still occurs within a limited time frame and context. Caregivers on the other hand can draw on knowledge of the child's communicative behaviors across a variety of settings over time when completing the questionnaire.

The Early Social Communication Scales (ESCS) is another assessment that provides opportunities for children to initiate communication. As in the other assessments discussed, the experimenter sets up specific opportunities for joint attention, behavior regulation, and other communication acts during play routines. For example, the assessor engages the child in a tickle game (walk mouse, creep mouse) then pauses to see if the child will request continuation of the game. This assessment has also been used extensively with children with autism (Lawton & Kasari, 2012; Roos, McDuffie, Weismer, & Gernsbacher, 2008). Kasari and colleagues (Kasari, Paparella, Freeman, & Jahromi, 2008) used the frequencies of joint attention communication acts observed during the ESCS and during mother-child interactions as one of the outcome measures in a randomized control trial study. The study found that children with autism who participated in an intervention that focused on teaching joint attention and symbolic play had significantly better growth in joint attention compared to children in a control group.

Thus, results from structured observations can provide information on frequencies of different forms and functions of communication acts as well as indicate how an individual communicates according to a developmental continuum. An advantage, particularly for research purposes, is that the context is stable over time. The information gathered through structured observations provides information that complements the information from caregiver reports and direct observations. The three assessments described in this chapter (the CCS, the ESCS and the CSBS) are intended to sample a range of communication functions. In clinical settings, it may be helpful to provide more focused structured observations to follow up on information from other sources or to evaluate results of a particular intervention. For example, interventionists may provide specific opportunities, such as choice-making opportunities, to specifically probe requesting. Following a course of intervention, the choice-making protocol could be re-administered to evaluate change after intervention. Specific probes such as these would be valuable if the team was not interested in describing how a learner communicated multiple functions, but rather wanted to document changes in the forms used by a learner to communicate a specific function (requesting a choice) over time. One may also view the functional analysis paradigms described in Chap. 7 as versions of scripted interactions because they also provide opportunities to communicate under conditions typically associated with challenging behaviors.

6.2 Implications for Research and Practice

Together, caregiver questionnaires/interviews, direct observations in authentic contexts and structured observation assessments provide complementary and comprehensive information about how a child communicates. When this information is considered together, it can also lead to identification of meaningful communication goals for children with autism who communicate prelinguistically. The following are two case examples offered to illustrate how educational or rehabilitative teams could use this comprehensive assessment information.

Case 1 Boniface is a 6-year-old child who has autism. Prior assessments have placed him below the first percentile on standardized assessments of communication. In fact, past evaluations describe him to be "untestable" with standardized language or cognitive assessments intended for his age. Boniface is in a first grade classroom in his neighborhood public school. He is supported with a paraprofessional in addition to special education, speech language pathology and occupational therapy services.

The IPCA was completed through an interview conducted with his mother. The results of the IPCA indicated the profile of communicative acts summarized in Table 6.1. As can be seen in this grid, most of Boniface's reported communication acts were nonsymbolic gestures and movements (e.g., plopping on the floor when asked to complete a task such as brushing teeth; and grinning when his Dad

Table 6.1 Summary of responses for Boniface's IPCA

Behavior	Social communication	Attention to self	Reject/protest	Request object	Request action	Comment	Choices
Grins	X (greets)						
Stares				x			x
Leads				x	x		
Fusses			x				
Hums						x (happy)	
Laughs						x	
Cries		x					
Rocks						x (bored)	

approached him). The IPCA indicated some potentially intentional communication acts, predominantly to request highly desirable items (e.g., leading Mom to a shelf that was out of reach and contained a favorite electronic game). However, it was also reported that Boniface frequently stood in front of desired objects and just waited until someone noticed he was there.

Based on this information, the team decided to observe Boniface at school in three different contexts. First they observed him during a required task — putting on his coat and mittens before going outside. Second, they observed him during snack time that was conducted in a group format. Teachers offered food items to each child in turn, holding the food up but out of reach of the child, and then waited for the children to request their snack. Graphic symbols were available to all children during snack time. Third, they decided to observe the end of a "free play" context where children were required to put their toys away. Boniface typically played with one electronic game and was usually still engaged with the toy when teachers signaled it was time to put the toys away. Each context was observed over 3 days to sample responses. The total direct observation time across the 3 days was approximately 45 min. Teachers recorded antecedent events, any communication attempts made by Boniface and the consequences for these events using an Antecedent, Behavior, Consequence (ABC) recording sheet (Ellingson, Miltenberger, Stricker, Galensky, & Garlinghouse, 2000). The observations indicated that Boniface reliably cried and pulled away when required to put on his coat. On two occasions, he looked directly at his teacher when he began to cry and then looked away. During snack time, it was observed that Boniface looked over towards the graphic symbols on two out of six choice opportunities and attempted to grab the snack foods during all six opportunities. During the toy clean-up context, Boniface initially cried when the toy he was playing with was taken away, then he stood in front of the toy on the shelf, jumped up and down and flapped his hands. On two occasions he also looked from the teacher to the toy and vocalized while jumping.

The assessment also included a structured observation using protocols developed by Brady and colleagues (2012). The assessment was videotaped and then scored using the CCS scoring system described above. The three highest communication acts observed across the structured context were two 7 s (give gestures), and a 6 for a triadic eye gaze. All three of these communication acts occurred during behavior regulation tasks, yielding a score of 6.67. The highest communication acts during joint attention tasks were two 4 s (vocalizing while looking at the novel event) and a 3 (looking without vocalizing), yielding a 3.67 for joint attention. These scores indicate that Boniface is beginning to use intentional communication acts to request objects, and is using pre-intentional communication during joint attention tasks.

To summarize, Boniface infrequently communicated intentionally during the structured observations. He used pre-intentional communication during classroom observations and at home based on the IPCA. Follow-up discussions with Boniface's mother indicated that he does occasionally give objects to request help at home and look back and forth between his mother and an object he wants on

occasion. His mother did not consider these as communication when completing the IPCA. However, these communicative gestures (giving and triadic eye gaze) were not observed during classroom observations. This information allowed the team to discuss ways to promote more intentional communication acts across school and home environments as well as ways to introduce symbolic communication during highly motivating tasks identified through the classroom observations. The team decided to allow Boniface to request additional time with a favorite toy by selecting a symbol for "more play" after the first announcement of "time to clean up." Boniface's Mom decided that when she observed a triadic eye gaze at home she would verbally map this behavior by saying "oh you want ____" and pointing to the object before giving the object to him. In addition, the team decided to give many more opportunities for Boniface to use the "give" gesture by providing toys and food that required assistance and waiting at least 5 s before prompting a response or giving the food or toy to him. These strategies were introduced to complement other communication goals — such as learning to discriminate symbols — and to promote communication throughout the day.

Case 2 Tonya is a 7-year-old child who has autism and Fragile X syndrome. She also attends a regular education classroom in her neighborhood school. A paraprofessional works with the teacher when needed to provide additional supports in the classroom. Tonya's educational team collected assessment information from the IPCA, direct observation and structured interactions. In contrast to Boniface, for Tonya all three sources of information converged on a communication profile that showed many different types of intentional communication acts used to communicate requests and protests and a few instances of comments. For example, Tonya's mother indicated that Tonya sometimes led her Mom to the television when a favorite commercial came on. During the scripted observation, Tonya "showed" an unusual toy to her Mom. In addition to these prelinguistic behaviors, Tonya signed "please" and "help" to request during the classroom observation of snack time and during the scripted observation. However, it was noted that Tonya would use these signs interchangeably and if her first sign was not responded to, she would switch to the other sign. It was not clear that she understood the different meanings of these two signs. Her mother also reported that she had been taught many different signs but mainly used these two signs and used them interchangeably.

Based on combined assessment information, Tonya's team decided to promote more advanced symbolic communication by teaching her to use a speech-generating device within contexts where she was observed to communicate with intentional nonsymbolic gestures, vocalizations or signs. A small, lightweight device was selected that could easily be carried from place to place. Symbols were selected to map onto her existing communication functions. For example, symbols for "look" and "TV" were provided so that Tonya's Mom could model "look TV" when Tonya pointed to something on the television.

These two examples illustrate the importance of collecting multiple sources of information during the assessment process, and considering the information in total. In addition to completing these activities at regular intervals, such as annually, the

assessment components may also be used to inform intervention decisions at more frequent intervals. For example, structured assessments could be given before and after a particular intervention is implemented to see if intervention effects generalize to the structured contexts. One consideration, however, is that some tasks may lose their salience for participants after repeated exposures. For example, the sight of a large (pretend) bug printed on the bag described previously may be unusual and noteworthy when first shown to a child, but is not likely to engender the same response if this task is administered just a few weeks later. For this reason, Brady and colleagues are currently building a compendium of interchangeable tasks that are designed to evoke the same communication functions and can be used across multiple administrations.

Time is another challenge that many intervention teams will face when implementing the intervention approach described in this chapter. In our research, completing all three types of assessment for a given learner requires anywhere from 3 to 5 h, including time to score and summarize results. One variable that affects the amount of time is the talkativeness of the person who is providing the information on the informant report. Some caregivers really appreciate the opportunity to talk about their child's communication and interviews with these caregivers can require an hour or more. In addition, directly observing children who are very low-rate communicators may require more time to see an adequate sample of behaviors. On the other hand, coding scripted interactions for children who are high-rate communicators can take extra time, up to an hour or more. The time commitment is well worth it, however, because of the richness of results derived from these comprehensive assessments. Another challenge can be the collection of information across different contexts that we know can provide unique data on communicative functions and forms. For example, obtaining information about how a school-aged child communicates at home will likely be accomplished through informant interview because home visiting is often not part of the program and direct observation in the home or other community contexts may not be possible. In this context, an image-enhanced interview may help to gain additional information about the child's communication behavior. Photovoice is one type of image-enhanced interview technique whereby caregivers are asked to take photographs of their child based on interview items or themes (Harte, 2009). Having caregivers then describe the photographs and why they took them can subsequently enhance the information provided by caregivers and promote engagement in the development and implementation of intervention strategies. Similarly, video conferencing has been used to assess and coach communication of prelinguistic children with ASD (Boisvert, Lang, Andrianopoulos, & Boscardin, 2010; Venker, McDuffie, Ellis Weismer, & Abbeduto, 2011). Given advances in digital technologies and the availability of mobile digital devices, image-enhanced interviews warrant further investigation and could potentially make an important contribution in the assessment of prelinguistic communication behavior for children with autism.

6.3 Conclusions

In this chapter we have summarized how to combine caregiver assessment with direct observation and structured interaction to gain valuable information about how an individual learner communicates. Unlike the information provided in Chap. 5 on standardized assessments, the information derived from these three sources will not indicate how one's communication compares to other individuals with or without disabilities. Instead, these assessments are intended to both describe extant communication skills and identify treatment goals that relate to and extend the communication skills described.

Thorough, accurate assessment is the key to successful intervention planning and monitoring intervention progress. Thus, the time and effort devoted to the procedures described in this chapter will enhance individualized programming for learners with autism and minimal verbal skills. Further research is needed to develop methods to systematically and efficiently apply these methods across classrooms, habilitation centers and homes. In addition, research is needed to address assessment of receptive as well as expressive communication, and to ascertain how to further adapt assessments and interventions to accommodate sensory or motor limitations that may co-occur with autism.

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Chapter 7
Functional Assessment of Problematic Forms of Prelinguistic Behavior

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Abstract Autism spectrum disorder is associated with communication impairment and problem behavior such as aggression and self-injury. Researchers have found an inverse relation between problem behavior and communicative competence, suggesting that some problem behavior might have a communicative basis. Additional support for this relation emanates from studies aimed at identifying variables that control problem behavior with experimental-functional analysis methodology. In this chapter, we review the results of current research that has used experimental-functional analyses of problem behavior among individuals with autism spectrum disorder. Results suggest that a substantial percentage of individuals with autism spectrum disorder present with problem behavior controlled by (a) attention from another person, (b) access to preferred objects/activities, and/or (c) escape from or avoidance of non-preferred objects/activities/people. Problem behavior controlled by these variables might be conceptualized as prelingusitic forms of intentional communication related to (a) recruiting attention, (b) requesting access to preferred objects/activities, and/or (c) rejecting non-preferred objects/activities/people. In such cases, intervention aimed at replacing the problematic forms by teaching appropriate communication alternatives has proven to be effective. Challenges in conducting experimental-functional analyses and interpreting their results are discussed, as are directions for future research related to replacing problematic prelinguistic forms with more acceptable alternatives.

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7.1 Introduction

Among the many developmental and behavioral characteristics associated with autism spectrum disorder (ASD), two are particularly relevant to this chapter. The first is that a significant percentage of individuals with ASD fail to develop any appreciable amount of speech or language. Osterling, Dawson, and McPartland (2001) estimated that 25 % of people with ASD lack speech and language and are likely to "remain mute their entire lives" (p. 437). Rowland (2009) reviewed evidence suggesting that up to 50 % of people with ASD will not develop sufficient speech to meet their everyday communication needs. While individuals in this latter group might develop some speech, they cannot rely on it as their primary mode of communication. Even when speech does develop, as is the case for the majority of people with ASD, communication is still impaired to some extent. For example, the individual might simply repeat words or phrases spoken by others, a phenomenon known as echolalia (Carr, Schreibman, & Lovaas, 1975; Sturmey, 2009). There appears to be another group of individuals with ASD who develop speech, as would be expected in the early developmental period (around 6–30 months of age), only to lose their acquired speech and language in a period of regression. Matson, Wilkins, and Fodstad (2010), for example, reported that 74 % of children with ASD who showed evidence of regression at about 28 months of age "lost previously developed speech or communication skills" (p. 43).

These figures support the well-established conclusion that severe communication impairment, defined as limited or no functional speech or language development, is common among individuals with ASD (American Psychiatric Association, 2013; Fitzer & Sturmey, 2009; Mirenda & Iacono, 2009). In the absence of a sufficient repertoire of speech and language — and without effective intervention to establish alternatives to speech (e.g., intervention to teach the person to use manual signs, picture exchange, or a speech-generating device) — such individuals are likely to rely primarily on more subtle or idiosyncratic prelinguistic forms of communication.

In terms of overall functioning, individuals with ASD who present with limited or no speech also tend to have comorbid intellectual disability and greater deficits in adaptive behavior functioning (Liss et al., 2001). Such individuals have been classified as functioning in the low range of the autism spectrum. Low-functioning autism has been characterized by (a) IQ less than 80, (b) significantly impaired social and communication abilities, and (c) higher levels of restricted/repetitive behavior (Stevens et al., 2000). As explained next, such individuals are at risk for developing a number of problematic forms of behavior.

The second most relevant characteristic in relation to this chapter is that a substantial percentage of individuals with ASD present with severe problem behavior. Emerson (2001) noted that behaviors are generally considered to be a severe problem when they occur with an intensity, frequency, or duration that is likely to (a) cause injury to the person or others, (b) disrupt the environment, and/or (c) restrict the person's participation in everyday activities and environments.

Problem behavior is often grouped into five main classes (Matson & Rivet, 2008). These are: (a) aggression (e.g., hitting, kicking, throwing objects at others, and/or biting others), (b) self-injury (e.g., hitting self, biting self, head banging, and ingesting inedible objects), (c) property destruction (e.g., ripping clothing and banging/kicking furniture, doors, and/or windows), (d) disruption (e.g., yelling, shouting, refusing to cooperate, and tantrums), and (e) stereotyped movements/ritualistic behavior (e.g., spinning, re-arranging, and/or mouthing objects, hand flapping, body rocking, and echolalia).

These types of problem behavior are common among individuals with ASD. Murphy, Healy, and Leader (2009), for example, found that 82 % of the children with ASD, in a sample of 157 children, engaged in one or more of these problematic forms of behavior. Other studies (e.g., Holden & Gitlesen, 2006; Matson, Wilkins, & Macken, 2009) have reported prevalence figures ranging from 35 % to more than 90 %. These prevalence estimates suggest that problem behavior is at least 2–3 times more common among individuals with ASD compared to other populations, including (a) typically developing individuals, and (b) people with intellectual disabilities (Holden & Gitlesen, 2006; Matson & Rivet, 2008; Rojahn, Matson, Lott, Esbensen, & Smalls, 2001).

In addition to documenting forms and prevalence, a number of investigators have sought to identify risk factors for problem behavior among individuals with ASD (Baghdadli, Pascal, Grisi, & Aussilloux, 2003; Murphy et al., 2009). Various potential risk factors have been explored, including: (a) age, (b) gender, (c) severity of autism symptoms, (d) level of intellectual disability, (e) adaptive behavior functioning, and (f) speech and language skills (see Lang et al., 2013 for a review). The findings of such studies have been mixed. For example, some investigators have identified a significant relation between age and gender with problem behavior (e.g., Baghdadli et al., 2003), while other investigators have found no such relations (e.g., Murphy et al., 2009). Lang et al. noted that these mixed findings could stem from differing composition of the sample groups and differences with respect to the specific types of problem behavior studied. Baghdadli et al., for example, focused on self-injury in a sample of preschool children (mean age = 5 years), whereas Murphy et al. studied a wider range of problematic forms in older children (mean age = 8.5 years).

Still, several authors have reported an inverse relation between communication ability and the frequency and severity of problem behavior (Beitchman & Peterson, 1986; Chamberlain, Chung, & Jenner, 1993; Lang et al., 2013). For example, Sigafoos (2000) assessed the frequency and severity of problem behavior and also changes in communication skills in a sample of 13 preschoolers with developmental disabilities. The sample consisted of 10 boys and 3 girls. When the study began, the children ranged from 33 to 55 months of age. These 13 children were assessed every 6 months over a 3-year period using standardized measures of communication development and problem behavior. The results indicated a strong inverse relation between the severity of problem behavior and children's communication ability. Specifically, children with more pronounced communication deficits were rated as having more severe problem behavior. These findings support a

general conclusion that people with more severe communication impairment tend to have more frequent and severe problem behavior, compared to those with better developed speech and language skills (see Didden et al., 2012 for a review).

Consideration of the high prevalence of problem behavior in light of the communication impairments associated with ASD has led to the hypothesis that some problematic forms might be viewed as communication behavior (Carr, 1977; Carr & Durand, 1985). Problem behavior might also have its etiology in communication impairment. That is, problem behavior might arise in part because the person has a purpose for communicating, but lacks the skills to do so in a socially acceptable manner (Weiss, 2003). Thus, problematic forms might emerge and persist because they often produce the intended outcome for the "speaker."

In keeping with this hypothesis, Sigafoos, O'Reilly, Drasgow, and Reichle (2002) outlined a learning/conditioning mechanism by which problematic forms of behavior might come to function as prelinguistic forms of communication. The process might unfold as follows: First, in the absence of speech — and in the absence of effective intervention to develop alternatives to speech — many individuals with ASD rely on prelinguistic acts to communicate their wants and needs. However, the prelinguistic forms used by individuals with ASD are often unconventional and idiosyncratic. This makes the communicative intent of the person's prelinguistic forms difficult for others to interpret and thus prone to frequent communication breakdowns (Brady & Halle, 2002). These breakdowns might, in turn, lead to changes in the force and/or topography of behavior due to the lack of reinforcement (i.e., extinction; Herrnstein, 1961; Keen, 2005) of the initial communication attempt. The change in force and topography could modify what initially was a rather benign prelinguistic request (e.g., leading an adult by the hand to an object) into a problematic form (e.g., forcibly grabbing or hitting the adult and screaming).

Imagine a hungry child with ASD attempting to request something to eat by leading an adult by the hand to a cookie jar. Now imagine the adult listener resisting the child's attempt. The child's initial attempt to request by leading would have been unsuccessful, which sets the occasion for an escalation of behavior. That is, in response to this extinction trial, the child escalates to forcibly grabbing the adult's hand and screaming. Being grabbed and screamed at has a tendency to secure one's attention and so the adult might then comply with the child's request, if for no other reason than to terminate the grabbing and screaming. If the adult reinforced the response by giving the requested item as described above, it would inadvertently teach the child that grabbing and screaming are more effective ways of communicating than leading. Grabbing and screaming could thus be conceptualized as problematic forms of prelinguistic requesting shaped by the adult's initial failure to attend to leading (i.e., extinction or a breakdown), and then reinforced by providing attention contingent on grabbing and screaming. It is plausible that through such an operant/learning mechanism, people with ASD might learn to engage in problem behavior to communicate. In essence, they could learn that certain (problematic) forms are more effective in recruiting a reinforcing response than attempting to use other existing and less intrusive forms. Problematic forms

might also become the default form because the person lacks other more conventional, socially appropriate, and sophisticated forms of either prelinguistic or linguistic communication that are equally effective. What makes the form effective is not its topography, but whether and how quickly listeners respond to it. Individuals with ASD are not purposely trying to anger or upset listeners with problem behavior; rather, they are simply engaging in behavior that they have found most functional in producing the outcomes they are seeking.

Durand (1990) argued that problem behavior could be conceptualized as functional communication when there was evidence that the behavior was, in fact, maintained by the resulting response of a listener. This conceptualization is consistent with Skinner's (1957) analysis of verbal behavior (i.e., communication) as a special type of operant behavior in the sense that it has an effect on the environment only through the mediation of a listener. For example, a window will not open simply by saying "Open the window." This request (or mand) will only be effective (from the speaker's perspective) if a listener, upon hearing the request, obliges the speaker by opening the window. Voluntary behavior of a speaker that occurs because of the resulting actions of the listener could be interpreted as intentional communication behavior (Durand, 1986).

Skinner (1957) noted that this definition of communication, or verbal behavior, includes not only the use of speech, but also the use of a wide variety of linguistic and prelinguistic forms. The critical variable is not the form of the behavior, but its function — whether or not the behavior occurs because of the resulting action (i.e., mediation) of the listener. It is thus possible that some behaviors viewed as problematic (e.g., hitting others, head banging, tantrums, throwing objects) could be conceptualized as instances of intentional communication in the sense that they are voluntary and functional (i.e., they produce the intended outcome through the mediation of a listener). Leading an adult by the hand to the cookie jar does not open the jar, but it just might cause the adult to do so. Similarly, grabbing and screaming does not open the cookie jar, but it just might cause the adult to do so.

In summary, there are correlational data suggesting a link between the communication impairments associated with ASD and increased risk of problem behavior (Beitchman & Peterson, 1986; Chamberlain et al., 1993; Didden et al., 2012; Lang et al., 2013; Sigafoos, 2000). There are also conceptual analyses (e.g., Skinner, 1957) that allow for an interpretation of some problem behavior as acts of intentional communication (Durand, 1986, 1990). And there is a plausible learning/conditioning mechanism by which problematic forms of behavior might come to function as prelingusitic forms of intentional communication (Sigafoos et al., 2004). But, an important question is whether there are any experimental data to support the hypothesis that some problem behaviors could be accurately defined as prelinguistic and intentional communication acts for individuals with ASD. Evidence bearing on this question emanates from studies that have undertaken experimental-functional analyses of problem behavior. In the next section, we describe this experimental-functional analytic approach and summarize the main findings of investigators who have employed it to examine the problem behavior of persons with ASD.

7.2 Experimental-Functional Analysis

A considerable amount of research has focused on assessing problem behavior among individuals with ASD and other developmental disabilities (Matson, 2012). Many studies in this area have been directed at providing an experimental-functional analysis of problem behavior (Vollmer, Roane, & Rone, 2012). The primary objective of such analysis is to identify the variables that control problem behavior. Control in this context refers to both the antecedent events that evoke, motivate, and/or set the occasion for problem behavior as well as the consequences that reinforce/maintain the behavior (Vollmer et al., 2012). From a behavioral psychology orientation, behavior is said to be "explained" when its controlling variables are identified (Skinner, 1953).

The gold standard for undertaking an experimental-functional analysis of problem behavior was developed by Iwata, Dorsey, Slifer, Bauman, and Richman (1982; Iwata et al. 1994). The approach involves observing the frequency of problem behavior under the following conditions: (a) attention, (b) demand, (c) alone, and (d) free play. Subsequent studies have often included another (tangible) condition (Mace & West, 1986). In the attention condition, the frequency of problem behavior is recorded when an adult is present and only attends to the person when the person engages in problem behavior. Consistently high rates of problem behavior in this condition, relative to other conditions, would indicate that problem behavior was occasioned by a non-attending adult and maintained by the reinforcing effects of attention from the adult. This attention-maintained problem behavior could be interpreted as a form of prelinguistic behavior for recruiting/requesting attention.

In the demand condition, the person is presented with a work task and the task is briefly removed when problem behavior occurs. Consistently high rates of problem behavior in this condition, relative to other conditions, could indicate that the behavior is occasioned by (evoked by) task demands and maintained by the resulting escape from those task demands, which is a type of negative reinforcement (Carr, Newsom, & Binkoff, 1976). This escape-maintained problem behavior could be interpreted as a form of prelingusitic behavior akin to protesting, rejecting, or requesting a break.

Another set of circumstances that is sometimes included in an experimental-functional analysis is a tangible condition. In this condition, the person might be required to wait before access to preferred objects or activities is allowed. However, the person is given immediate access to the items contingent upon occurrences of problem behavior. Again consistently higher rates of problem behavior in this condition, relative to the attention and demand conditions, would indicate the problem behavior is occasioned by preferred items and maintained by positive reinforcement in the form of gaining access to those items. Problem behavior that is maintained by access to preferred objects could be interpreted as a form of prelinguistic requesting. An everyday example of such tangible-maintained problem behavior is the common scenario of children who tantrum in the grocery store

because in the past this has been an effective means of coercing their parents to buy them a preferred item.

High rates of problem behavior in the attention, demand, and tangible conditions described above could be suggestive of a possible communicative function. That is, if problem behavior is maintained by socially-mediated attention, escape, and/or access to preferred objects/activities, then the problem behavior could be interpreted as functional/intentional communication (Carr & Durand, 1985; Durand, 1986, 1990). Another possibility, however, is that problem behavior might occur under conditions that suggest a non-social/non-communicative function. For example, it is possible that problem behavior could be self-stimulatory or largely biological in origin (Carr, 1977; Weiss, 2003). To test for these possibilities, experimental-functional analyses typically include an alone condition. Here the person is simply observed while alone. Because this condition eliminates the possibility of social mediation, any behavior that occurs in this condition is considered to be non-social and non-communicative. Such behavior might instead be self-reinforcing or automatically reinforced by the resulting sensory stimulation it produces. Such behavior might also have a primarily biological basis and hence would be expected to be largely insensitive to environmental conditions. Lovaas (1982), however, noted that the alone condition might not necessarily be a pure test for non-social functions. Instead, for some individuals, being alone might increase the motivation/need to recruit attention.

A final condition that is typically included in an experimental-functional analysis is free play, which acts as the control condition. Here, an adult is present and attends to the person. There are no demands made on the person and the person has free access to a range of preferred materials, such as toys and activities. It is expected that socially motivated/communication-related problem behavior would be low in this condition because there is no need to recruit attention, no need to reject a non-preferred task, and no need to request preferred items. If high rates of problem behavior did occur in this condition, it might suggest that the behavior is self-stimulatory or self-reinforcing and that nothing in the present environment was sufficiently powerful to compete with this automatically generated stimulation. Another possibility is that the behavior is largely biological in nature and hence insensitive to environmental stimuli and contingencies.

The function or causes of problem behavior exhibited by persons with ASD has often been attributed to the nature of the impairments associated with ASD. For example, a child engages in self-injury because of a greater need for self-stimulation or due to the neurological disturbances that underlie ASD (see Carr, 1977 and Weiss, 2003 for reviews of such explanations). These explanations are inferences and would be difficult to demonstrate empirically. If data from experimental-functional analyses were to reveal that problem behaviors were instead related to attention, demands, or tangibles, then an environmental/communication explanation would be indicated. So what have been the results from studies that have assessed the problem behavior of persons with ASD via experimental-functional analyses? Do the results of these studies support the hypothesis that some problem behaviors represent prelinguistic forms of intentional communication?

In one study relevant to these questions, O'Reilly et al. (2010) completed an experimental-functional analysis with 10 children with ASD. The sample included 9 boys and 1 girl, ranging from 4 to 8 years of age. The children presented with a range of problem behavior including: (a) aggression (e.g., hitting others), (b) negative vocalizations (e.g., crying, screaming), (c) self-injury (e.g., hitting self, hand mouthing), and (d) stereotypic movements (e.g., spinning objects, hand flapping). For the experimental-functional analysis, each child was exposed to an (a) attention, (b) demand, (c) tangible, (d) alone, and (e) free-play condition as described previously. Children participated in 10 sessions under each condition with each session lasting 5 min. The order in which conditions were presented was alternated to align with a multi-element design (Kennedy, 2005). For example, a child might first receive a tangible session, followed by a demand session and then an attention condition, and so on. After this initial phase, the children received a further phase in which only two conditions (alone and free play) were alternated. This second phase was intended to determine if problem behavior was more likely to occur when the child was alone compared to the play condition when the social motivation for problem behavior was considered minimal. During each session, instances of problem behavior were recorded using a standard observational protocol (i.e., 10-s partial interval recording; Kennedy, 2005) enabling the researchers to calculate the percentage of observation intervals with problem behavior for each 5 min session.

The results revealed two main patterns. The first pattern, evident for 8 of the 10 children, was one of undifferentiated responding. That is, 8 children engaged in comparable amounts of problem behavior across each of the conditions. This pattern could indicate that the children's problem behaviors were largely non-social, perhaps self-stimulatory and/or largely biologically determined. Alternatively, such a pattern could indicate multiple sources of control, as suggested by Lovaas (1982) and Iwata et al. (1982, 1994). Indeed, it is possible that these 8 children had learned to engage in problem behavior under each of the assessment conditions to (a) produce sensory stimulation, (b) recruit attention, (c) request tangibles, and (d) escape from task demands. The second pattern, evident for 2 of the 10 children, was one characterized by a higher percentage of observation intervals with problem behavior under the demand and tangible conditions. This pattern suggests that problem behaviors were related to socially-mediated (a) negative reinforcement in the form of escaping from task demands, and (b) positive reinforcement in the form of gaining access to preferred objects. In these cases, the problem behavior might be interpreted as prelinguistic communicative acts for (a) rejecting tasks, and (b) requesting tangibles.

Based on results of the O'Reilly et al. (2010) study, it might be tempting to downplay the communication hypothesis as applicable to only a small percentage of people with ASD. However, other studies with larger samples have found a higher percentage of cases (64–89 %) with socially-mediated, communication-related problem behavior (Asmus et al., 2004; Derby et al., 1992; Iwata et al., 1982, 1994; Kurtz et al., 2003; Love, Carr, & LeBlanc, 2009; Wacker et al., 1998). For example, Love et al. undertook analyses of the problem behavior exhibited by

32 children with ASD. Types of problem behavior among these 32 children represented all of the main categories (e.g., aggression, tantrums, self-injury, and stereotypy) referenced by Matson and Rivet (2008). The sample included 28 boys and 4 girls, from 3 to 14 years of age (mean age approximately 7 years). Children were assessed using a variety of protocols, including the standard experimental-functional analysis protocol of Iwata et al. (1982, 1994). The results suggested that for approximately 80 % of the children, problem behavior appeared to be maintained by socially-mediated reinforcement. The authors speculated that this high percentage of socially-mediated problem behavior could be related to the children's lack of more socially appropriate forms of communication that would enable them to successfully recruit attention, request preferred items, and/or reject non-preferred objects/activities. Put another way, these children might need to rely on problematic forms of prelinguistic behavior because they lacked more appropriate requesting and rejecting skills.

Lancioni, Singh, O'Reilly, Sigafoos, and Didden (2012) summarized 28 studies that included functional analyses of problem behavior. These 28 studies included a heterogeneous sample of 46 participants ranging from 3 to 90 years of age with varying types and degrees of disability (including ASD) and varying types of problem behavior. Lancioni et al. classified studies as identifying an attention function for 14 participants (30 %), a tangible function for 7 participants (15 %), an escape function for 5 participants (11 %), and an automatic (self-stimulation) function for 18 participants (39 %). The remaining 2 participants (4 %) had idiosyncratic functions, meaning that the maintaining consequence was unique and specific to the individual. For example, a child might learn to engage in problem behavior because, in the past, that behavior has resulted in a very specific type of reinforcing consequence (e.g., the caregiver pushing the child's wheelchair or the child being allowed to go for a walk). The results of this review suggest that socially-mediated functions (i.e., using problem behavior to gain attention, tangibles, and/or to escape) were identified for 55 % of the participants. This is consistent with other studies indicating that a substantial percentage of individuals with ASD and other developmental disabilities are likely to present with problem behavior that could be interpreted as prelinguistic forms of intentional communication.

Overall findings from the extensive literature involving experimental-functional analyses of problem behavior offer partial support for the communication hypothesis in that some individuals' problem behaviors appeared to be maintained by socially-mediated consequences, specifically: (a) attention, (b) access to preferred objects, and/or (c) escape from task demands. Problem behavior maintained by these consequences could be interpreted as prelinguistic and intentional communication acts related to (a) recruiting attention, (b) requesting preferred objects, and/or (c) rejecting non-preferred objects/activities. This tentative support for the communication hypothesis would also seem consistent with studies showing that children with ASD use prelinguistic behavior primarily for instrumental/behavior regulation functions, such as gaining access to preferred objects and rejecting non-preferred objects and activities (Carr & Kemp, 1989; Maljaars, Noens, Jansen,

Scholte, & van Berckelaer-Onnes, 2011; Mundy, Sigman, Ungerer, & Sherman, 1986; Rutter, 1978).

7.3 Implications for Practice

The communication hypothesis, supported as it is by voluminous experimental data, has two major implications for practice. One relates to how practitioners conceptualize problem behavior and the second relates to the design of intervention strategies aimed at reducing problem behavior. With respect to the first implication, findings from experimental-functional analyses support a view that problem behavior can, in some instances, be highly functional and adaptive for the individual. Indeed, when problem behavior is shown to be maintained by (a) attention, (b) access to tangibles, and/or (c) escape from non-preferred objects/activities, the behavior can be conceptualized as functional in the sense that it represents the person's means of communicating important wants and needs. For some individuals, problem behavior may be their only effective way of communicating such wants and needs. Thus, results from experimental-functional analyses suggest that problem behavior is not necessarily maladaptive, but rather that it can serve important and useful (communicative) functions or purposes for the individual. What is maladaptive is the form or topography of the behavior that conveys the message.

This conceptualization implies the value of an intervention approach that begins with an understanding of the function or purpose of the problem behavior. In cases where problem behavior is controlled by socially-mediated consequences, one solution is to teach the person to access these same reinforcers by adopting more socially acceptable (communication) forms. This is an alternative to an intervention approach aimed at suppressing the problematic form by eliminating the controlling variables (i.e., those that trigger or reinforce) or punishing instances of problem behavior. For example, the person might be taught to recruit attention, request tangibles, and/or reject non-preferred activities by using more conventional means of communicating, such as manual signs, picture exchange, or speech-generating devices. This approach is known as functional communication training (FCT; Carr & Durand, 1985).

FCT has been widely used as an intervention to reduce problem behavior in persons with ASD (see Mancil, 2006 and Sigafoos, O'Reilly, & Lancioni, 2009 for reviews). For example, Schmidt, Drasgow, Halle, Martin, and Bliss (2014) provided FCT to three students with ASD. The sample consisted of three boys aged 9, 10, and 15 years, respectively. In addition to ASD, the students were diagnosed with severe to profound intellectual disability. Two children were described as nonverbal, while the other boy had a vocabulary of approximately 100 words, but he mainly used these words in an echolalic fashion. All three students were considered candidates for FCT due to numerous and severe problem behaviors, including aggression, throwing objects, pica, self-injury, fecal smearing, and

inappropriately touching other people. The intervention involved two phases. First, experimental-functional analyses were conducted to identify the variables that controlled each child's problem behavior. The results suggested that one student's (Billy) problem behavior was evoked by situations in which an adult was not attending to him and was reinforced (maintained) by attention from the adult. Thus this student's problem behavior could be interpreted as attention-maintained or as a problematic form of prelinguistic communication for recruiting attention. For the other two students (Ivan and Thomas), problem behavior was most frequent when preferred edibles were out of reach and least frequent when they had access to these same preferred edibles. This pattern suggested that problem behavior functioned as a (prelinguistic) request for preferred edibles.

Based on these assessment results, the second phase of the study aimed at teaching new, functionally equivalent request forms to replace problem behavior. Billy was taught to say "Talk to me" to recruit attention and Ivan and Thomas were taught to sign "eat" to request preferred edibles. Teaching procedures consisted of (a) creating opportunities to communicate with the new forms, such as offering a preferred edible; (b) prompting the new communication form if necessary; (c) fading the prompt by delaying its introduction and giving the students more time to initiate (time delay); and (d) reinforcing the new communication form when it occurred, provided that problem behavior had not occurred. With these procedures, the students learned to use the new communication forms to recruit attention (Billy) and to request preferred edibles (Ivan and Thomas). Most importantly, as the new communication form was acquired, problem behavior showed a collateral decrease to low levels. The decrease in problem behavior as the new communication form was acquired suggests that the new communication form served the same function or purpose as the students' problem behavior. That is, problem behavior and the new communication forms were functionally equivalent (Carr & Durand, 1985; Carr & Kemp, 1989).

The general effect reported by Schmidt et al. (2014) is a consistent finding of many other studies that have evaluated FCT as a treatment for problem behavior among individuals with ASD and other developmental disabilities (Didden et al., 2012; Mancil, 2006; Sigafoos et al., 2009). Indeed, Didden et al. identified over 100 studies on FCT, that all had "... almost entirely positive findings" (p. 134). FCT appears to be among the most effective approaches, in terms of effect size, for addressing problem behavior in individuals with ASD and other developmental disabilities (Didden et al., 2012). Data suggest that there are several features that are critical to the success of FCT.

1. Success depends on ensuring that the new communication forms serve the same communicative function(s) as the existing problem behavior. That is, the new communication form must be functionally equivalent to existing problem behavior. Hence, FCT must be linked to the results of a prior functional assessment that accurately identified the function of problem behavior. The same variables that control problem behavior must come to control the new communication forms that are being taught. For example, if a child's tantrums are triggered when

the parent is distracted/not attending, then the child needs to be taught to recruit the parent's attention on these same occasions, perhaps by selecting a relevant icon from the display of a speech-generating device (e.g., a photograph of the parent), that would produce relevant speech output (e.g., *"Mommy, please come here."*).

2. The new communication form targeted for intervention must be at least as easy to produce as the existing problem behavior. If the new communication form requires more physical effort or greater cognitive demands than the problem behavior, then acquisition of the new form could prove difficult and the child might continue to engage in problem behavior. Tantrums may require more physical effort than selecting a single icon on a speech-generating device. However, if the child also had to discriminate among several different screen icons, then the new communication task becomes more demanding. This could slow acquisition and perhaps cause a resurgence of problem behavior due to the new and more difficult task demand associated with learning to communicate via a speech-generating device.
3. Listeners need to reinforce the new communication forms consistently and refrain from reinforcing the old problematic forms. For example, when problem behavior is maintained by attention, a logical replacement would be to teach the person to recruit attention in a more appropriate way. The person might, for example, be taught to operate a call buzzer when adult attention is desired (Sobsey & Reichle, 1989). Of course, the adult must provide attention in response to the buzzer more quickly and more consistently than for problem behavior.
4. Five factors have been grouped together to determine response efficiency (Halle & Drasgow, 2003; Horner & Billingsley, 1988; Horner & Day, 1991). The label is apt because each of the factors shares a common thread of ensuring that the response produced is the most efficient one in optimizing the desired outcome. Each is described briefly using the common example above of requesting assistance. *Response effort* is the amount of effort (sometimes measured in calories expended or cognitive challenge) required to produce the response. Leading an adult by the hand to obtain assistance is physically more effortful than the other competing responses and, thus, all other factors being equal, would be less probable. The *immediacy of obtaining the desired outcome* is a second efficiency factor. If screaming consistently produces the outcome more quickly than saying, "Help, please", then screaming would be more probable than using words. A third factor, *consistency of obtaining the desired outcome*, refers to the number of responses that occur before the outcome is obtained. That is, if Amelia has to say "Help, please" two or three times before help is provided, yet throwing materials on the floor produces assistance each time it occurs, then this latter response is more efficient. *Quality or magnitude of outcome produced* is a fourth factor determining efficiency. If Amelia wants a drink of water from a fountain in the hall of her school and she requests assistance by saying, "Help, please", her teacher holds the lever down for 20 s, allowing Amelia to drink a large quantity of water. However, when Amelia leads her teacher by the hand to

the fountain, the teacher provides access for only 5 s, and when Amelia screams as she approaches the water fountain, her teacher ensures that Amelia is not allowed to drink. Saying "Help, please" is more efficient than leading, which is more efficient than screaming. A fifth, and final, factor contributing to the efficiency of equivalent responses is their *history of punishment*. Here, punishment is defined as any consequence that reduces the future likelihood of the response. Thus, if screaming or throwing materials on the floor are responses that on occasion are punished by the teacher removing Amelia's favorite squeeze toy from her desk, then these responses are less likely to be used to obtain the teacher's assistance.

At least three caveats warrant mention in this discussion of response efficiency. First, all five determinants of efficiency are highly dependent on the behavior of the social partners with whom a child interacts. It is these partners who decide which request for assistance they will respond to and the immediacy, magnitude, and form of their response. Later, in the intervention section of this article, we revisit this issue by describing in more detail the role that practitioners must assume to ensure the efficiency of desired response forms and the inefficiency of problem forms. Second, none of these five factors functions alone or independently of the other four. That is, the value of all five combined is what determines which member of the class of requesting options will occur in any particular situation. So, all five factors must be considered when selecting responses to teach the child and responses to which the social partners will be responsive. For example, a child would be more likely to attempt to repair a communication breakdown by using a targeted strategy (e.g., selecting a communication symbol) if it required less energy and resulted in a more immediate, consistent, and higher quality outcome compared to other responses in the response class. A final caveat is that our entire discussion of response efficiency has been restricted to requesting assistance. Efficiency factors are equally applicable to communicative functions other than requesting. For example, the form of a comment would depend on the most efficient response for producing joint attention or attention from the listener, or the form of a protest would depend on the most efficient response for removing the unpleasant event or material.

7.4 Implications for Research

Future research examining experimental-functional analyses and FCT is relevant for prelinguistic communication because of the prodigious literature supporting the premise that problem behavior often is socially mediated and, therefore, has communicative intent. That is, problem behavior is a means of influencing the behavior of others, encompassing a fundamental feature of communication. The evidence base linking experimental-functional analysis results with FCT is sufficiently large and robust to support its classification as well established, empirically validated, and highly efficacious for the treatment of problem behavior among

persons with ASD and other developmental disabilities (Didden et al., 2012; Healy, Lydon, & Murray, 2014; Mancil, 2006; Sigafoos et al., 2009; Sigafoos, O'Reilly, Lancioni, Lang, & Didden, 2014). While the efficacy[1] of this approach has been well established, there would seem to be value in undertaking additional research of FCT in at least two general areas.

First, given that FCT has produced consistently positive and large effects (Didden et al., 2012; Healy et al., 2014; Mancil, 2006; Sigafoos et al., 2009, 2014), it is plausible that the early introduction of FCT might prevent the emergence of problem behavior as a communicative option in young children with ASD. An important research question is thus whether or not the early introduction of FCT would prevent the emergence of severe behavior problems in children with ASD. Experimental-functional analytic studies have consistently demonstrated that problem behavior is often maintained by socially-mediated consequences, specifically: (a) attention, (b) access to preferred tangibles, and (c) escape from non-preferred activities (cf. Asmus et al., 2004; Derby et al., 1992; Iwata et al., 1982, 1994; Kurtz et al., 2003; Love et al., 2009; O'Reilly et al., 2010; Wacker et al., 1998). In light of this evidence, a preventative FCT intervention could focus on teaching young children to use easy, yet socially appropriate, forms of augmentative and alternative communication (e.g., gestures, picture exchange, speech-generating devices) to accomplish these same communication outcomes. If some problem behaviors do, in fact, represent prelinguistic forms and emerge because other more socially acceptable communication forms are ineffective or seriously delayed in developing, then the early introduction of FCT might successfully prevent the emergence of problem behavior.

There is some reason to be optimistic about the early introduction of FCT. Reeve and Carr (2000) demonstrated that an FCT intervention was effective in preventing minor problem behaviors (e.g., crying and whining) from escalating to more severe behavior problems in four (33- to 60-month-old) children with developmental delays. Results of an initial experimental-functional analysis suggested that the children's minor behavior problems were maintained by attention. FCT therefore involved teaching the children to request attention by tapping the adult on the arm and saying, "Look what I'm doing." The four children who were taught this replacement, attention-getting response showed less intense and less frequent problem behavior than a matched group of four children who were taught general expressive language responses (e.g., answering questions, labeling objects). Based on the superior outcomes for the FCT group, Reeve and Carr speculated that FCT might also be effective as an "inoculation against behavior problems" (p. 159).

Given these promising results, additional research would seem warranted. Future research could focus on larger samples to increase external validity and on teaching additional communication skills (e.g., teaching children to recruit

[1] Efficacy refers to how well an intervention works under controlled/research conditions, whereas effectiveness refers to how well an intervention works under real-world conditions (Singal, Higgins, & Waljee, 2014).

attention, request preferred objects/activities, and reject non-preferred objects and activities). It might also be useful to include procedures to teach appropriate communicative repair strategies. This may be indicated for many young children with ASD given their propensity to present with a relatively impoverished range of repair skills that are primarily prelinguistic in nature and often problematic in form (Gevarter, Mulloy, Ramdoss, O'Reilly, & Watkins, 2014). It should be noted that successful communication could occur via socially acceptable (non-problematic) forms of prelinguistic behavior. To this end, it may be effective to develop interventions aimed at strengthening appropriate prelinguistic forms, such as the intervention described by Tait, Sigafoos, Woodyatt, O'Reilly, and Lancioni (2004), as part of a preventative FCT program.

Second, a beneficial line of inquiry might focus on the "listener" or those who interact with the individual with ASD, rather than focusing exclusively on teaching new communicative forms to the individual. Remember that essential features of FCT require the social partner to execute prescribed procedures such as employing differential reinforcement of the new response by responding more quickly and more consistently to it and refraining from or delaying a response to problematic forms of behavior. Or partners might anticipate situations known to trigger problem behavior (e.g., a ringing phone signaling the upcoming loss of attention to the child with ASD) by teaching the child to request a preferred solitary activity at the precise time that the phone is ringing.

Third, given that FCT is a well-established, empirically-validated, and highly successful intervention for the treatment of problem behavior among individuals with ASD and other developmental disabilities, there would seem to be considerable value in future research aimed at enabling its uptake in ASD services. The settings for this research could include home-based, school-based, community-based, and clinic-based services. A potentially useful starting point might be research aimed at developing effective methods for training parents, teachers, speech-language pathologists, educational psychologists, and other professional to implement FCT with fidelity.

Again, there is some reason to be optimistic that FCT might be effective under real-world conditions, based on studies showing successful use of FCT by parents (e.g., Suess et al., 2014; Tait et al., 2004; Wacker et al., 2005, 2013). In addition, several studies have shown that non-research personnel (e.g., parents, teachers) can learn to conduct a functional analysis of problem behavior via training programs that employ modeling, video demonstrations, role playing, and/or feedback (Moore et al., 2002; Phillips & Mudford, 2008; Stokes & Luiselli, 2008; Wallace, Doney, Mintz-Resudek, & Tarbox, 2004). Given these promising results, future researchers could seek to determine whether non-research personnel can effectively link the results of a prior functional analysis to the design of a successful FCT program. Successful linking would seem to depend, in part, on not only competence with conducting an experimental-functional analysis, but also with correctly interpreting the resulting data. However, undertaking functional analyses and interpreting their results accurately are not without their challenges.

7.5 Challenges

Before implementing experimental-functional analyses, it is important to highlight a few controversial features. Schlichenmeyer, Roscoe, Rooker, Wheeler, and Dube (2013) conducted a 10-year review of research involving functional analyses that yielded *undifferentiated outcomes*. They hypothesized that these outcomes may have been due to test conditions (e.g., attention, task demand) that failed to identify, and then include, relevant antecedent and consequent events. Relevant here means those events in everyday settings that either trigger or reinforce problem behavior. The resulting outcomes from structured experimental-functional analyses may vary depending on the adult who interacts with the individual with ASD, the preferred items chosen for the tangible condition, the task selected for the demand condition, the type of attention provided for the attention condition, and the setting in which the assessment occurs.

Different teams of investigators (e.g., Vollmer & Iwata, 1991; O'Reilly et al., 2009; Worsdell, Iwata, Conners, Kahng, & Thompson, 2000) have generated a line of research examining the impact of environmental and social variables occurring immediately prior (pre-session) to conducting structured functional analyses and have found that manipulating these variables may produce differing outcomes. Thus, generalizing the results from a structured experimental-functional analysis to the variables operating in the everyday settings in which the individual lives, works, and recreates may be a tenuous process. Often very specific and idiosyncratic variables are precursors, triggers, or consequences for problem behavior and these often are overlooked or imprecisely identified in functional analyses that uncover only more general explanations such as attention, tangibles, or demands.

A number of additional challenges can arise in attempts to employ experimental-functional analyses to identify whether problematic forms of behavior are communicative and, if they are, the function they serve for the individual. Some of these challenges relate to practical and logistical issues. Others are conceptual challenges that impact the interpretation of results from experimental-functional analyses.

One set of practical challenges revolves around ensuring personnel have the competence, time, and resources to complete an experimental-functional analysis. With respect to competence, Rispoli, Ninci, Neely, and Zaini (2014) noted that there is debate as to whether parents and practitioners should be undertaking these types of assessments. The debate has centered, in part, on whether parents and practitioners can be expected to have sufficient skills to execute this sophisticated analysis (cf. Iwata & Dozier, 2008 vs Matson & Minshawi, 2006; see also O'Neill et al., 1997). The issue of time might not necessarily be a major stumbling block. Bloom, Iwata, Fritz, Roscoe, and Carreau (2011) estimated that a standard experimental-functional analysis can typically be completed in 3–4 h. A challenge might arise, however, in attempting to complete 7–10 individual (10-min) sessions across five different conditions (e.g., attention, tangible, demand, alone, free play) within a reasonable span of time (e.g., within 3–4 days). In response to this

logistical challenge, variations on the gold standard experimental-functional analysis protocol have been developed.

Variations have included (a) indirect assessments, (b) brief assessments, and (c) trial-based functional analysis (Matson, 2012). Indirect methods include interviews with caregivers who know the person well and/or the use of standardized questionnaires and rating scales (Crone & Horner, 2003; Durand & Crimmins, 1992; Kozlowski & Matson, 2012). Brief functional analysis involves running one or two sessions under each condition within single 90-min out-patient, clinical appointments (Northup et al., 1991). In the trial-based variation (Schmidt et al., 2014; Sigafoos & Saggers, 1995), the aim is to complete approximately 20 assessment trials under each of the standard conditions (i.e., attention, demand, tangible, alone), but with each trial lasting only about 1–2 min and embedding these trials in typical, everyday routines. While the trial-based approach does not present a time saving overall (Bloom et al., 2011), each trial is relatively brief. This brevity might make it possible to integrate assessment trials into ongoing routines whenever the assessor and assessee have a spare moment. This flexibility could be an advantage in applied settings. While each of these variations can be helpful in identifying the variables that control problem behavior, none offers the same high level of predictive validity as the gold standard experimental-functional analysis methodology developed by Iwata et al. (1982, 1994).

With respect to resources, a well-controlled experimental-functional analysis typically requires highly trained personnel and specialized clinical settings to ensure fidelity of protocol implementation, control over potential confounding variables, and prevention of interruptions (Bloom et al., 2011). Such resources are generally not available in applied settings and, therefore, might not be feasible. In such settings, practitioners might have to rely on assessment approaches with less predictive validity (e.g., interviews, questionnaires). This in turn could lead to an incorrect hypothesis about the function of the problem behavior (e.g., interpreting the child's self-injury as attention motivated vs escape motivated), which could in turn lead to selecting an ineffective, contraindicated prelinguistic replacement.

A major conceptual challenge relates to whether the conditions included within an experimental-functional analysis (e.g., attention, tangible, demand, alone, free play) identify functions that exist in people's everyday routines of life. In examining escape-maintained problem behavior, Carr (1994) argued there could be at least two types of escape behavior. For example, problem behavior might occur to escape from a task (i.e., task avoidance) or to escape from a person (e.g., social avoidance). This latter type of escape might occur because the social partner is non-preferred or perhaps has been associated with non-preferred tasks in the past (e.g., the teacher who presents only difficult math lessons). Knowing about such possible differences in types of escape has important implications for intervention. A common intervention strategy for task avoidance, such as teaching an individual to request a break from work, might not be effective if the true function of the behavior is a type of social avoidance. Furthermore, it could be the case that when a person requests a break, she is not so much escaping a non-preferred task, but rather is accessing a more preferred situation during the break time. It could also be the case that two

motivational states are operating: pushing and pulling the person simultaneously. Golonka et al. (2000), for example, found that escape behavior was maintained by both (a) wanting a break from an activity, and (b) the subsequent access to preferred activities that were available in the break setting. This finding informed the intervention so that when given an opportunity to work for an enriched break (i.e., a break during which the person had access to preferred activities vs a break alone), the authors observed a decrease in escape-maintained problem behavior.

There is also the possibility that certain consequences unrelated to the assessed function of the problem behavior might, nonetheless, be important. For example, Gardner, Wacker, and Boelter (2009) looked at problem behavior maintained by escape under high- versus low-quality attention conditions. Although neither participant had shown sensitivity to the attention condition prior to intervention, when given high-quality attention during the task-demand condition, their seemingly escape-maintained problem behavior decreased. This suggested that high-quality attention might have reduced aversive stimulation related to engaging in the task, thus reducing the motivation to escape.

Similarly, attention-maintained behavior may be impacted by idiosyncratic variables (Carr, Yarbrough, & Langdon, 1997), such as a specific type of attention (e.g., Kodak, Northup, & Kelley, 2007) or attention from a specific person (e.g., Skinner, Veerkamp, Kamps, & Andra, 2009; Tiger, Fisher, Toussaint, & Kodak, 2009). This can complicate the determination of function for attention-motivated, tangibly-motivated, or demand-motivated problem behavior when conducting experimental-functional analyses. For example, if the form of attention provided in the functional analysis is not the same as the type the student is seeking, then the assessment will fail to identify attention as a potential function for the problem behavior.

The challenges described above and many others can be captured by a set of questions. When higher rates of problem behavior occur in the attention condition (the point applies to any of the four conditions), relative to the other conditions, does this mean that the function or purpose of the problem behavior is to gain attention? If so, does that mean that the problem behavior is a form of intentional (prelinguistic) communication that is directed at the goal of obtaining the attention of a listener? If this is true, then a range of additional questions could be asked. For example: Why is the person seeking attention? Are they recruiting attention so that the listener will then mediate some other important outcome for the person? Or is it because other people in the environment too often ignore the person, thus enhancing a state of deprivation and empowering behavior that produces attention? One could also ask whose attention and/or what kind of attention the person is seeking? That is, does the person want a smile, a touch, a jingle sung to them, and/or eye contact? There are a plethora of ways people provide attention, some of which may reinforce the problem behavior, others that might discourage it, and still others that have no effect. Furthermore, are there some social partners whose attention functions as a reinforcer and others whose attention is neutral or aversive? Answers to these questions could have considerable implications for practice in terms of what

would be the best (most functional) communicative replacement to teach the person and who might teach it.

There is evidence to suggest that the types of questions raised above are not purely speculative. Kodak et al. (2007), for example, assessed the influence of different types of attention as consequences for problem behavior. They tested verbal reprimands (e.g., *I don't like what you're doing*.), unrelated comments (e.g., *Today is Wednesday*.), physical attention (holding hands down without verbal interaction), tickles (including *I'm tickling you*.), eye contact (no verbal interaction), and praise (e.g., *I love it when you play with your toys*.). Results indicated that some of these consequences reinforced problem behavior, whereas others did not. This suggests that different forms of attention can have differing effects on attention-maintained problem behavior. In another study that involved analyzing variables related to the attention function, Skinner et al. (2009) found that problem behavior was maintained by both attention from peers and attention from the teacher. This finding suggests that some participants might be seen as generalists in terms of their attention seeking.

In other cases, specific features of the context might come to control problematic forms of prelinguistic behavior. For example, problem behavior might only occur in the presence of a specific person (e.g., McAdam, DiCesare, Murphy, & Marshall, 2004), in a specific setting (e.g., Lang et al., 2009), and/or in the presence of specific environmental variables, such as a noisy background (e.g., McCord, Iwata, Galensky, Ellingson, & Thompson, 2001). Thus, prior to conducting an experimental-functional analysis of problem behavior, it is important to consider the unique circumstances and environmental arrangements that might impact assessment outcomes and adjust assessment conditions accordingly to ensure that the assessment results have ecological validity. Although we believe that identifying the unique circumstances and then embedding them in the functional analysis are essential practices, we have no current means of determining, in advance, what these unique circumstances are for any individual. The more familiar we are with the individual, the more likely we might guess accurately about these unique circumstances or idiosyncratic variables.

There is also the issue of how to interpret the experimental-functional analysis data when they are undifferentiated or ambiguous, as was the case for 8 of the 10 children in the O'Reilly et al. (2010) study. One approach to this predicament is to modify the conditions examined in the functional analysis. This is done in an attempt to isolate variables unique to that person that might be controlling his or her problem behavior. Researchers have shown that an initially ambiguous or undifferentiated result from a functional analysis could be made more definitive by modifying the conditions to assess the effects of hypothesized or potential idiosyncratic variables. Tiger et al. (2009), for example, demonstrated that the variables controlling problem behavior became clear only when conditions were modified to assess idiosyncratic variables that were suspected of being important for the individual. For one participant, conditions were modified to assess whether a specific type of prompt would evoke problem behavior during the demand condition. More than 30 idiosyncratic variables have been identified as influencing the results of experimental-functional analyses (Schlichenmeyer et al., 2013). Given

that problem behavior is likely to be influenced by a range of contextual and idiosyncratic variables, the communicative function, if any, of problem behavior might also become context specific and highly idiosyncratic.

7.6 Conclusion

Results from numerous experimental-functional analysis studies suggest that problem behavior of individuals with ASD often serves a communicative function or purpose. Specifically, the results of these studies suggest that problem behavior often functions as a means of (a) recruiting attention, (b) requesting access to preferred objects/activities, and/or (c) rejecting non-preferred objects/activities. In such cases, the problem behavior might be usefully interpreted as a form of prelingusitic communication, differentiated from other prelinguistic acts only by virtue of its problematic form or topography. There are, however, a number of challenges related to this conceptualization of problem behavior: Is the problem behavior communicative? If so, what function or purpose does it serve? If the problem behavior is attention-, tangible-, or escape-motivated, what are the precise stimuli that reinforce the behavior? Despite these challenges, a conceptualization of problem behavior in terms of (communicative) function has implications for intervention. One primary implication is that intervention should aim at teaching the person socially acceptable forms of prelinguistic communication that produce the same outcome (are functionally equivalent), rather than merely trying to suppress problem behavior. This FCT approach has been evaluated in numerous studies and shown to be highly successful as a treatment for problem behavior among individuals with ASD. FCT introduces its own set of challenges, such as how best to scale-up its associated conceptual framework and procedures to ensure that multitudes of parents and teachers are implementing with fidelity. Investigators continue to push the boundaries of FCT research by exploring the maintenance and generality of its effect and to reduce the likelihood of resurgence of problem behavior. Future research should try to determine if early introduction of FCT might effectively prevent the development of severe behavior problems in persons with ASD by giving them other, socially-appropriate prelinguistic options that serve meaningful, communicative functions.

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Part III
Interventions for Prelinguistic and Minimally Verbal Communicators

Chapter 8
Social Communication Interventions

Stephanie Shire, Connie Kasari, Ann P. Kaiser, and Elizabeth Fuller

Abstract Initiations of social communication skills, including prelinguistic and spoken behavior to share and to request, are a core challenge for children with autism spectrum disorder (ASD). Prelinguistic behaviors including eye contact and gestures to request and to share (joint attention) are strongly associated with later language growth and, therefore, are a critical focus for children who are pre- or minimally verbal. Forty-one studies including randomized controlled trials (RCTs) and single-case designs (SCDs) examining social communication skills are reviewed in this chapter. On average, both RCTs and SCDs were of "moderate" methodological quality using published metrics for rating internal validity. Additional criteria to examine the external validity of the studies were also applied. Advances in external validity included specific recruitment of populations less frequently examined in research, delivery of intervention in community settings, and emergence of long-term follow-up studies. The studies were limited by assessment and reporting of composite social communication outcomes. Collapsing outcomes across behavioral form and function occludes understanding of which specific behaviors are changing over time. In studies in which outcomes are collapsed, lower level or simpler skills (e.g., responding to joint attention, eye contact to request) may drive change in overall outcome scores. Detailed examination of changes in specific social communication behaviors will promote better understanding of the influence of different interventions on child outcomes.

The purpose of this chapter is to present a review of published intervention studies aimed at improving social communication for children with autism with a particular focus towards preverbal and minimally verbal children with autism spectrum disorder (ASD). For our purpose, social communication is defined as a set of nonverbal and verbal skills used to socially initiate and respond to others. Many

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of these skills are prelinguistic in that they emerge in development prior to children's ability to use spoken language, and include gestures used to share attention with others (pointing, showing, giving, and coordinated joint looks) and to request others to do something (pointing to request, reaching, giving). These prelinguistic skills are used to respond to others' bids for attention, or to initiate interactions with others. In general, children who are toddlers and preschoolers, and just learning to acquire language, are considered preverbal. However, children who have reached school age, and are still unable to use very much spoken language, are considered minimally verbal. The review is aimed at summarizing the efficacy of current interventions aimed at prelinguisitic skills that are the focus of communication programming for preverbal and minimally verbal children with ASD and evaluating the quality of studies according to established evaluative criteria. Several possible directions for improving the state of the science and moving forward with research and clinical practice are addressed.

8.1 Current Research on the Topic

It is common that children with ASD demonstrate delays in their spoken language development. In the current 5th edition of Diagnostic and Statistical Manual of the APA (DSM-V) it is recognized that the majority of children develop language by school age. Only 25–30 % of children with ASD show very slow development in spoken language, such that they remain minimally verbal by the time they enter school at ages 5–6 years (Tager-Flusberg & Kasari, 2013). The publication of the latest DSM-V highlights the importance of the pragmatic functions of spoken and prelinguistic behavior by the inclusion of social communication as one of two core impairments required in the diagnosis of ASD. To meet the social communication criterion, a child must demonstrate challenges in using spoken and prelinguistic behavior for social purposes (American Psychiatric Association [APA], 2013). Social communication skills serve three functions: (a) to demonstrate affiliation or manage a social interaction; (b) to coordinate attention between oneself, another person and an object/activity (joint attention); and (c) to regulate the behavior of another by requesting for objects/activities (Mundy, Sigman, Ungerer, & Sherman, 1987). Because the preverbal phase of development is marked by rapid social communication growth, interventions for children with ASD are increasingly focused on improving their prelinguistic abilities as a means to support the development of social communication and later spoken language.

Prelinguistic skills including joint attention and requesting gestures appear early in development, beginning with coordination of gaze between a person and an object as early as 6 months of age (Mundy & Crowson, 1997). This is followed by gestures such as showing objects to share at around 10 months of age until the full array of gestures across sharing and requesting functions have emerged by about 18 months of age (Bruner, 1995; Mundy & Gomes, 1998; Paparella, Goods, Freeman, & Kasari, 2011). Indeed, it is the absence of these behaviors in early

development that can indicate concern for an ASD diagnosis (Robins, Fein, Barton, & Green, 2001). Children with ASD show specific and pervasive impairment in the development of gestures used for sharing attention with others, particularly proto-declarative, joint attention gestures (Mundy et al., 1987), with individual gestures appearing in a slightly different and delayed order from typical development (Paparella et al., 2011). In particular, shifting gaze to follow the gaze of another person emerges as one of the first responsive joint attention behaviors in typical development well before 20 months of age. On average this skill has been observed at about age 4 in children with ASD (Paparella et al., 2011).

In the past decade, there have been several studies aimed at improving the core social communication impairment in spontaneous communication for children with ASD (e.g., Kasari et al., 2006, 2008, 2014). These studies follow on the experimental work of the 1980s in which researchers were able to pinpoint specific differences in the profiles of children with ASD compared to matched groups of other children, for example, typical, language impaired, developmentally delayed and Down syndrome (Loveland & Landry, 1986; Mundy, Sigman, Ungerer, & Sherman, 1986; Sigman & Ruskin, 1999). Children with ASD are less likely to coordinate their attention between people and events/objects, point to share attention, or show objects to others. As noted in previous reviews, it is the spontaneous initiations of gestures and verbal behavior for the purpose of joint attention (socially sharing something with another person) that distinguishes children with ASD from children with other developmental disorders (Mundy & Gomes, 1998). In contrast, requesting behavior is often less impaired for children with ASD when compared to children matched for mental age and language level (Mundy, Sigman, & Kasari, 1990).

The importance of prelinguistic gesture use to later spoken language has been studied in multiple samples of children with ASD. For example, initiations of joint attention gestures have consistently predicted later language use (e.g., Mundy et al., 1990). Responding to joint attention (the child's ability to follow another person's line of vision) has also been noted to predict later language (e.g., Mundy et al., 2007; Sigman & Ruskin, 1999). Other prelinguistic skills, including requesting and social turn-taking, have inconsistently related to later spoken language (e.g., Mundy et al., 1987). In all, prelinguistic skills have strong associations with later language development.

Since the late 1990s, researchers have increased their focus on interventions aimed at improving joint attention skills in children with ASD. These efforts began to appear in the literature in the early 2000s, with case studies of intervention on joint attention appearing in 2001 (Kasari, Freeman, & Paparella, 2000), followed by a single-case design ($n = 5$ children; Whalen & Schreibman, 2003), and a relatively small randomized trial ($n = 58$ children; Kasari, Freeman, & Paparella) appearing in 2006. Since this time, significant advances have been made with larger randomized trials appearing in the literature, including tests of comparator interventions, movement from efficacy studies in the laboratory to effectiveness trials in the community, and the uptake of interventions by community non-specialists (see review: Shire & Kasari, 2014). Given the current state of the science, we can now

take a close look at the challenge of maintaining both high internal and external validity for studies investigating joint attention interventions. Researchers must balance the methodological rigor and controls necessary to ensure that the study measures what it intends to (internal validity) with the need for the findings to extend or generalize (external validity) beyond the immediate constraints of the study (Grimes & Schulz, 2002). External validity can include examination of the feasibility (acceptability, adherence, ability to disseminate the protocol), generalizability (participant characteristics, interventionist characteristics, contextual factors), as well as the costs and benefits of the intervention to both the individual and the community (APA Task Force, 1995). In this chapter we examine both internal and external validity. Thus, we find that some studies have high internal and external validity, and some have moved from efficacy trials to effectiveness trials. All of this work bodes well for the next generation of studies that need to address issues of specificity in intervention approach, for which children, and in what contexts.

8.2 Methods

8.2.1 Search Process

A literature search including five electronic databases (ERIC, PsycINFO, PsychArticles, Linguistics and Language Behavior Abstracts, Web of Science) was conducted in October 2014. The database search was limited to "full text only" and "peer reviewed only" for articles published from January 2005 to October 2014. Search terms targeting autism (e.g., autis*, pervasive develop*), social communication (e.g., joint attention, response to joint attention, requesting), and intervention (e.g., treatment, intervention, parent-mediated) were included. In addition, Online First publications were searched from relevant journals including, but not limited to, *Journal of Autism and Developmental Disorders, Autism, Journal of Speech, Language, and Hearing Research, Pediatrics, Journal of Applied Behavior Analysis*, and *Teaching Exceptional Children*.

To be included in the review, studies met the following criteria:

1. Study utilizes an experimental single-case design (SCD) or a randomized controlled trial design (RCT). Pre-experimental designs (e.g., case studies, AB studies) and quasi-experimental group designs (two group pre/post) were not included.
2. Study includes participants with a diagnosis of autism, autism spectrum disorder, or pervasive developmental disorder. Studies including samples with only a portion of children with an autism diagnosis were not included.
3. Study includes participants age 8 years of age and younger. Studies including any participants above age 8 were excluded.

4. Study includes a social communication behavior as the primary dependent variable. Social communication (Mundy et al., 1987) includes both prelinguistic behavior (e.g., gaze and gestures for the purpose of joint attention or requesting) and spoken language (e.g., spoken or augmented words for the purpose of joint attention or requesting). Target outcomes may include both spontaneous initiations and prompted responses. No inclusion criteria were placed on the method of assessment.
5. For studies using SCDs, graphical data must allow for visual inspection (level, trend, and variability) of the social communication outcome.
6. Study includes a psychosocial/behavioral intervention targeting a social communication outcome (see criterion 4 above).

The electronic search led to 2718 results. After review of titles and abstracts, 185 unique studies were retrieved for full text examination. Of these studies, 41 met the inclusion criteria.

8.2.2 Evaluation of Internal Validity: RCTs

An evaluation of internal validity was conducted to examine the degree to which systematic bias and error may influence the study results and the inferences that can be made based on those findings (Higgins, 2008). In order to examine the internal validity of the RCTs, a rating scale developed by the American Academy of Cerebral Palsy and Developmental Medicine (AACPDM, 2008) was applied. The scale includes seven items that are rated as present (value of 1) or absent (value of 0) for a total score out of seven. This score is translated to an overall quality rating including "weak" (0–3 points), "moderate" (4–5 points) and "strong" (6–7 points). This score represents the following core components of internal validity: (a) participant inclusion/exclusion, (b) description of intervention and control conditions and adherence to condition (lack of contamination of participants between conditions) is reported, (c) clear description of valid and reliable measures, (d) outcome assessors blinded to participant status, (e) report appropriate statistical analysis including power calculations, (f) report attrition of less than 20 % through follow up, and (g) use appropriate methods to control for confounds and bias. Item (e) was adapted: A study received a score of 1 for this item if appropriate statistical analyses are conducted and significant effects are documented; however, studies that did not report a significant effect for the primary outcome were required to provide a power analysis to demonstrate that a sufficient number of participants were included to conduct the chosen analyses and detect moderate size effects for the primary outcome.

8.2.3 Evaluation of Internal Validity: SCDs

The included studies were reviewed for methodological quality using indicators published by Logan, Hickman, Harris, and Heriza (2008), supplemented by a second scale from Smith et al. (2007) that includes additional items focusing on generalization and treatment fidelity. Altogether, the scales address reporting of participant characteristics, independent and dependent variables (operationalized definitions, reliable measurement), graphical data (baseline stability, visual analysis, replication of treatment effects), and data analyses (visual and statistical)—see Table 8.1 for internal validity scores for all studies. Independent reliable raters scored the data; 20 % of the studies were rated for reliability. Inter-rater agreement was calculated for each scale by dividing agreements by disagreements (percent agreement for the AACPDM scale: 86 %).

8.2.4 Examination of External Validity: RCTs and SCDs

A set of criteria published by Rothwell (2005) for application with RCTs was used to examine external validity. The criteria address the following domains of external validity: (a) setting of the trial (e.g., country, center and clinician selection), (b) selection of participants (e.g., eligibility, exclusion, randomization), (c) characteristics of randomized participants (e.g., clinical characteristics, comorbidity, diagnosis, ethnicity), (d) differences between the trial protocol and routine practice (e.g., intervention adequacy to non-trial treatment, representative of current state of science, appropriateness of control), (e) outcome measures and follow up (e.g., clinical relevance of outcomes and measures), and (f) adverse effects of treatment (e.g., trial safety, attrition). We extended these criteria to studies utilizing SCDs. The same critical issues addressed in the Rothwell criteria are applicable to SCDs—participant selection and characteristics, trial setting and protocol, outcome and follow-up measures, as well as adverse effects of treatment. Independent reliable raters scored the data; 20 % of the studies were rated for reliability. Inter-rater agreement was calculated for each scale by dividing agreements by disagreements (percent agreement by scale: Logan et al., 2008, scale: 87.5 %; Smith et al., 2007, scale: 89.3 %

8.3 Summary of Current Literature

8.3.1 RCTs

Twenty-one RCTs met the inclusion criteria for this review (see Table 8.1 for information by study). Overall, the studies were of "moderate" ($n = 8$) to "strong"

Table 8.1 Communication interventions and outcomes

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Randomized controlled trials									
Carter et al. (2011)	N = 62 ASD or Risk for ASD	Moderate = 5	3.5 months Hanen More Than Words (MTW) vs. community control	Parent Training; No main effects of MTW on IJA, IBR, parent-reported communication or parental responsivity			NS	NS	
RCT	Toddlers						ESCS	ESCS	
	MSEL EL AE (8.22 Tx; 8.17 control)								
Casenhiser et al. (2013)	N = 51	Weak = 0	MEHRI (2 h per week) vs. community control (avg. 3.9 h per week)	Parent Training; Main effect of treatment (Tx) on global social skills (mCBRS) with moderate to large effects (d = 0.51–1.02) and parents' behavior; No main effect on standardized language outcomes					NS
	N = 25 Tx;								PLS-IV
	N = 26 control								CASL
Partial sample of ongoing RCT	Autism								
	Toddlers & preschoolers								
	No cognitive scores provided								
Goods et al. (2013)	N = 7 Tx;	Moderate = 5	30 h a week of ABA plus JASPER vs. 30 h of ABA per week alone	Main effect JASPER on IBR, play types, and decreases in time unengaged in classroom. No change on IBR or IJA on ESCS	Yes*		Yes*	NS	
	N = 8 control				Decrease in time unengaged		Obs	Obs	
RCT	Autism						NS	NS	
	Preschoolers								
	MSEL DQ 26.67 (Tx), 37.7 (control)						ESCS	ESCS	
Ingersoll (2012)	N = 29	Moderate = 5	Reciprocal Imitation Training (RIT) for 3 h per week × 10 weeks vs. community control	Main effect of RIT on IJA. Imitation not a significant mediator of outcomes				Yes*	
	Autism							ESCS	
RCT	Toddlers & preschoolers								
	NVMA 20.8 m (tx) 17.9 m (control)								

(continued)

Table 8.1 (continued)

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Kaale et al. (2012)	N = 61 ASD	Strong = 7	Preschool plus JASPER vs. preschool only	Teacher training; Significant increase JA skills in teacher-child interaction (d = .44), significant increase in joint engagement during parent–child interaction only (d = .67). No significant increases in IJA on ESCS	Y*			Y*	
	N = 34 Tx;				Joint engagement			Obs	
RCT	N = 27 control				Obs with parent			NS	
	Preschoolers				NS			ESCS	
	MSEL DQ 53.3 (Tx), 59.9 (control)				Obs with teacher				
Kaale et al. (2014)	N = 61 ASD	Strong = 6	1 year follow up of above Kaale et al. (2012)—Preschool plus JASPER vs. preschool only	Teacher training; significant findings one year post JASPER for joint engagement with parent and IJA in class; no significant effect of group on language	Y*			Y*	NS: between groups
	N = 34 Tx;				Obs with parent			Obs in class	
RCT follow up	N = 27 control				Joint engagement			NS	Reynell Receptive and Expressive
	Preschoolers				NS			ESCS	
	MSEL DQ 53.3 (Tx), 59.9 (control)				Obs with teacher				
Kasari et al. (2006)	N = 58	Strong = 6	30 h a week of early intervention plus JA or SP at 30 min 5 × a week for 6 weeks vs. 30 h early intervention only	Gains in play level on SPA as well as play types and level in parent–child interaction for SP group; Gains in IJA shows, and RJA on ESCS and IJA in parent–child interactions for JA group		Y*		Y*	
	Autism					ESCS		ESCS	
RCT	Preschoolers							Y*	
	MSEL MA 26.29 (JA), 24.55 (SP), 21.86 (control)							Obs with parent	

Kasari et al. (2008)	N = 58	Strong = 6	Language outcome follow up of above Kasari et al. (2006)—JA or SP vs. control	Expressive language gains for both tx groups over control 6 and 12 months post intervention; greatest gains for children with lowest language skills in JA intervention; JA and SP greater rate of change in IJA & time in JE than control; no significant difference between group difference in RJA	Y*	NS		Y* Rate of change IJA	Y*
	Autism				Joint Engagement with parent	Group diff			Reynell
RCT follow up	Preschoolers							ESCS	Expressive
	MSEL MA 26.29 (JA), 24.55 (SP), 21.86 (control)					ESCS			NS
									Reynell
									Receptive
Kasari et al. (2010)	N = 38	Strong = 6	JASPER (24 × 30-min sessions) vs. Waitlist control (WL)	Parent training; Main effect of JASPER-increase time jointly engaged ($d = .97$), decreases in object engagement ($d = 1.09$), RJA ($d = .74$), types of functional play ($d = .88$) compared to waitlist. No significant effect on IJA or diversity of symbolic play	Y*	Y* Obs with parent		NS	
	Autism				Joint Engagement with parent			Obs with parent	
RCT	Toddlers								
	MSEL MA 19.83 (Tx), 18.57 (WL)								
Kasari et al. (2012)	N = 40 of original 58 now school age	Strong = 6	Language outcome follow up of above Kasari et al. (2006)—JA or SP vs. control	5 years after intervention 80 % of children used functional language; language gains predicted by assignment to treatment over control, age, IJA, and play level					Y*
RCT follow up									Expressive Vocabulary Test
	Non-spectrum (8), Autism (27), ASD (5)								

(continued)

Table 8.1 (continued)

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Kasari, Lawton, et al. (2014)	N = 112 Autism Preschoolers RCT MSEL MA 23.6 (Tx), 26.3 (group tx)	Strong = 6	3 months of Caregiver-mediated JASPER vs. group caregiver lecture sessions	Parent training; Main effect of JASPER on joint engagement, IJA, and symbolic play types. Engagement and IJA gains maintained at 3 month follow up	Y* Joint Engagement with parent			Y* ESCS	
Kasari, Kaiser, et al. (2014)	N = 61 Autism School age Leiter brief IQ 68.7 (JASP + EMT), 67.7 (plus SGD) RCT	Strong = 6	SMART Design: JASP + EMT spoken vs. JASP + EMT spoken plus inclusion of speech generating device (SGD)	Includes parent training; JASP + EMT + SGD group showed greater rapid growth in spontaneous communicative utterances, novel words, and comments over JASP + EMT					Y* Natural language sample –Spontaneous communicative utterances –Novel words –Comments
Kasari, Siller, et al. (2014)	N = 66 At risk ASD toddlers RCT MSEL DQ 65.78 (tx), 66.66 (control)	Strong = 6	12 sessions parent education intervention vs. control—4 sessions behavior support	Parent training; Significant gains in parental responsivity. No main effect on children's IJA or language (MSEL)				NS ESCS	NS between groups (all increase) MSEL language subscales
Landa et al. (2011)	N = 50 ASD Toddlers RCT MSEL EL 23.9 (Tx), 25.9 (control)	Moderate = 5	Interpersonal Synchrony vs. - Non-interpersonal Synchrony; both 10 h a week in classroom, plus 1.5 h a month parent coaching	Includes parent training; Treatment group significantly higher rate of change in socially engaged imitation to exit ($d = .48$) and follow up ($d = .86$). No effect on MSEL expressive language, IJA (CSBS) or shared positive affect				NS CSBS	NS between groups (all increase) MSEL language subscales

Lawton & Kasari (2012)	N = 16	Strong = 6	6 weeks of preschool plus JASPER vs. Delayed Intervention (preschool only)	Teacher training; main effect of JASPER on joint engagement ($d = 1.24$), total IJA ($d = 1.85$) as well as points ($d = 2.02$) and shows ($d = 1.85$) in classroom obs and shows in assessment ($d = 2.02$)	Y* Joint Engagement with parent			Y* Obs ESCS	
	Autism								
	Preschoolers								
RCT	MSEL MA in months 30.3 (tx)/ 33.8								
Rogers et al. (2012)	N = 98	Moderate = 5	12 weeks for 1 h per week—Early Start Denver Model vs. Community control	Parent training; No main effect of ESDM on parent–child interaction variables, MSEL language scales or parent-reported communication (VABS, MCDI)		NS Social orienting			NS MSEL language Parent report: MCDI & VABS communication
	At risk/autism								
RCT	Infants & toddlers								
	MSEL DQ 64.9 (tx), 69.8 (control)								
Schertz et al. (2013)	N = 23 ASD	Moderate = 4	Joint Attention Mediated Learning (JAML) for 15 weekly home visits vs. community control	Parent training; Main effect of JAML on focusing on faces and RJA; receptive language, VABS communication; no effect on IJA, turn taking or expressive language		Y* Obs		NS Obs Looks	NS between groups MSEL Expressive
	N = 11 Tx;								
RCT	N = 12 control								
	Toddlers							NS Obs Turn taking	Y* MSEL Receptive & VABS communication
	MSEL EL AE 24.6 (tx), 24.8 (control)								
Siller et al. (2013)	N = 70	Moderate = 4	12 sessions × 90 min each: Focused Playtime Intervention (FPI) vs. Control	Parent training; Significant main effect of FPI on maternal synchrony (ES = 0.08); no main effect on children's expressive language; no significant assoc between synchrony and children's later expressive language		NS RJA with clinician			NS Mullen Expressive Language
RCT	64 = Autism, 6 = ASD								
	Preschoolers & school age								
	MSEL Expressive Language 16.5 (tx), 15.1								

(continued)

Table 8.1 (continued)

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Wetherby et al. (2014)	N = 82	Moderate = 4	Individual Early Social Interaction (ESI) 2–3 × week for 9 months vs. Group ESI 1 × week for 9 months	Parent training; Significantly greater gains for children in individual tx on CSBS composite score, MSEL receptive language, and VABS composite score			Y*		Y* MSEL
	ASD						Composite social communication score		Receptive & VABS communication
	Toddlers								
RCT	MSEL composite 75.56 (individual tx), 74.05 (group)						CSBS		NS between group MSEL
									Expressive
Wong & Kwan (2010)	N = 17	Weak = 3	Autism 1-2-3 Project (10 × 30 sessions over 2 weeks) vs. no treatment control (cross-over trial—WL)	Parent training included; No main effect of tx on ADOS subscale scores, symbolic play, parent stress or parent observations of language or social behavior.					NS between group differences
	Autism								
	Toddlers								
RCT	MA in months 17.9 (tx)/ 17.9								All standard and obs measures
C. Wong (2013)	N = 33 ASD	Strong = 7	In preschools—Symbolic Play (SP) then Joint Attention (JA), JA then SP, vs. wait list	Teacher training; Treatment effect of JA and SP interventions on joint engagement, IJA, RJA, and symbolic play for preschoolers in classrooms; no significant change in play or IJA on assessments	Y*	Y*		Y*	
RCT	N-10 SP; N = 14 JA; N = 10 control				Joint Engagement with teacher	Obs with Teacher		Obs with Teacher	
	Preschoolers					Y*		NS	
	MSEL MA in months 36.3/ 27.4/ 30.4					ESCS		ESCS	
Single subject research designs									
Dykstra et al. (2012)	N = 3	Logan: 8 (Moderate)	Teacher delivered ASAP group (40–75 min/week) and 1-on-1 sessions (40 min/week) for 7.5–14 weeks	Stable baseline: No		N: Obs with teacher: composite social communication variable			
	Preschoolers			Three or more replications of treatment effect: No—unclear pattern due to unstable baselines					
	ASD	Smith: 4							
	MSEL MA $M = 28.75$ months (n = 2), Leiter-R Brief IQ 71 (n = 1)								

Ferraioli & Harris (2011)	N = 4 Preschoolers ASD MSEL MA $M = 40$ months	Logan: 3 (Low) Smith: 3	Sibling delivered joint attention tasks in 36 × 15-min sessions	Stable baseline: No Three or more replications of treatment effect: No—high variability		N: Obs with sibling	N: Obs with sibling	N: Obs with sibling	
Franco, Davis, & Davis (2013)	N = 6 Males = 5 School age with autism Mean REEL EL 7.1 months	Logan: 11 (Strong) Smith: 3	P-EMT prompts and imitation embedded in activities; 14 × 25–30 min sessions in the home	Stable baseline: Yes Three or more replications of treatment effect: Yes		Y: Obs composite variable: spontaneous eye contact, gesture or vocalization to sustain interaction			
Ingersoll & Wainer (2013)	N = 8 Preschoolers and school age ASD or PDD Mean Bayley MA 25.9 months	Logan: 8 (Moderate) Smith: 6	12 weeks of parent delivered ImPACT intervention in clinic either 1 (n = 3) or 2 (n = 5) times per week	Stable baseline: No Three or more replications of treatment effect: No Low rates and high variability of spontaneous language					N: No observed spontaneous language with parent. Variable data
Jones et al. (2006) Study 1	N = 5 Preschoolers ASD or PDD Mean MSEL/ Hawaii Early Learning Profile MA 12.6 months	Logan: 9 (Moderate) Smith: 5	Teacher delivered DTT for RJA and IJA; 19–78 sessions to reach mastery in RJA, range 26–157 for mastery in IJA	Stable baseline: Yes Three or more replications of treatment effect: Yes		Y: response to SD with teacher		Y: response to SD with teacher	
Jones et al. (2006) Study 2	N = 2 Preschoolers ASD or PDD-NOS Mean MSEL/ Hawaii Early Learning Profile Developmental checklist MA 11.5 months	Logan: 5 (Weak) Smith: 3	Extended previous study with parent-delivered DTT for RJA and IJA during play and daily activities; Range of 11–32 sessions to reach mastery in RJA, range 18–36 for mastery in IJA	Stable baseline: No Three or more replications of treatment effect: No Unclear change in level due to high baseline rates of behaviors		N: response to SD with parent		N: response to SD with parent	

(continued)

Table 8.1 (continued)

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Jones (2009)	N = 2	Logan: 5	Teacher-delivered PRT to teach gaze alternating, point, and verbalize in response to SD; About 10 trials per day for a range of 5–22 days	Stable baseline: No				Y: Obs IJA with teacher in response to SD	
Study 1	Preschoolers	(Weak)		Three or more replications of treatment effect: No—baseline trend in direction of intervention for one participant					
	ASD	Smith: 3							
	VABS (n = 1) standard score 68, Preschool Evaluation Scale below average (n = 1)								
Jones (2009))	N = 1	Logan: 6	Teacher-delivered PRT to teach gaze, point, and verbalize in school routines, generalized to peers; About 10 trials per day for 5–22 days	Stable baseline: Yes				Y: Obs IJA with teacher	
	Preschooler	(Weak)		Three or more replications of treatment effect: Yes (with adults), No (with peers)				N: Obs IJA with peer	
Study 2	ASD	Smith: 3							
	VABS standard score 68								
Koegel et al. (2009)	N = 3	Logan: 8	Clinician (n = 2) or parent (n = 1) PRT-embedded social interaction versus non-social; 1 × 2 h session/week for 7–12 weeks	Stable baseline: No	Y: Obs higher levels of social engagement				
	Preschoolers	(Moderate)		Three or more replications of treatment effect: Yes					
	ASD	Smith: 4							
	Mean VABS MA 16 months								
Koegel et al. (2014)	N = 3	Logan: 9	Targeted question-asking embedded in PRT; 10 h per week, 2 h of parent training for 10 months	Stable baseline: Yes					Y: Obs number of questions during probe session
	Preschoolers	(moderate)		Three or more replications of treatment effect: Yes					
	ASD	Smith: 6							
	Mean VABS standard score 77.6								
Krstovska-Guerrero & Jones (2013)	N = 3	Logan: 8	Discrete trial instruction (smile/gaze). Each session 10 trials, presented 1–3 × per day for 1–3 sessions a week	Stable baseline: Yes		Y: Obs RJA in response to SD			
	Preschoolers	(Moderate)		Three or more replications of treatment effect: Yes					
	PDD-NOS	Smith: 5							
	Mean MSEL standard score 81								

Loncola & Craig-Unkefer (2005)	N = 6 School-aged Autism Mean Leiter Brief IQ 79	Logan: 7 (Moderate) Smith: 4	Teacher-implemented play-based intervention in dyads; 3 × per week for 4 weeks	Stable baseline: Yes Three or more replications of treatment effect: No					No: Obs frequency of descriptive statements during play
Lorah et al. (2014)	N = 3 Preschool and school-aged ASD	Logan: 8 (Moderate) Smith: 3	Teaching request to a peer; secondary—peer appropriate responding (no baseline data provided)	Stable baseline: Yes Three or more replications of treatment effect: Yes					Y: Obs spoken or picture exchange to request to a peer
Martins & Harris (2006)	N = 3 Preschoolers Autism Mean Stanford Binet IV MA 43.6 months	Logan: 8 (Moderate) Smith: 5	Taught RJA with four levels of prompts; 10 trials per session, delivered by a clinician	Stable baseline: No Three or more replications of treatment effect: Yes		Y: Obs RJA in response to SD		N: Obs IJA	
Mason et al. (2014)	N = 3 School-aged ASD Mean VABS-2 standard score 91	Logan: 11 (Strong) Smith: 4	Peer network recess teacher-delivered intervention; 2–3 times per week	Stable baseline: Yes Three or more replications of treatment effect: Yes (but variable data)					Y: Obs communicative acts (word or vocalization) towards a peer
Olive et al. (2007)	N = 3 Preschoolers ASD or PDD-NOS Mean VABS standard score 63	Logan: 6 (Weak) Smith: 3	Teacher-implemented EMT with VOCA during play over 2–3 weeks	Stable baseline: Yes Three or more replications of treatment effect: Yes (but data variable)					Y: Increased VOCA activation with teacher
Ozdemir (2008)	N = 3 School-aged Autism Mean SSRS standard score 85	Logan: 3 (Weak) Smith: 4	Multi-media social stories; 3 × a week for 10 min	Stable baseline: Yes Three or more replications of treatment effect: Yes	Y: Obs intervals of appropriate social engagement				
Rocha et al. (2007)	N = 3 Preschoolers Autism Bayley Scales MA 14.6 months	Logan: 8 (Moderate) Smith: 5	Parent training in discrete trial and PRT to target of RJA and IJA skills for 17 × 20-min sessions	Stable baseline: Yes Three or more replications of treatment effect: Yes—increase in level of RJA		Y: Obs RJA with parent			

(continued)

Table 8.1 (continued)

Study	Population	Internal validity rating	Intervention	Outcomes & findings	Engagement	RJA	IBR	IJA	Language
Vernon et al. (2012)	N = 3 Preschoolers Autism Mean VABS MA 17.9 months	Logan: 5 (Weak) Smith: 4	PRT parent training with the addition of embedding social interaction in preferred activity; 3–5 × a week for 1 h	Stable baseline: Yes (verbal initiations), No (eye contact) Three or more replications of treatment effect: Yes (verbal initiations), no (eye contact)					Y: Obs child verbal initiations to parent
Wilson (2013)	N = 4 Preschoolers ASD MSEL MA subscale range 8–27 months	Logan: 9 (Moderate) Smith: 5	Compared video to in vivo modeling of a discrete social communication skill (individual requesting or sharing targets)	Stable baseline: No Three or more replications of treatment effect: No No pattern of effects observed across participants			N: gestures (n = 2)	N: Point and vocalize (n = 1)	

Abbreviations for RCTs: *NS* not significant, *Y** statistically significant effect of treatment
Abbreviations for SSRDs: *N* less than three replications of the treatment effect, *Y* three or more replications of the treatment effect
RJA responding to joint attention
IBR initiating behaviour regulation
IJA initiating joint attention

($n = 11$) methodological quality. Only two studies received "weak" quality scores. A total of 1169 participants were randomized across the studies with 1074 retained for analyses. Across the 15 studies reporting participant gender, a total of 631 boys and 159 girls were included. The participants were primarily toddlers and preschoolers, with only three studies including school-aged children (see Table 8.1). In most cases, studies did not specifically highlight participants who were preverbal or minimally verbal. However, we included studies in this review of toddlers and preschoolers we considered to be preverbal, and school-aged children identified as minimally verbal. Thus, interventions focusing on prelinguistic skills and beginning spoken language goals were relevant. A total of nine interventions were implemented across the studies. While one intervention was examined in multiple studies (Joint Attention, Symbolic Play, Engagement, and Regulation: JASPER), eight different interventions were examined by one RCT each, including Autism 1-2-3 Project, Focused Playtime Intervention, Hanen More than Words, Individual Early Social Interaction intervention, Interpersonal Synchrony, Joint Attention Mediated Learning, Reciprocal Imitation Training, and an unnamed social communication intervention (see Table 8.1). Notably, all of these interventions included some parent training with the exception of Ingersoll (2012). The greatest number of RCTs ($n = 11$) examined the JASPER intervention. JASPER was examined in highly controlled clinic settings (e.g., Kasari et al., 2006), mediated by parents (e.g., Kasari, Gulsrud, Freeman, Paparella, & Helleman, 2010), mediated by preschool teachers (e.g., Kaale, Smith, & Sponheim, 2012) and in combination with Enhanced Milieu Teaching (Kasari, Kaiser, et al., 2014). Across the JASPER studies, consistent increases in time spent jointly engaged and increases in initiations of joint attention (IJA) in interactions with caregivers or teachers were observed. There were mixed findings regarding increases in IJA measured in a semi-structured assessment protocol (Early Social Communication Scales [ESCS], Mundy et al., 2003).

Nineteen studies included a combination of prelinguistic and linguistic social communication outcomes while two studies (Kasari et al., 2012 Kasari, Kaiser, et al., 2014) focused only on spoken language outcomes. Prelinguistic outcomes were frequently combined with language and reported as composite scores observed using semi-structured measures, including the ESCS and Communication and Symbolic Behavior Scales—Developmental Profile (CSBS-DP) (Wetherby & Prizant, 1993). In addition, 10 studies targeted spoken or augmented language measured using naturalistic language samples (e.g., Kasari, Kaiser, et al., 2014), standardized measures of language (e.g., Reynell Developmental Language Scales, in Kasari, Paparella, Freeman, & Jahromi, 2008), or parent-reported vocabulary or communication (e.g., Vineland Adaptive Behavior Scales in Wetherby et al., 2014). All studies assessed children's social communication in highly controlled clinic contexts with university-level assessors. Social communication was also examined during classroom observations (five studies), and caregiver play observations (eight studies). In addition, two studies systematically examined generalization of child-initiated joint engagement to caregivers who had not received training from

teacher-mediated (Kaale et al., 2012) or therapist-mediated interventions (Kasari et al., 2006).

Three studies explicitly focused on follow-up data from previously published trials. Kaale, Fagerland, Martinsen, and Smith (2014) examined 1-year follow-up data of their 2012 JASPER evaluation in preschools while Kasari and colleagues provided 1-year (Kasari et al., 2008) and 5-year follow-up data (Kasari, Gulsrud, Freeman, Paparella, & Hellemann, 2012) from the trial in 2006. Data from these follow-up studies provided mixed findings for long-term language outcomes. Kasari and colleagues documented gains in expressive language, joint engagement, and rate of change in IJA 1 year post treatment (2008) as well as expressive vocabulary gains after 5 years (2012). Kaale and colleagues (2014) also reported sustained effects of treatment for both time jointly engaged and IJA 1 year post treatment. However, no significant variations between group differences in language outcomes were found 1 year post treatment; children in both treatment groups gained 12–14 months on average in language scores.

8.3.2 SCDs

A total of 20 SCD studies in 18 articles (Jones, Carr, & Feeley, 2006 and Jones, 2009 each reporting two unique studies) examining the effects of early interventions on social communication for young children with ASD were included in the review. Studies primarily applied multiple baseline and multiple probe designs ($n = 16$) while one study used a reversal design (Koegel, Vernon, & Koegel, 2009) and one used an alternating treatments design (Wilson, 2013). A total of 70 children, including 59 males, with a mean age of 52.8 months ($sd = 15.6$ months) participated. The studies were primarily of moderate methodological quality (Logan et al., 2008 average score = 7.1 out of 14 possible points). Two studies obtained "strong" ratings, 13 "moderate" ratings, and 5 "low" quality scores.

Eight of 20 SCD studies included interventions that used a massed-trial teaching approach. Children were taught to respond to specific stimuli with discrete social communicative behavior. For example, Rocha, Schreibman, and Stahmer (2007) taught children to respond with behaviors including shifting gaze or attention to a series of joint attention prompts, each to a target criterion level. The other studies ($n = 12$) examined naturalistic developmental behavioral interventions including Pivotal Response Teaching (e.g., Koegel, Bradshaw, Ashbaugh, & Koegel, 2014), Milieu Teaching (e.g., Olive et al., 2007), Project ImPACT (Ingersoll & Wainer, 2013), author described play-based interventions (e.g., Loncola & Craig-Unkefer, 2005), video modeling (e.g., Mason et al., 2014) and multimedia social stories (Ozdemir, 2008).

Across the SCD studies, social communication outcomes were examined in four different combinations including: (a) spoken language only (four studies: Ingersoll & Wainer, 2013; Koegel et al., 2014; Lorah, Gilroy, & Hineline, 2014; Loncola & Craig-Unkefer, 2005), (b) both prelinguistic and spoken or augmented

communication (6 studies: Dykstra et al. 2012; Franco et al., 2013; Mason et al., 2014; Olive et al., 2007; Vernon et al., 2012; Wilson, 2013), and (c) prelinguistic skills only or social engagement only (10 studies).

Social communication behaviors were reported as one composite outcome combining multiple forms of behavior (e.g., eye contact, gesture, spoken word) and/or multiple functions (e.g., to request and joint attention) in 6 of 16 studies (Dykstra et al. 2012; Loncola & Craig-Unkefer, 2005; Mason et al., 2014; Olive et al., 2007; Ozdemir, 2008; Vernon et al., 2012). Studies that measured prelinguistic communication most frequently measured responding to joint attention or prompted joint attention skills. For example, although "initiations" of joint attention were reported as targets, these behaviors occurred in response to positional, verbal, or gestural prompts within contrived trials (e.g., Ferraioli & Harris 2011; Martins & Harris, 2006). No SCD study examined spontaneous initiations of joint attention as a primary dependent variable. Only five studies clearly reported a focus on spontaneous social communication outcomes including combined prelinguistic and linguistic outcomes (Franco et al., 2013; Olive et al., 2007; Vernon et al., 2012), language (Ingersoll & Wainer, 2013), and social question asking in a contrived setting (Koegel et al., 2014). Measures of generalization or maintenance of social communication outcomes were included in 14 of the 20 SCDs. The follow-up periods were typically 1 month long with one study reporting 10-month follow up (Jones et al., 2006).

Similar to group design studies, social communication behaviors were targeted using a variety of communication intervention strategies that were implemented by a range of individuals including researchers ($n = 4$), school staff ($n = 8$), caregivers ($n = 3$), and peers or siblings ($n = 5$). Social communication was examined most frequently in the context of interactions with adults (16 studies), but also in interactions with peers or siblings (five studies: Ferraioli & Harris 2011; Loncola & Craig-Unkefer, 2005; Lorah et al., 2014; Mason et al., 2014; Ozdemir, 2008).

8.3.3 Summary

Both the RCTs and SCDs included massed trial and naturalistic behavioral approaches to teaching social communication. The majority of studies included some participation of community stakeholders and/or treatment delivered in community settings. Overall, the RCTs and the SCDs targeted social communication outcomes that differed in critical ways. The findings from RCTs provide support for the effect of intervention on children's spontaneous initiations of joint attention and language. In contrast, most SCDs targeted requests, prompted joint attention skills, and measured children's responses to an adult's joint attention bid as the primary dependent variables. In both types of studies, maintenance (follow up) and generalization of these outcomes are infrequently measured; however, long-term 1–5-year follow-up studies have emerged in the RCTs.

8.4 Challenges

Addressed below are challenges related to both internal and external validity. Due to the differences in quality criteria based on study design, internal validity is addressed separately for RCTs and SCDs while one combined discussion is provided for external validity.

8.4.1 Internal Validity Challenges: RCTs

Overall, the studies demonstrated moderate to strong methodological quality. Valid and reliable outcome measures were applied in 17 studies, coding was completed by team members blind to treatment allocation in 18 studies, and confounds were well assessed and statistically examined in 18 studies. As such, the majority of studies met at least four of the seven quality criteria. Of the seven quality criteria, the four missed with the greatest frequency included clear reporting of participant inclusion/exclusion criteria (six studies), clear description of the intervention conditions across the treatment arms (three studies), reporting a priori power calculations for statistical analyses when no main effects of treatment were found for children's primary communication outcome (five studies), and participant attrition (seven studies). Poor uptake of the study was reported in two studies. Wetherby et al. (2014) reported loss of eligible participants early in the study due to selection into another research study or refusal to participate and Kasari, Lawton et al. (2014) reported failure to engage in the treatment after assessment and randomization. Attrition was also greater in long-term follow-up studies where more than 20 % of the sample was lost at the distal follow-up visit. For example, only 70 % were found at 5-year follow up (Kasari et al., 2012).

Five of eight studies scoring "moderate" internal validity reported no significant effects of treatment for primary communication outcomes (Carter et al., 2011; Casenhiser, Shanker & Steiben, 2010; Rogers et al., 2012; Schertz, Odom, Baggett, & Sideris, 2013; Wong & Kwan, 2010). Three studies with mixed or no main effects of treatment reported that power was lost due to missing data (Carter et al., 2011), underpowered analyses (Schertz et al., 2013), or inadequate sample size to accurately analyze between group differences (Wong & Kwan, 2010). A priori calculations inform study planning to detect small but potentially clinically meaningful effects of treatment (Glasgow, Lichtenstein, & Marcus, 2003).

8.4.2 Internal Validity Challenges: SCDs

Overall, studies were of moderate methodological quality (Logan et al., 2008 average score = 7.1 out of 14)—see Table 8.1 for internal validity scores by

study. Across the studies, the independent variables and conditions were consistently defined to allow replication ($n = 16$); dependent variables were also well defined ($n = 19$). Further, standard conventions for graphs were followed in two-thirds of the studies ($n = 15$). Yet, the studies were limited by lack of clear visual analyses ($n = 6$) or statistical analyses ($n = 5$). In addition, only a third of the studies ($n = 7$) included thorough descriptions of the participants' diagnoses and social communicative behavior prior to intervention.

Overall, two issues impede interpretation of the efficacy of treatment on children's social communication outcomes. First, in order to demonstrate a treatment effect, baseline data must be stable, include at least five data points, and show no trends in the direction of the intervention effect (Logan et al., 2008). Only half of the studies met this criterion ($n = 10$). Examples of stable baseline data include Krstovska-Guerrero and Jones (2013) which allowed for demonstration of a clear change in level and trend once the intervention phase began. In contrast, the combination of short baseline phases with variable data and trends in the direction of treatment confound experimental control and the corresponding interpretation of treatment effects (e.g., Ferraioli & Harris, 2011). Replications of the treatment effect and demonstration of experimental control are required.

Second, at least three replications of the effect of treatment on the study outcomes must be demonstrated to provide sufficient evidence for the influence of the treatment on the desired outcome. Thirteen studies reported designs that provided experimental control (stable baseline data allowing for clear interpretation of the introduction of the intervention) and demonstrated clear changes in level and trend with the onset of intervention for at least three participants or conditions. For example, Koegel et al. (2009) demonstrated a clear influence of embedded social PRT treatment where a large change in level (e.g., from an average of 10 to 95 % of intervals) occurred when the embedded social condition was introduced followed by an immediate decrease when the non-social condition was presented.

8.4.3 Summary

Rigorous SCDs that demonstrate experimental control may be useful to examine novel intervention components/protocols, pilot new measures, examine inclusion of under-studied low-incidence populations, or examine the influence of a novel treatment on a primary participant outcome (Smith et al., 2007). RCTs are particularly powerful in demonstrating the efficacy and effectiveness of a treatment. However, in both SCD and group designs, future studies will benefit from focusing on consistent, meaningful outcome measures, high quality designs that have longitudinal follow up, and generalization of data.

8.4.4 External Validity Challenges: RCTs and SCDs

Balancing high internal validity with high levels of external validity is a challenge in well-controlled intervention studies. By nature of the controls placed on participant selection, context, intervention procedures, and evaluation, findings from studies with high internal validity often fail to generalize to the wide range of children present in the community and the variety of contexts/settings children engage in day to day. For these reasons, some have recommended rigorous studies implemented within community setting from the beginning rather than moving from efficacy to community implementation. The studies included in this chapter demonstrate strengths as well as global limitations to external validity, as described below.

8.4.4.1 Setting of the Intervention

Limited information was provided about location or context of interventions. All studies were conducted in major metropolitan centers in North America with the exception of six studies including two RCTs in Norway (Kaale et al., 2012, 2014), one RCT in China (Wong & Kwan, 2010), and one SCD in Turkey (Ozdemir, 2008). Within the studies conducted in the USA, several RCTs included partial delivery of the intervention in homes (Carter et al., 2011; Rogers et al., 2012) or delivered the full treatment package in community settings including family homes (Kasari, Kaiser, et al., 2014; Wetherby et al., 2014) and community preschool classrooms (Kaale et al., 2012, 2014; Lawton and Kasari, 2012; Wong, 2013). Of the SCDs, only four were conducted in clinic settings (Ingersoll & Wainer, 2013; Koegel et al., 2014; Rocha et al., 2007) while the other 16 studies were conducted in home and school settings.

8.4.4.2 Selection of Participants and Characteristics of Randomized Participants

To understand how an intervention can work in the community, it is necessary to enroll participants who are representative of the community, including those who are not frequently included in research studies. Several studies included ethnically and socioeconomically diverse samples of participants, an advancement in external validity. For example, Kasari, Lawton and colleagues (2014) focused explicitly on underserved and under-resourced families, demonstrating that families often excluded from clinical trials also make significant gains through parent-mediated intervention. Further, two studies recruited samples of children with minimal spoken language (Kasari, Kaiser et al., 2014) or children with significant intellectual impairment and ASD (Goods, Ishijima, Chang, & Kasari, 2013), both populations that are often not actively recruited for studies. Rothwell (2005) refers

to the recruitment of participants likely to make gains in treatment an enrichment strategy. Many studies use particular inclusion/exclusion criteria to optimize outcomes (e.g., Rogers et al., 2012 excluded participants at less than 12 months developmental age and children who have previously received at least 10 h a week of one-on-one intervention). These can be considered strategies to enrich the potential of the participants to respond to treatment.

8.4.4.3 Differences Between Experimental Treatment and Routine Community Services

Many studies provided intervention programs that are not widely available in the community. However, nearly all RCTs included a control group of participants who received community treatment as usual or a comparative intervention. Comparison to community treatment provides information about the effect of the novel treatment over and above the provision of the usual community services received by the population. Overall, no restrictions were placed on the services that families could access prior to or during the study treatment phase.

Although some studies obtained significant outcomes (see Table 8.1), the cost benefit of the treatment may be limited. For example, in Jones et al. (2006) one participant required 157 sessions to reach criterion levels of initiating joint attention and in another study, 10 h of therapy per week for 10 months was needed for an increase of about three questions during a 10-min interval (Koegel et al., 2014). Although these interventions were successful at increasing the targeted communication skills, when considering implementation in real-world settings, the clinical significance of the outcomes may not warrant the intensity of human and financial resources required to deliver the intervention.

8.4.4.4 Outcome Measures and Follow Up

Social communication outcomes were captured through semi-structured assessment protocols, counts of discrete behavior during play with clinicians, parents, siblings or teachers, and standardized tests of language. No study included assessment by community stakeholders; however, 13 RCTs included examination of children's behaviors in the community with parents or teachers (see Table 8.1). Twelve studies using SCDs included generalization probes or conditions. Probes frequently indicated that level of the target behavior was below that observed during the intervention phase (e.g., Vernon et al., 2012). Specific teaching was required to maintain gains beyond the intervention setting. For example, participants in a study by Jones et al. (2006) demonstrated increases in IJA and Responding to Joint Attention (RJA) behavior during intervention (Study 1). The second study included in the article examined targeted programming to generalize these skills across other partners (from adults to peers) using different materials, and moving from a contrived massed trial context to familiar preschool routines with the peers (e.g.,

snack time, playing a familiar board game). This study demonstrated that the target child did not generalize IJA with peers until intervention with peers was provided.

Fourteen of the 21 RCTs included data collected during a follow-up period and 12 of 20 SCDs included examination of maintenance of treatment gains. Follow-up data were the focus of three RCTs (Kaale et al., 2014; Kasari et al., 2008; Kasari et al., 2012). The longest follow-up period was 5 years in length (Kasari et al., 2012) while the other two studies examined a follow-up period of 1 year each. Key to examination of follow-up data is whether the children's skills at follow up are greater than at baseline. These follow-up studies demonstrate sustained gains in children's primary outcomes, including joint engagement and IJA, as well as findings for language gains in two of the three studies (Kasari et al., 2008; Kasari et al., 2012). Further, an additional 10 studies included relatively brief follow-up periods ranging from 1 to 2 months (e.g., Schertz et al., 2013) through extended follow-up periods of 1 year (e.g., Kasari et al., 2010; Siller, Hutman, & Sigman, 2013). Follow up was generally brief when included by studies using SCDs. Follow up ranged from 1 week post intervention (Vernon et al., 2012) through 10 months post intervention (Jones et al., 2006). Brief follow-up periods may not be sufficient to gauge the sustained effects of intervention on children's behavior.

8.4.4.5 Adverse Effects of Treatment

Limited information was provided about adverse effects of the treatment protocols. Although adverse effects are routinely logged by study teams, this information is not typically published for behavioral intervention trials. Most studies did not report high rates of discontinuation once treatment began.

8.5 Implications for Research and Practice

The studies included in this review demonstrate advances in external validity through the inclusion of both community settings and implementation of intervention by community stakeholders, with several studies demonstrating high internal validity (e.g., Kaale et al., 2014; Kasari, Kaiser, et al., 2014). Results demonstrate that intervention targets of joint attention and other prelinguistic gestures are sensitive to change in children with ASD, and that improving these behaviors results in greater spoken language gains. Intervention gains maintain over time, even when children return to their natural environment of home/school and generalize to non-targeted individuals and contexts. These are impressive advancements.

In advancing this line of research, future research studies should consider reporting social communication skills by both form and function rather than in aggregate form. Many studies we reviewed reported results in the aggregate which impedes our understanding of which behaviors are changing due to intervention (Rothwell, 2005). It is clear that requesting behaviors are easier to improve, as well

as getting children to respond to a prompt. Future research needs to focus on spontaneous initiations and the maintenance and generalization of taught skills to better understand the contribution of joint attention to spoken language outcomes.

Clinically, teachers, therapists, and parents should be encouraged to teach preliniguistic skills as these skills can improve, and can have downstream effects on other areas of development. Studies are just beginning to address the large research-to-practice gap in this area of research with encouraging results by Kaale et al. (2012) and Wong (2013) among others. Future studies may want to position research within the community context from the beginning to determine the feasibility and acceptability of different methods in different contexts.

8.6 Conclusion

Altogether the 41 studies included in this review demonstrated advances in our understanding of possible effective interventions for improving prelinguistic skills in children with ASD who are preverbal or minimally verbal. Both internal and external validity have improved in recent studies. Thirteen RCTs demonstrated main effects of treatment and 13 SCDs demonstrated multiple replications of the treatment effect on children's social communication outcomes. To continue to advance understanding of the influence of different interventions on children's outcomes, it is critical that trials include measures that differentiate the forms, functions, and spontaneity of social communication skills. This careful examination of children's outcomes will deepen our understanding of how children's skills are changing in response to intervention and inform future examination of active ingredients of treatment.

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Chapter 9
Augmentative and Alternative Communication Applications for Persons with ASD and Complex Communication Needs

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Abstract This chapter provides an introduction to the concepts of intentional and non-intentional communicative acts as they relate to the emergence of a learner's attempts to influence others. In addition, critical terminologies related to these concepts are defined. Second, this chapter describes the variables involved in the implementation of augmentative communication systems that can greatly expand contexts for independent social interaction. Specifically, augmentative and alternative communication (AAC) is defined and specific types of AAC (i.e., aided and unaided) are described. Third, topics related to the selection of communicative mode(s), functions, and symbols to teach during the early stages of intervention are discussed. Fourth, the authors address whether implementing an augmentative communication system is likely to have a negative or positive effect on the probability of acquiring other communicative behavior, specifically vocal mode communication. Additionally, the authors discuss potential collateral gains that have been reported in learners who were taught to use augmentative communication systems. Fifth, the authors address instructional formats that are available to communication interventionists along with the need to consider overall intervention intensity and specific intervention parameters of dosage when selecting a format. Last, authors examine generalization of AAC responding and discuss strategies to enhance it.

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Nearly all learners engage in communication depending on how one defines it. ***Communicative intent*** involves the emission of an act that is intended to influence the behavior of another individual by expressing a purpose for producing the act. ***Communicative means*** describes the form that a communicative act assumes (spoken [and/or] gestural [and/or] graphic). The learner's choice of a communicative means is based on the matching law (Herrnstein, 1961) which suggests that an individual's response rate will be proportionate to the immediacy amount/duration of positive reinforcement, the response effort to gain reinforcement, and the practical operationalized parameters of "response efficiency". Among beginning communicators selecting a more conventional communicative alternative for an existing communicative means requires the best possible match between the purpose of the existing communicative act and the communicative act chosen to replace it. In teaching a communicative alternative it is important that the learner either already attempts to influence the actions of others or can be taught to do so. Thus the first section of this chapter addresses the emergence of a learner's attempts to influence others and the range of communicative acts that can be acquired.

9.1 Events Leading to the Learner's Attempts to Influence Others (Distinguishing Between Non-Intentional and Intentional Communicative Acts)

The term ***communicative function*** is used often in discussing an individual's initial communicative repertoire (Carr & Durand, 1985; Wetherby, Reichle, & Pierce, 1998). Communicative function describes the outcome of behavior produced that actually influences the actions of others. When an individual repeatedly produces a particular behavior in the same context that in turn leads to specific outcomes (e.g. to gain attention, gain access to a desired object/event or escape demands), it becomes increasingly clear that he/she is seeking to achieve an outcome associated with the act. However, it does not follow that all communicative functions are communicative intentions. The two terms refer to somewhat different phenomena.

Bates (1979) described communicative intentionality as "signaling behavior in which the sender is aware apriori of the effect that a signal will have on his listener" (p. 36). Intentionality must be inferred. Further, there is a difference between ***intentional behavior*** and ***intentional communicative behavior*** (Reichle & Brady, 2012). For example, a 7-month-old might attempt to obtain a toy on a shelf by reaching for it (intentional behavior). However, after struggling and being unable to reach the toy, he may not realize that an adult can be used as an agent to gain access (this would be a potential indicator of a failure to demonstrate intentional communicative behavior).

Communicative function describes the effect that a learner's act has on others. For example, in response to crying, a parent may provide a nutriment. If hunger

around a typical feeding time resulted in crying and if a parent fed the child at this time, the probability of crying would increase around mealtime. As a result one might conclude that the function of the learner's behavior is to obtain a desired object/event (e.g., food). However, in this example, the child's behavior may not be produced to influence a listener, if it is guided more by the learner's schedule and less as a function of an available listener. Wetherby and Prizant (1989a, 1989b) suggested criteria to assist in determining whether a learner's communicative behavior is intentional. As Reichle and Brady (2012) observed, although specific criteria employed have differed (cf. Harding & Golinkoff, 1979; McLean, McLean, Brady, & Etter, 1991; Wetherby & Prizant, 1989a, 1989b), several often described include: (a) alternating eye gaze between object/event of interest and one's communicative partner, (b) persistent signaling until a goal is accomplished or failure indicated, (c) waiting for a response from a listener after an initial communicative act has been produced, (d) changing the signal quality until the goal has been met (e.g., speaking louder), and (e) ritualizing or conventionalizing communicative forms (e.g., doing what one's older brother does to obtain a desired item).

Augmentative communication strategies can be implemented with learners who do not emit intentional communicative acts. For example, Calculator (2002) taught parents of nine children with severe neurodevelopmental disabilities, including severe to profound intellectual delays, to enhance natural gestures (ENGs). ENGs were defined as gestures comprised of motor components already in the child's repertoire that do not rely on physical contact with a referent and are easily understood by familiar communication partners. An example of an ENG might involve the hand movement made to bring a cup to one's mouth and drink, when made in the absence of the cup. The program involved coaching parents in natural environments. The dependent measure was a parent self-evaluation rather than specific dependent measures on child performance. A questionnaire, Enhanced Natural Gestures-Acceptability Rating Form (ENG-ARF), sampled parents' perceptions about the acceptability and feasibility of the ENG training procedures. With few exceptions, parents described this method as acceptable, effective, reasonable, and easy to teach others, with minor negative consequences and side effects.

We hypothesize that it is important to make the distinction between intentional and non-intentional communicative acts (see Reichle & Brady, 2012, for a more complete discussion). We believe that it is likely that a greater number of instructional opportunities will be required by a learner who is not yet producing intentional, but more idiosyncratic, communicative acts.

In the paragraphs that follow we will describe the variables involved in the implementation of augmentative communication systems that can greatly expand contexts for independent social interaction. We begin with a definition of augmentative and alternative communicative communication. This will be followed by topics that address the selection of communicative mode(s), functions, and symbols to teach during the early stages of intervention. Next, we will address whether implementing an augmentative communication system is likely to have a negative or positive effect on the probability of acquiring other communicative behavior

(specifically vocal mode communication). Related to this topic, we will discuss potential collateral gains that have been reported in learners who were taught to use augmentative communication systems. Finally, we address instructional formats that are available to communication interventionists, along with the need to consider treatment dosage in selecting a format. Finally we examine generalization and strategies to enhance it.

9.2 Defining Augmentative and Alternative Communication

Augmentative and alternative communication (AAC) includes any system of communication that supplements (augments) or replaces (alternative) conventional speech in providing support for an individual who, due to a disability that has resulted in a permanent or temporary condition, has a complex communication need (CCN) (Romski & Sevcik, 1997). There are two main categories of AAC, *aided* and *unaided*. Aided AAC includes systems that require equipment (Johnston, Reichle, Feeley, & Jones, 2012; Light, Roberts, Dimarco, & Greiner, 1998). Some examples include written or typed messages, pictures in which the learner points to images to create messages that may be displayed non-electronically in a notebook or on a board or, alternatively, on a high-tech display that might involve the use of a smart phone, tablet, or laptop application with dedicated software. Unaided AAC does not require external equipment. Examples include sign language (e.g., American Sign Language), sign systems (e.g., Signed English), and the informal use of gestures (e.g., pointing) and nonverbal communication (e.g., raising eyebrow – see Johnston et al., 2012).

Distinct advantages have been reported for both aided and unaided communication systems. Aided AAC may be advantageous for individuals who have difficulties with recall memory, more abstract language, or fine motor control in that they can be designed to offer concrete symbols that are less transient than speech or gesture, and they can provide the opportunity to choose symbols via recognition memory rather than requiring recall (with rudimentary single-page displays or with a system that minimizes the need for multi-page navigation skills). Additionally, aided systems can be configured such that they have relatively modest requirements for motor control such as an eye-tracking switch (see Johnston et al., 2012, for further description). Sign languages and sign systems cannot claim these advantages (Ganz et al., 2012; Johnston et al., 2012). Unaided AAC applications (particularly signs), on the other hand, may be more suitable for individuals who have strong recall memory, a better grasp of learning more abstract symbols, intact fine motor skills, and access to communicative partners who readily understand signs (Johnston et al., 2012; Rotholz, Berkowitz, & Burberry, 1989). Advantages of unaided AAC include potentially immediate access to unlimited vocabulary, portability, and speed of production (Johnston et al., 2012).

9.3 Describing Aided Augmentative and Alternative Communication Options

9.3.1 Low-Tech Options

Low-tech aided AAC systems include any non-electronic aided systems used by people with CCN to communicate (Ganz, Earles-Vollrath, et al., 2012; also see Johnston et al., 2012). A range of low-tech AAC options have been investigated and recommended for use with persons with autism spectrum disorder (ASD) who experience a CCN. These options largely fall into two categories: non-exchange-based picture-photograph-product logo or exchange-based systems using the same types of symbols (Ganz, 2014). Non-exchange-based systems involve providing a person with CCN with a page or board with pictures or letters with which the individual communicates messages of varied lengths. In exchange-based systems, the person with a CCN is taught to exchange picture cards with a communicative partner for expressive communication (e.g., Picture Exchange Communication System [PECS] – Bondy & Frost, 1994). Exchange programs have the features of teaching the learner to locate a communicative partner prior to emitting a message. Additionally, they make it easy for the interventionist to randomize symbol choices during the early phases of instruction to ensure that the learner is not choosing symbols based on their position rather than their visual features (Reichle, York, & Sigafoos, 1991).

In using a low-tech system, both exchange and non-exchange can involve the use of a direct selection technique where the learner chooses a specific symbol without any device or partner assistance. However, non-exchange (those where the graphic symbols are in a fixed position on the display) low-tech systems have the advantage of permitting the use of a scanning technique to select specific symbols in which a communicative partner offers symbol choices sequentially and the aided system user signals (e.g., head nod, eye blink) when the partner has offered the symbol that the individual wishes to select.

In general, aided AAC has been considered to be moderately to very effective for persons with ASD (Ganz, Earles-Vollrath, et al., 2012) and also among learners with moderate and severe intellectual delay (Johnston et al., 2012). When skills are broken down by domain, aided AAC has been shown to be particularly effective at improving communication, but somewhat less effective with social skills such as social initiation and responsiveness (Ganz, Earles-Vollrath, et al., 2012). One exchange-based system, the PECS (Frost & Bondy, 2002), has a substantial base of experimental support for use with people with ASD. For instance, PECS has been found to have a substantial impact on communication outcomes with the caveat that it has not been demonstrated to be as effective as functional communication training (FCT) for individuals who engage in problem behavior (Ganz, Rispoli, Mason, & Hong, 2014). This may be because in the initial phases of PECS, the learner must travel to a listener requiring a greater delay in time between symbol selection and the delivery of desired outcome. Thus, reinforcement may not be as

immediate. This, in turn, allows more time for existing problem behavior to continue to be emitted. Thus, an exchange-based system may have greater constraints on the response efficiency parameter of immediacy of reinforcement (Horner & Day, 1991). Additionally, unlike FCT, PECS does not require the implementation of a functional behavioral assessment to identify the function of problem behavior. Thus, it is less likely that functional equivalence between the problem behavior and the new communicative alternative is established prior to program implementation. Some learners may benefit from more sophisticated graphic mode displays that have been described as mid- to high-tech speech generating devices.

9.3.2 Aided AAC: Mid- to High-Tech Options

Mid- and high-tech AAC options include any electronic devices used to augment or replace conventional speech (Johnston et al., 2012). Typically, devices that generate speech are described as higher-tech speech generating devices (SGDs) that produce human recorded digitized speech and/or synthetic speech when activated (McNaughton & Light, 2013; Son, Sigafoos, O'Reilly, & Lancioni, 2006). Although there is clearly a continuum from mid- to high-tech devices, some examples of mid-tech devices include older SGDs, such as the BIGmack® and the Tech Speak®, and Go Talk®. These devices range from one to approximately 128 messages or keys that each contains a different recorded message. Some devices requiring human recorded speech allow only a brief number of seconds to record a message on each symbol; others allow the user to allocate the total number of seconds however they wish (for example one symbol could have a minute of recorded message while another might have only 5 s). Having the flexibility to individualize the number of seconds per message affords an advantage with learners who may wish to participate in "show and tell" or "sharing activities with longer narratives".

Some mid-tech devices use paper overlays with each overlay corresponding to a different page of programmable symbols. Each of these different levels can be selected by adjusting a switch to move across levels (electronic pages). Although this type of mid-tech communicative device typically is less costly, it tends to require greater physical effort than using higher-tech devices that allow an automatic linking of one symbol to another across electronic pages. On some mid-tech devices, the user's partner must switch between levels of recorded message using a switch on the back of the device. On others, a row of symbols on the main page of the device can link to another page if the learner selects the symbol. For many learners, regardless of the option, their communicative partner must change the overlay. Usually, mid-tech devices use digitized speech.

As mentioned earlier, high-tech AAC systems often combine digitized and synthesized options so that sound effects and singing can be easily displayed via digitized recordings while text-to-speech and prediction applications can be readily

utilized with synthesized speech, affording the learner who is literate or partially literate to construct his/her own message. Many high-tech aided communicative options are tablet-sized computers and may be either dedicated AAC devices or may be applications, or "apps," within multi-purpose mobile technology (McNaughton & Light, 2013; Shane et al., 2015). Dynamic AAC software and apps allow for significant flexibility in selection and organization of vocabulary, display design, and navigation between pages. Examples of dedicated devices include the DynaVox® T-Series and Prentke Romich products, such as the Accent™-M Group of products. Current AAC apps include Proloquo2Go®, GoTalk NOW®, and Dynavox Compass™.

Virtually all high-tech speech-generating devices allow any given symbol to be linked to any other page. Additionally, high-tech systems permit *prediction* to lessen keystrokes required for selection. Prediction provides the learner with additional visual cues to signal possible or appropriate available choices. For example, when beginning an utterance, only the symbols that are used to begin a turn are available. Then, once an initial selection is made, only those symbols that are paired with the first choice are offered, thus decreasing the field of available options, and narrowing the field of choice. Prediction also permits *pronunciation exceptions* so that a spoken message will be pronounced correctly but will also be printed correctly via traditional orthography. Further, many high-tech systems permit communication via email and have environmental control features to assist the learner beyond communication. With respect to apps, emerging research has demonstrated their efficacy in teaching a number of communication skills to people with ASD (Ganz, Boles, Goodwyn, & Flores, 2014; Kagohara et al., 2013; Murdock, Ganz, & Crittenden, 2013).

Some research syntheses have concluded that high-tech aided AAC can be highly effective, while others have found little difference in effectiveness between high- and low-tech aided AAC. Thus, more research remains to be done to assist with selection of AAC modes given particular individual characteristics (Ganz, 2014; Lancioni et al., 2007). However, as high-tech AAC becomes increasingly affordable and portable, such systems may become increasingly preferred (Ganz, 2014; Shane, Blackstone, Vanderheiden, Williams, & DeRuyter, 2012). Given its recency, it is likely that this area of research will greatly expand over the next decade.

Traditional AAC systems, both low-tech and high-tech, display available vocabulary in a grid format, in which each language concept is represented by separate symbols in "boxes" organized in rows and columns. An alternative approach that may be appropriate for individuals who are functioning at beginning stages of communication is the use of visual scene displays (VSD). In this approach, vocabulary is embedded under "hot spots" in a picture or photograph that depicts a situation, place, or experience that is familiar to the learner. In this approach language is presented within a meaningful context, while meaning is derived from the entire scene (Drager, Light, Speltz, Fallon, & Jeffries, 2003). For typically developing young children, toddlers at the age of 2½ were more accurate in locating vocabulary using VSDs than grid displays (Drager et al., 2003), while 4- and

5-year-olds performed with similar accuracy when locating vocabulary using VSDs or grid displays (Light et al., 2004). This suggests that VSDs may be better suited than grid displays for infants, toddlers, younger preschoolers, and other beginning communicators (under age 4–5 years developmentally).

The majority of published research using VSDs is with typically developing children; there are very few studies involving individuals with ASD. Gevarter et al. (2013) compared three different AAC display systems in teaching requesting (snack, drink, and/or toys) to 3-year-old children with ASD: grid-based, scene-based, and a hybrid display (that involved a combination of a grid display and VSD display features). Two of the three participants reached mastery with the scene-based condition that appeared to be more advantageous. The display type had no effect on the third participant, who reached mastery on all three types in a similar number of sessions. However, in this study the "scenes" carried very little contextual information (which is purported to be a primary advantage of VSD displays), and were similar to photographs of real objects in isolation.

Ganz, Hong, Gilliland, Morin, and Svenkerud (2015) investigated the use of a high-tech system with VSDs versus a communication book with an exchange-based system with two 5-year-olds with ASD, using an alternating treatments design. One participant spontaneously commented and responded to questions more often in the VSD sessions, while the other did not use either form of AAC. This suggests that individual differences may have played a role in the children's performance. It is also impossible to parse the effects of the use of VSDs from the speech output available on the high-tech system. But for at least one of the children, the system using VSDs appeared to have a positive effect on spontaneous communication.

Finally, Drager et al. (2014) investigated the effect of a high-tech system that included VSDs and just-in-time programming (fast "in the moment" import of photos as VSDs and programming of vocabulary within the VSD) on communication turns with nine school-age children and adolescents. Three of the participants had a diagnosis of ASD (an 8-, 16-, and 20-year-old). The introduction of the high-tech AAC system using VSDs was effective in increasing the number of communicative turns for all nine participants. Any comparison of VSD and grid displays is likely to be influenced by prior intervention history. For example, if a learner had a prior history with PECS, which utilizes a grid display, it is reasonable to hypothesize that the learner may perform better with that type of a display when compared with performance on a VSD.

Regardless of display option, dynamic display systems require strategies to search for and locate symbols across pages. Using a high-tech system is essentially a matching-to-sample task, requiring the learner to think about a referent, and then matching that referent to the symbol on the device (Reichle & Drager, 2010). Several strategies have been recommended to establish beginning matching skills, including stimulus control procedures which establish successful matching to sample under simple and obvious conditions, and then subsequently maintaining the responses under more challenging conditions. These procedures have been shown to be effective in teaching children to move from more to less iconic symbols

(e.g., photographs to line drawings – see Carr, Wilkinson, Blackman, & McIlvane, 2000; Serna, Jeffery, & Stoddard, 1998).

Use of a dynamic display also requires being able to visually scan a page of symbols, make a decision about whether the desired symbol is present, and if necessary navigate to another page to continue searching for the symbol. In addition, it often becomes necessary to search for a target symbol in the absence of an external physical referent (e.g., Johnston et al., 2012; Romski, Sevcik, & Pate, 1988). For example, a learner may wish to request the presence of a favorite teacher who is not currently in the room. To search for a symbol to accomplish this request, the learner must keep the target symbol in mind while (a) inhibiting attention to the non-target symbols that appear, and (b) recalling on which page the desired symbol is located (Reichle & Drager, 2010). This situation is similar to a delayed matching-to-sample task. Research is lacking on strategies to teach learners to successfully navigate across pages. Reichle and Drager, however, have hypothesized about several display approaches that may facilitate searching, such as the use of zoom or magnification, "popups", scrolling, or menus that border the page, eliminating or facilitating the need to navigate without learning a search path.

The past 10 years have spawned a plethora of aided communication systems apps that are most often used with tablets or smartphones. Emerging research has demonstrated their efficacy in teaching a number of communication skills to people with ASD (Ganz, Boles, et al., 2014; Kagohara et al., 2013; Murdock et al., 2013). However, a careful evaluation of most of these applications is lacking.

9.4 Describing Unaided Augmentative and Alternative Communication Options

Unaided AAC includes both representational and non-representational gestures and signs. Representational unaided AAC includes manual sign languages/systems (Goldstein, 2002). They are representational in that they correspond to a particular referent, action, attribute, location, and so on that is discriminable from another symbol within or across a class. In the United States, the primary systems used are American Sign Language (ASL) Signed Exact English, and variations of Signed Exact English; unlike ASL, sign systems such as Signed English closely match some aspects of spoken English. Thus such sign systems are not distinct languages like ASL. Non-representational unaided AAC includes nonverbal communication, such as deictic gestures (e.g., pointing, touching/proffering referents), facial expressions, and body language. Gestural symbols can be differentiated based on their handshape(s), movement pattern and location (and orientation) where they are produced with respect to the body.

Sign language/system implementation may be influenced by the more prevalent fine motor, memory, intellectual, and cognitive deficits (Mirenda, 2003; Worley & Matson, 2012) experienced in this population among AAC users. Most studies

teaching sign to this population have included small numbers of participants who learned a small number of signs (e.g., Bonvillian & Nelson, 1976; Carr, 1979; Remington & Clarke, 1983). Further, much of this literature consists of case studies (quasi-experimental) and anecdotal reports (Bonvillian & Nelson, 1976; Kee, Casey, Cea, Bicard, & Bicard, 2012; Konstantareas, Hunter, & Sloman, 1982). When participants have been given the choice between sign and aided AAC, children with ASD who experience CNN have more frequently chosen aided AAC (van der Meer, Sutherland, O'Reilly, Lancioni, & Sigafoos, 2012).

Increasingly, interventionists have come to recognize the advantages and disadvantages of the variety of the available AAC applications, and a strong case can be made for using a combination of aided and unaided communication modes. However, an essential consideration is determining how an interventionist, during the initial stages of intervention, can ensure from the learner's standpoint that the new AAC system will be maximally efficient. To that end, we will turn our attention to examples of decisions made by educational teams that influence efficiency.

Most learners rely on all three communicative modes (vocal, gestural, and graphic). However, during the early phases of intervention, the interventionist is trying to demonstrate the efficiency of more conventional communication to the learner. As such, it is important to maximize the efficiency of the communicative modes utilized. Therefore, it may be important to consider the ease with which the learner can acquire communicative forms from each of the three modes to determine, at least "in the short run", where to place intervention emphasis. Consequently, next we will address an experimentally based strategy that can assist interventionists in choosing which communicative mode(s) to emphasize at any given time.

9.5 Describing Modality Sampling and Multimodal AAC Use

Often, augmentative communication mode emphasis is not an empirically based decision. Our experiences suggest that most learners benefit from using multiple modes of communication. However, with learners who are demonstrating significant communicative delays, we believe that it is important to emphasize the communicative mode that will be most efficient from the learner's standpoint in any given communicative context. Modality sampling, discussed next, involves systematically implementing several communicative modes concurrently and examining features of learner performance to make decisions regarding which communicative modes to emphasize.

9.5.1 What Is Modality Sampling?

Modality sampling has been implemented to determine which communicative mode(s) to emphasize in AAC instruction (Johnston et al., 2012; Martin, Reichle, Dimian, & Chen, 2013; Reichle et al., 1991). Reichle et al. and Johnston et al. suggested that prior to emphasizing a particular communicative modality, it may be advantageous to expose learners to multiple modalities under at least "quasi-controlled" circumstances to determine whether a learner performs "better" with a particular communicative mode. "Better" can involve several different or a combination of dependent measures that include (a) teaching opportunities to criterion, (b) maintenance accuracy, (c) generalization performance, and (d) expressed preference, among others. This assessment strategy is a longitudinal assessment that allows a concurrent performance comparison of different communicative modes. Initial symbols to be taught are divided into three modes including gestural, graphic, and vocal. Dependent measures are obtained on performance in each mode (with symbols across modes equated for preference and frequency of use). Ideally, these comparisons are replicated several times with new vocabulary item sets.

The results of modality sampling may or may not clearly favor one communicative mode. Some communicative acts may be more efficient in one mode. For example, if one does not have impaired head movement, shaking one's head "no" could be a far more portable and immediate option to communicate a protest than a graphic symbol. Further, it is also possible that, in the future, a learner may become better equipped to acquire symbols in a communicative mode that were much more difficult for a learner earlier in his or her development. For example, the learner may not be vocally imitative during an initial modality sampling, but the development of this skill over time would facilitate proficiency in acquiring spoken word approximations. This makes repeated samplings important to ensure continued exposure to modes under "easy to learn" circumstances. We agree with the point of view that children who use multiple communicative modes tend to select the modes that are easiest to produce. Unfortunately, some children do not begin using multiple modes as a result of their particular disabilities. For these learners, more controlled sampling under more optimized learning conditions may be helpful in focusing intervention efforts in at least the short term. Executing an objective strategy to select a communicative mode to emphasize during the early phases of intervention has the potential to be very helpful with individuals who have a limited history of acquiring, at best, a modest conventional communicative repertoire. This approach may allow interventionists to optimally allocate valuable intervention resources and obtain maximal initial gain. Another advantage is that concurrent sampling of communicative modalities means that the interventionist does not need to wait for one mode to fail before implementing intervention in another communicative mode.

9.5.2 How Is Modality Sampling Implemented?

Typically, this assessment strategy involves first conducting a preference assessment (see Pace, Ivancic, Edwards, Iwata, & Page, 1985). This is followed by matching symbols, in a range of modes (e.g., verbal, gestural, pictorial) to the most preferred items (or items of similar preference). Next, concurrently, interventions are implemented in two or more communicative modes in order to compare any possible mode advantage with respect to acquisition, maintenance and/or generalization. Such an approach would be repeated with additional sets of symbols and in varied contexts to determine the most efficient communicative mode for that individual (Martin et al., 2013).

Depending on the context, it may be appropriate to provide a person with CCN with multiple communicative options (King & Fahsl, 2012). This strategy was referred to by Reichle et al. (1991) as duplicated communicative modes. Unfortunately, while a number of studies have investigated choice among AAC options for people with ASD (Ganz, Hong, & Goodwyn, 2013; McLay et al., 2015; van der Meer et al., 2012), relatively little work has been done investigating implementation of multiple communicative modes concurrently.

9.5.3 What Have Been the Outcomes of Modality Sampling?

Variations of modality sampling have been executed by a number of investigators (e.g., Adkins & Axelrod, 2001; Boesch, Wendt, Subramanian, & Hsu, 2013; Chambers & Rehfeldt, 2003; Hyppa Martin, Reichle, Dimian, & Chen, 2013; Tincani, 2004). In most cases, learner performance resulted in the selection of a primary mode for an individual participant based on acquisition performance.

Regardless of the communicative mode selected, an important aspect in making the case to the learner that new communicative forms are maximally efficient involves carefully selecting the communicative intent(s) or reasons that will be associated with symbols being taught. Next we address the selection of communicative intents to teach one that will be represented by the communicative means that have been chosen.

9.6 Selecting and Teaching Varied Communicative Intents

Wetherby and Prizant (1993) summarized three key categories of communicative functions, that is, reasons for which people communicate (also see Shumway & Wetherby, 2009). *Behavior regulation* includes communication intended to direct others' behaviors, such as by asking for something or asking someone to "stop." *Social interaction* includes communicating for the purpose of gaining or

maintaining someone's attention. *Joint attention* includes communication intended to direct someone's attention to information or items, or responding to others' bids for joint attention (see Shumway & Wetherby, 2009). Given the broad range of purposes for which humans communicate, it seems to be common sense that persons with CCN would be afforded the same opportunity. However, the majority of research on AAC with people with CCN has involved instruction in behavior regulation (particularly requesting skills), while other communicative functions, such as those that involve social interaction or joint attention, have been addressed more sparingly (Ganz, Earles-Vollrath, et al., 2012; Gevarter et al., 2013). This is not the case with learners acquiring AAC representing other disability groups (Ganz & Hong, 2014). Thus, this literature base would seem to be applicable to persons with CCN until more efficacy research has been conducted.

Daily routines and interactions must be observed to determine current communicative skills and functions that need to be taught in particular contexts (Hart & Risley, 1992; Reichle et al., 1991). For instance, a student may need a small range of different vocabulary items for use at his or her after-school job to ask for assistance or more materials or to greet customers. The same student may need a relatively large number of different vocabulary items to share information with their parent about their day. These situational vocabulary items will likely be needed to express a variety of communicative functions. Additionally, a range of conversational functions, including how to initiate, maintain (including repair), and terminate a conversational exchange will make it easier for the learner to socially interact with prospective communicative partners (Wetherby & Prutting, 1984). Lund and Light (2007) suggested teaching numerous communicative functions concurrently, whereas some AAC instructional protocols teach requesting skills exclusively for an extended period until requesting is mastered (Frost & Bondy, 2002). The selection of communicative intents to emphasize during initial instruction brings with it the need to select the type of communicative symbol. In our discussion we will emphasize decisions that must be made when a graphic communication mode has been selected.

9.7 Selecting Symbols to Match the Communicative Functions Being Taught

One important set of decisions to be made involves the selection of specific symbol forms to introduce to beginning communicators. This involves not only the physical symbol type (e.g., photo, line drawing, product logo) and the presence or absence of color but the specificity of the symbol as well (e.g., dog vs. collie, drink vs. orange juice).

9.7.1 What Is the Range of Symbol Types That Can Be Used in Aided Communication?

Within aided communication systems, interventionists have a wide variety of types of symbols from which to choose. These include pictures, photographs, line drawings, and product logos (all of which may be colored or black and white). Additionally, with higher technology style speech-generating devices, brief animated movies become an option. Reichle et al. (1991) suggested that sampling among these types in much the same way that one would implement modality sampling could be accomplished via simple discrimination tasks embedded during young children's daily routines to determine whether a particular symbol type was easier for a learner to discriminate.

Among symbol types, interventionists, often, have presumed that adding color to graphic symbols enhances their discriminability in that they are more representational (more closely resemble their referent). However, for individuals who engage in "stimulus over-selectivity" this may not be the case. Lovaas and Schreibman (1971) described stimulus over-selectivity as instances of overly selective attention to a portion of a more complex stimulus package. These investigators found that learners with ASD made selections based on a single stimulus component rather than attending to and using multiple features of the stimulus package that comprise an entity. Lovaas and Schreibman concluded that children with ASD exhibited overly selective attention. Since Lovaas and colleagues' original work, there has been increasing evidence that stimulus over-selectivity is positively correlated with chronological age (McHugh & Reed, 2007) as well as mental age (regardless of autism status [e.g., Rincover & Ducharme, 1987; Wilhelm & Lovaas, 1976]). Thus, while historically of particular interest to those serving persons with ASD, it is a topic that has much wider applicability in the establishment of early symbol discrimination skills.

9.7.2 Why Should Symbol Specificity Be Considered?

Symbol specificity is another area that has significant implications for the learner but has received relatively little attention to date. Specificity determines how much context and/or listener inference is needed to decipher a learner's message. It also determines the range of instructional contexts in which intervention opportunities can be embedded. At the most general level is a symbol such as "want" or "more". At the most explicit level is the symbol "Coca-Cola®". At an intermediate level of specificity, we have chosen "Cola." Assuming that an interventionist wishes to teach a learner a symbol when he wants to obtain a Coke® he/she could choose a symbol from a variety of specificity levels. We know that, initially, many typically developing learners tend to master symbols at an intermediate level of specificity ([i.e., "dog" rather than "animal" or "Collie"] Reichle et al., 1991). At slightly later

points in development, they tend to acquire more "superordinate" (animal) as well as "subordinate" (Collie) levels of symbols depending on the importance of specificity in any given context. Of course there are exceptions to this observation and we also are aware that developmental propensities can be helpful to the interventionist, but do not necessarily preclude considering other options.

There are a number of possible variables that can influence symbol specificity choices. One of the most general symbols that could be selected to communicate a request would be a symbol signifying "want." This general symbol offers several advantages for both learner and interventionist. First, the more general symbol "want" can fit a wide variety of objects and activities. With a more general symbol, the interventionist can create learning opportunities across a wide range of activities that occur throughout the day. Additionally, more general symbols can be associated with a wide array of objects. Consequently, there is an increase in the likelihood that an interventionist can implement teaching opportunities with highly preferred items/activities in a variety of occasions, thus taking advantage of the learner's motivation. Finally, in the case of teaching a symbol to be used as a request, a more general symbol precludes having to limit teaching opportunities as a result of satiation or a preference shift that is not directly due to satiation.

Unfortunately, there are some disadvantages associated with general symbols. General symbols tend to require a greater level of inference by social partners. For example, if one travels to Burger King® and approaches a clerk while touching a symbol "want", the clerk will not know enough about the learner's preferences to make a correct inference about the desired item. Therefore, general symbols make the learner far less independent in community environments. The advantages and disadvantages for explicit symbols are more or less the reciprocal of those described for general symbols.

In implementing an augmentative communication system regardless of communicative mode(s) chosen, parents are often concerned that doing so will negatively influence their child's acquisition of communication using speech. Although a reasonable concern, it appears to be unfounded. To the contrary, implementing an augmentative communication system may have a facilitative effect in collateral behavioral gains (see Millar, Light, & Schlosser, 2006).

9.8 Describing the Relationship Between AAC Implementation and Subsequent Speech Production and Comprehension of Speech Outcomes

In our experience, one concern often expressed by parents involves the fear that implementing an augmentative communication system with a learner who currently uses some spoken behavior (or may in the future acquire some speech) will impede speech development (Johnston et al., 2012; Romski & Sevcik, 2005). Existing evidence suggests that this does not appear to be the case. In fact, for a number of

learners participating in research, speech has been found to markedly improve during AAC instruction (Ganz, Earles-Vollrath, et al., 2012; Millar et al., 2006). Additionally, some (e.g., Harris & Reichle, 2004) have reported improvements in the comprehension of spoken vocabulary following the implementation of aided communication systems. Furthermore, the use of AAC modes has been reported to result in a reduction of problem behavior when implemented following a carefully implemented functional behavior assessment (Durand, 1999; Reichle & McComas, 2004; Walker & Snell, 2013; and numerous others).

When communication is made as efficient as possible, it may provide a learner with greater opportunities to devote attention and effort to other ongoing events at the time during which a communicative episode occurs. This, in turn, may enhance a learner's capacity to attend to and act on other simultaneously ongoing events. Thus, it is important to attempt to obtain a better understanding of collateral gains that may accrue during communicative opportunities.

9.8.1 How Might Collateral Gains in Speech Production and Speech Comprehension Be Facilitated?

Augmented input refers to a strategy wherein the partner uses AAC in conjunction with speech when interacting with the learner. Goossens (1989) first described an intervention system called aided language stimulation, in which the interventionist selects a graphic symbol paired with a verbal model during a naturalistic play activity. In doing so, an association can be made between the spoken word and the visual symbol. If the learner knows the symbol, this pairing will aid the learner in comprehension. If not, repeated pairings appear to provide (at least some learners) with the association needed to support learning (Harris & Reichle, 2004; Jones & Bailey-Orr, 2012; Wood, Lasker, Siegel-Causey, Beukelman, & Ball, 1998).

In addition to supplementing comprehension, providing a visual model (sign or graphic symbol) along with speech is likely to have further advantages for the learner. Modeling ensures that the communication mode for input is matched to the expected communication mode for output. That is, for most learners who use aided AAC, communicative input is spoken language, while communication output may consist of primarily aided AAC, resulting in a mismatch between these two modes. Typically developing children hear hundreds of thousands of models of spoken language before first words, while children who require AAC may see few, if any, models of symbol use as input before being expected to use the symbols as output. Arranging for the delivery of these models may also be an effective demonstration of use of the AAC system, reinforcing the acceptability of the communicative form and de-stigmatizing its use, while providing a natural demonstration of the effect of the symbolic communication in interactions (Romski & Sevcik, 1996), although there is no existing empirical evidence of these direct outcomes.

Although "aided language stimulation" (Goossens, 1989) is a term most commonly used to describe augmented input interventions, it originated as a highly structured intervention program. The System for Augmented Language (SAL) (Romski & Sevcik, 1996) is a similar modeling intervention. SAL differs from aided language stimulation in that it requires a speech-generating device (SGD) and the aided symbols are introduced gradually, beginning with one symbol. Goossens suggested beginning with at least 12 line-drawn symbols. However, all of the aided modeling interventions have the following components in common: (a) they are implemented during opportunities that arise out of natural contexts, (b) they augment the input the child receives, and (c) they employ modeling to expand vocabulary (Drager et al., 2006).

Aided modeling in combination with speech interventions has been successful with preschoolers, children, and adolescents with a range of disabilities, including moderate cognitive disabilities, Down syndrome, cerebral palsy, and apraxia (Binger & Light, 2007; Bruno & Trembath, 2006; Dada & Alant, 2009; Harris & Reichle, 2004), and adults with developmental disabilities (Beck, Stoner, & Dennis, 2009). The SAL (Romski & Sevcik, 1996) was implemented with children with a variety of diagnoses, including ASD, but it is impossible to isolate the effects of the intervention definitively for this population. However, a handful of investigators have examined these approaches specifically with children with ASD. Cafiero (2001) investigated the use of an aided modeling intervention, Natural Aided Language Stimulation, with an adolescent with autism and challenging behaviors in a middle school special education classroom. The intervention consisted of modeling and expanding upon any communicative overture (via signs, vocalizations, or symbols) by using a communication board. No direct instruction or prompting was provided. After the intervention, an increase in receptive and expressive vocabulary was noted, in addition to a decrease in challenging behaviors. Drager et al. (2006) investigated a modeling intervention with two preschoolers with ASD. These researchers implemented Aided Language Modeling ([ALM], a term used to differentiate the intervention from the more highly structured aided language stimulation, as coined by Goossens, 1989) in a preschool classroom during interactive play activities. Models were provided on language boards. For both children, symbol comprehension and symbol production increased upon introduction of the intervention, with production somewhat lagging behind comprehension.

While the evidence for aided modeling interventions with learners with ASD is meager to date, for learners who benefit from imitative models as a prompting strategy aided language modeling may be extremely useful. The available published research on aided modeling interventions with learners with ASD has been implemented using low technology communication boards and pictures. Romski and Sevcik (1993) suggested that speech output may aid in comprehension, and included use of an SGD as part of the SAL intervention. Brady (2000) noted that two 5-year-old children, one of whom had a diagnosis of ASD, demonstrated an increase in speech comprehension of objects via use of an SGD; the only time the children heard the names of the objects was with the speech output of the SGD.

Research is required to investigate whether the use of an SGD and speech output is facilitative of improved performance with these interventions with learners with ASD.

With respect to collateral decreases in problem behaviors as a result of teaching functionally equivalent communicative alternatives, it is important to note that functional communication training (FCT) has played an important role in providing an intervention approach in the collateral deceleration of problem behavior concurrent with the implementation of aided communication alternatives (Falcomata, Roane, Feeney, & Stephenson, 2010; O'Neill & Sweetland-Baker, 2001; Volkert, Lerman, Call, & Trosclair-Lasserre, 2009; Wacker et al., 2013; Wu, Mirenda, Wang, & Chen, 2010; see also Chap. 8, in this volume). Other intervention strategies such as the PECS have also resulted in collateral changes. However, as mentioned earlier, an FBA is an inherent part of FCT, but not for PECS. Thus, unless an FBA precedes PECS's implementation, obtaining a collateral deceleration in problem behavior may be less consistently achieved. An FBA involves assessing to identify the function, or purpose, of problem behavior prior to the development of a communication intervention to teach the client to engage in a communication behavior that results in access to an event that meets the client's desire or behavioral function (Durand & Merges, 2001).

By incorporating FCT into AAC intervention approaches, clients' needs are accounted for in regard to addressing problem behavior, which may result in easier access to community settings and decreases in stress to parents and service providers (Durand & Merges, 2001; Heath, Ganz, Parker, Burke, & Ninci, 2015). FCT implemented with aided AAC has been determined to be effective with people with ASD and other developmental disabilities (Heath et al., 2015). There is an overwhelming base of experimental evidence demonstrating the success of FCT in obtaining collateral effects including problem behavior reduction, play, increased academic engagement, and social outcomes (see Chap. 8 for a more detailed discussion of functional analysis of problem behavior and the replacement of problematic forms by teaching more appropriate communicative alternatives). Regardless of the intervention approach utilized, it is important to consider the instructional format that will be implemented. Next, we consider the continuum of general treatment approaches that are available to interventionists.

9.9 Describing Current Issues Involving AAC Instruction: Considering the Range of Discrete-Trial to Naturalistic Approaches

Our experience suggests that often there appears to be somewhat of a dichotomy between proponents of more discrete-trial intervention procedures and more diffusely implemented interventions with fewer controls placed on implementation procedures and the contexts in which intervention is implemented. We believe that

this dichotomy may not be in the learner's best interest. Clearly there are advantages and disadvantages to both approaches. Further, we believe that implementing one approach does not preclude considering or implementing the other as well.

9.9.1 Describing Discrete-Trial Approaches

AAC instructional practices range from adult-directed to learner-centered approaches. Adult-directed instruction often includes discrete-trial techniques that have a behavioral orientation. These strategies are among the best-researched interventions for people with ASD (e.g., Campbell, 2003; Eldevik et al., 2009; Howlin, Magiati, & Charman, 2009). Traditionally, discrete-trial interventions have been adult directed and highly structured with distractions minimized. Often, there is very little time between instructional opportunities. During the early phases of acquisition, each correct response is reinforced with a validated reinforcer. While internal validity is extremely high, it often creates limitations on external validity or generalization unless the interventionist takes special precautions to maximize generalization programming. Thus, given the evidence supporting these procedures (but also their limitations), they should be incorporated within more flexible, naturalistic instruction at the earliest possible point.

9.9.2 Describing Social Pragmatic (Naturalistic) Approaches

Naturalistic AAC interventions take place within contexts and for communication skills that are deemed to be socially valid and necessary for the particular clients and expand on previously-mastered communication skills (Binger & Light, 2007; Light, 1997; Ogletree, Davis, Hambrecht, & Phillips, 2012). Wetherby and Prizant (1993) characterized social pragmatic approaches to intervention as having characteristics that include: use of interactive-facilitative (shaping) strategies; interspersing directedness with following the child's lead; concurrently focusing on a variety of communicative functions in a variety of contexts; emphasis on using multiple communicative modes; use of "real" activities: and tendency to rely on developmental data on acquisition to guide patterns of content selection. Examples of more naturalistic approaches, such as aided language stimulation, allow for blending of behavioral techniques with the implementation of AAC interventions across natural settings and contexts and in combination with a more learner-centered approach. Naturalistic interventions fall under many names, including (but not limited to) milieu teaching, prelinguistic milieu, and enhanced milieu teaching. Several investigators have reported that the use of naturalistic AAC interventions with people with ASD have been effective (Dyches, 1998; McMillian, 2008).

Aided language stimulation, described earlier in this chapter, is one type of naturalistic approach for teaching communication skills (Jonsson, Kristoffersson, Ferm, & Thunberg, 2011). This approach and aided AAC modeling, a similar approach, involve selecting and combining AAC symbols, paired with verbal models (Binger & Light, 2007; Drager et al., 2006; Harris & Reichle, 2004). Additionally, the System for Augmenting Language (also described earlier) involves using an SGD, providing clients with feedback for their communicative attempts, aiding the client in expanding on his or her communication abilities, and providing positive reinforcement (see Romski & Sevcik, 1997).

9.9.3 Transitioning from Discrete-Trial Teaching to a Social Pragmatic Approach

We believe that the most naturalistic AAC interventions may involve a blended approach that incorporates behavioral strategies within natural contexts (Ganz & Hong, 2014), such as those identified as naturalistic developmental behavioral interventions (Schreibman et al., 2015). They may include the following components.

1. Implementation within settings in which AAC skills would naturally be used, such as natural routines and everyday activities, enabling generalization of skills into a range of settings (Light, 1997; Ogletree et al., 2012; Schreibman et al., 2015).
2. Child-led instructional practices, such that instructional episodes are based on activities that motivate the child/client and instruction begins once the client has approached the instructor or initiated communication (Schreibman et al., 2015).
3. Instructors' use of modeling instructional prompts, in much the way that typically developing children learn to communicate by first hearing others modeling language (Binger & Light, 2007).
4. Expansion of current, developmentally appropriate, socially important communication skills (e.g., verbal, AAC, gestures) and involving natural responses and rewards (e.g., naming a toy and receiving it to play).
5. Implementation of behavioral techniques including time delay, positive reinforcement, and prompting (Reichle, Drager, & Davis, 2002) in natural contexts.
6. Inclusion of natural communication partners as key interventionists within the context of active social engagement involving concrete people and items (Schreibman et al., 2015).

Although loosening instruction to include implementation in the most natural environments possible at the earliest possible point during intervention will help to facilitate generalization, there are explicit instructional frameworks that can also be implemented to enhance generalization among learners who have substantial learning challenges.

9.10 Maximizing Generalization and Conditional Use of Newly Established Communicative Alternatives

Conditional communication refers to maximizing a learner's ability to learn when and when not to use a particular communication skill being taught. Determining when to use a newly-taught skill requires that the learner extend the use of a new skill to situations that are still part of the stimulus class that fits the new vocabulary item (appropriate generalization). However, at the same time the learner must refrain from using a newly-acquired vocabulary item in a situation that is part of a different stimulus class. For example, if taught the word "ball", the learner should refer to a variety of objects (basketballs; tennis balls, foot balls) as balls, but should refrain from referring to an apple as a ball. Conditional communication is not only crucial for typically developing people: it is also important for individuals with moderate to severe developmental disabilities (Johnston et al., 2012). The concepts of generalization and conditional use function in opposition to each other to hone and sharpen the appropriate use of communication in context. They function much like opposing muscles that refine movement.

For instance, among individuals who utilize AAC that encompasses natural gestures, manual signs, picture-based communication board, and speech-generating devices, teaching the conditional use of communicative modes in the production of requests, rejections, or comments as a function of speaker and context variables has been advocated (Mirenda & Iacono, 2009; Sigafoos & Drasgow, 2001). For example, a sign which is quick to produce might be appropriate when one wants to communicate as fast as possible with someone who signs, but a slower to emit graphic symbol may be a better choice with a listener who does not sign. Increasingly, translational research has placed the burden on communicators with developmental disabilities to optimize communicative behavior for one's listener rather than relying on a communicative partner to accommodate the speaker (see Johnston et al., 2012). For example, a child who has learned how to request preferred items in which a large proportion of requests have been reinforced during acquisition may increasingly overgeneralize his/her emission of requests to situations in which: (a) the item may not always be readily available, (b) frequent consumption of the item may not be healthy or may interrupt other important daily living activities, (c) the high-rate requests may not be age appropriate; (d) the setting in which the request is made is inappropriate (e.g., asking for a soda during a church service), or (e) the individual who is the recipient of the request makes the request inappropriate (e.g., asking a stranger for money to operate a vending machine).

Existing evidence suggests that people with developmental disabilities who experience significant communicative challenges often have difficulty using newly acquired communicative behavior conditionally (Horner & Albin, 1988; Johnston et al., 2012; Reichle, Rogers, & Barrett, 1984). One challenge in learning to use communicative acts conditionally is that teaching exemplars must concurrently address both stimulus discrimination and stimulus generalization (Chen & Reichle, 2013). Stimulus discrimination refers to responding differently when a

relevant stimulus property is changed while stimulus generalization refers to responding in the same or a similar manner despite changes in irrelevant properties of a stimulus (Cheng, Spetch, & Johnston, 1997). For instance, when a child learns to request help when asked to open a well-tightened container (that he or she is not capable of opening), s/he must also continue to realize that s/he should continue to open a loosened container independently without requesting assistance. Further, the learner must see enough varying examples of each of these two conditions to make reasonable decisions about when to request and when to refrain from requesting.

Unfortunately, an extensive research array suggests that individuals with moderate to severe intellectual disabilities often have difficulty with stimulus generalization (e.g., Haring, 1988; Horner & Albin, 1988; Johnston et al., 2012; Joseph & Konrad, 2009; Turner, Dofny, & Dutka, 1994; Westling & Fox, 2009). Horner, Bellamy, and Colvin (1984) summarized generalization difficulties often exhibited by individuals with developmental disabilities. Some of those that are prevalent among persons with ASD include (a) irrelevant stimuli controlling the target response (e.g., referring to dogs as cats), (b) irrelevant stimuli controlling irrelevant responses (learner calls a Collie a dog but calls a small dog a cat), and (c) restricted stimulus control, meaning that a response that should be under the control of multiple relevant stimuli or multiple characteristics of a relevant stimulus is only controlled by a subset of those stimuli (calling a red apple an apple but not referring to a green apple as an apple). One framework of instruction, which is ideally suited to minimizing generalization errors while maximizing discrimination skills, is general-case instruction. Although it has been used in teaching persons with ASD somewhat sparingly, it represents an excellent instructional logic.

General-case instruction originated from Direct Instruction, a teaching technology founded by Engelmann, Becker, and Carnine (Becker & Engelmann, 1978; Carnine & Becker, 1982). Overall, general-case instruction emphasizes the concurrent implementation of both multiple positive (S+) and negative (S-) teaching exemplars to produce well-differentiated responses between the two types of exemplars and promote the generalization of learned skills to other untrained positive and negative exemplars. Positive teaching examples refer to any teaching example that should produce the target response, while negative exemplars refer to teaching examples that should NOT result in the learner producing the target response. General-case methodology has been utilized to teach many kinds of functional skills such as dressing skills (Day & Horner, 1986), personal hygiene (e.g., Stokes, Cameron, Dorsey, & Fleming 2004), street crossing (Horner, Jones, & Williams,, 1985), vending machine use (Sprague & Horner, 1984), telephone use (Horner, Williams, & Stevely, 1987), and fast food restaurant skills (Steere, Strauch, Powell, & Butterworth, 1990), as well as communication (e.g., Chadsey-Rusch, Drasgow, Reinoehl, Halle, & Collet-Klingenberg, 1993; Horner & Albin, 1988). Most of these studies demonstrated that general-case instruction is more effective in producing generalized effects than single-instance instruction (e.g., Chadsey-Rusch et al., 1993). Additionally, persons with significant developmental disabilities including ASD have often been a focus of general-case instructional strategy implementation.

Regardless of the approach selected to teach augmentative and alternative communication skills, an interventionist must grapple with how dense teaching opportunities must be to make it as easy as possible for any given learner to acquire a new skill. Determining this density falls under the domain of "treatment dosage" and represents an important factor that has been grossly under-addressed in the intervention literature (Parker-McGowan et al., 2014; Warren, Fey, & Yoder, 2007).

9.11 Considering the Importance of Treatment Dosage in Implementing Intervention

Regardless of whether a discrete-trial, more naturalistic, or blended approach is embraced by an interventionist, an important feature of any intervention for learners with significant developmental disabilities is: how much intervention is enough (Baker, 2012a, 2012b)? An inappropriate amount of intervention may have unintended consequences. If implemented more often than it needs to be, an intervention may provide no additional benefit and may divert valuable time that could be used to teach other essential skills. Alternatively, implementation with insufficient intensity may jeopardize skill acquisition, maintenance and generalization (Glogowska, Roulstone, Enderby, & Peters, 2000; Lincoln et al., 1984; Yeaton & Sechrest, 1981). Often overlearning or a more rigorous criterion for acquisition promotes enhanced generalization (see Reichle & Wacker, 2015). The selection of a particular intervention depends on a multitude of variables that include, but may not be limited to: (a) learner profile, (b) time-commitment required by the learner and his/her family, (c) skills targeted by the intervention, (d) setting where the intervention is delivered, and (e) a number of parameters of treatment intensity. Although each of these parameters is important, the focus of this portion of our discussion is treatment intensity and the influence that it may have on intervention outcomes.

Warren et al. (2007) described a framework that defined intervention intensity (see Table 1). They proposed that to accurately compare outcomes across interventions, there must be a common metric describing the intensity of an intervention that a learner experiences. Their framework included four quantitative intensity dimensions: (a) dose, (b) dose frequency, (c) total intervention duration, and (d) cumulative intervention intensity.

Determining the optimal intervention dosage of an AAC intervention is difficult because of the limited evidence on differential outcomes that may be associated with different dosage parameters (Baker, 2012a; Fey, Yoder, Warren, & Bredin-Oja, 2013; McGinty, Breit-Smith, Fan, Justice, & Kaderavek, 2011). The majority of available research has involved dose and dose frequency manipulations of interventions borne out of applied behavior analysis (e.g., Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Eikeseth,

Table 1 Dosage parameters described by Warren et al. (2007)

Dimension of intensity	Warren et al. (2007)	Further operationalized definitions (Parker-McGowan et al., 2014)
Dose	The number of properly administrated teaching episodes during a single intervention session	Dose includes three subcomponents;
		(a) Average number of teaching episodes per intervention session
		(b) the length of the intervention session
		(c) and the distribution of episodes over the session
Dose form	The typical task/activity/context within which the teaching episodes are delivered	The typical setting within which the teaching episodes are delivered
Dose frequency	The number of times a dose of intervention is provided per day and per week	Average number of times a dose of intervention is provided per week
Total duration	The time period over which a specified intervention is presented	Number of weeks during which an intervention is implemented
Cumulative index of intensity	The product of dose × dose frequency × total intervention duration	The product of dose multiplied by frequency of dose and total intervention duration

With permissions from American Speech-Language-Hearing Association (ASHA): Language, speech, and hearing services in schools. Parker-McGowan et al. (2014, pp. 351–364), Table 1

Smith, Jahr, & Eldevik, 2002; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987; Romanczyk, Lockshin, & Matey, 2001; Smith, Groen, & Wynn, 2000). Some of this work is difficult to evaluate in that variables in addition to dosage have been simultaneously manipulated within the comparisons being made. We do know that full disclosure of the treatment dosage parameters outlined by Warren et al. (2007) is rare in empirically based communication intervention work (Parker-McGowan et al., 2014). This results in the question "how do interventionists determine dosage parameters?"

Brandel and Loeb (2011) surveyed almost 2,000 school-based speech language pathologists to determine what factors (i.e., student characteristics, workplace characteristics, or intervention characteristics) influenced their recommendations regarding intervention program intensity. They found that dosage parameters were not regularly monitored. They also found that caseload size, years since graduation, number of years working in a school, and severity of the learner's disability were important variables used to determine intervention intensity. It is possible that for any given intervention, there is no "magic bullet" for dosage. Instead, it may be that dosage is best considered as an evaluation strategy to determine what allocation of time and resources may best serve a learner in a particular curricular area. As such,

it is a decision-making tool. An additional area for future research is the impact of all dosage components on generalization and maintenance of skills.

Fey et al. (2013) explicitly asked the question "is more better?" (p. 679) with respect to milieu teaching intervention. This seems a reasonable question given that some interventions comparing dosage parameters have not controlled for reinforcement or task preference across comparisons of dosage. We hypothesize that more may not always be better, particularly when the learner has limited or modest incentive to persist longer in a task. More carefully controlled research examining the parameters of dosage represents a critical need in the ASD communication intervention literature.

In our discussion here, there may be some oversimplification of issues related to intervention dosage. For example, among more social pragmatic oriented AAC intervention strategies, relying on a learner's lead for some of the teaching episodes may make it difficult to implement a given number of teaching episodes in a session. In addition, the natural environment, such as a loud classroom, may make it more difficult for an interventionist to initiate a predetermined number of teaching episodes or sustain intervention for a set period of time. In spite of the challenges (given the scarcity of research related to dosage), there are a number of directions for future research, including (a) clarification about optimal treatment intensity within learners and across skills, (b) clarification about optimal treatment intensity across learners with similar characteristics, (c) impact of dosage on generalization and maintenance, and (d) the application of dosage parameters to more naturalistic social-communication interventions.

In considering features of a learner's communication system as well as the treatment dosage/intensity and the conditions under which newly taught behavior will be used, it is also important to consider that whatever planning is done is likely to involve parents and other stakeholders who may not be highly trained interventionists. Thus it is important to consider the range of potential interventionists who will be interacting with a learner and the contextual fit considerations that entails.

Implementing instruction in authentic environments is particularly important for learners with ASD in that it places reduced demands on the learners' need to generalize a behavior acquired in a "clinical" setting to home, school, and community environments. To maximize the utilization of authentic environments, a number of interventionists have implemented intervention procedures that utilize parents and siblings as potential interventionists.

9.12 Facilitation of Peer- and Parent-Mediated AAC Instruction

One strategy to enhance the generalization of AAC intervention is to involve family members not only in the planning process but also in the implementation process as well. Because communication is a ubiquitous skill, it is critical to provide supports

for all contexts that a learner will encounter. Investigators have examined AAC implementation with a variety of communication partners. Studies involving parents (see Chap. 11), peers, and school staff as implementers of AAC have indicated that their applications may be as effective as those implemented by highly-trained researchers (Durand, 1999; McMillian, 2008; Nunes & Hanline, 2007; Park, Alber-Morgan, & Cannella-Malone, 2011; Sigafoos et al., 2004; Trottier, Kamp, & Mirenda, 2011).

When involving a range of stakeholders in intervention, care must be taken to plan from the early stages of intervention to ensure that generalization to varied communication partners occurs, as it is unlikely to do so without targeted intervention. Unfortunately, research with natural communication partners, particularly family members, is sparse; if expanded it could prove to have important implications for intervention (Ganz et al., 2013; Hong, Ganz, Gilliland, & Ninci, 2014).

Collaboration with family members as well as the immediate community in which the learner resides involves carefully considering the influence that ethnic, racial and linguistic diversity may have on intervention support needed and provided. Although numbers of Americans with developmental disabilities from culturally and linguistically diverse backgrounds are growing, some populations, such as learners with ASD, are growing very dramatically (Centers for Disease Control and Prevention, 2012). While AAC research focusing on diversity with people experiencing CCN and ASD from such backgrounds is sparse (Boesch et al., 2013; Ganz, Simpson, & Lund, 2012; Seung, Siddiqi, & Elder, 2006; Valicenti-McDermott et al., 2013), some research is reported. For example, bilingual parents of persons with ASD, some of whom had CCN, have noted the benefits of providing bilingual communication opportunities to increase employment and community inclusion opportunities (Kay-Raining Bird, Lamond, & Holden, 2012). Further, because many forms of aided AAC applications have strong iconicity, they may be particularly well suited for this population. Further, picture-based systems may include written translations in two languages, promoting growth in both the home and community languages and providing concrete reinforcement of abstract language concepts (Ganz, Simpson, et al., 2012). Language skills of bilingual children with ASD are no worse than language skills in monolingual children with ASD (Petersen, Marinova-Todd, & Mirenda, 2012); thus, it seems prudent to honor both the language of the family and that of the community when providing AAC interventions for people with ASD.

9.13 Conclusion

In summary, this chapter introduced the concepts related to the selection and implementation of AAC systems. Initially, concepts and terminology related to intentional and non-intentional communicative acts were defined. Second, the two categories of AAC, aided and unaided, were defined as were the continua of systems and strategies within the categories. Advantages and disadvantages of

each of these categories were explored. Third, topics related to the selection of communicative mode(s), functions, and symbols to teach during the early stages of intervention were considered. For example, variables including an individual's communicative repertoire, as well as personal preferences and the targeted communicative function, were defined. In addition, FCT as it relates to potential collateral gains that have been reported in learners who were taught to use augmentative communication systems was elaborated. Fourth, available instructional formats were reviewed along with a call to consider overall intervention intensity and specific intervention parameters of dosage when selecting a format. Finally, we considered generalization and discussed strategies to enhance it.

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Chapter 10
Parent Involvement in Communication Interventions

Hedda Meadan and Deb Keen

Abstract Parents play an important role in facilitating the communicative development of their child. When the child has autism spectrum disorder (ASD), the parental role may change significantly as they may provide detailed assessment information, assist in educational planning and goal setting and for some, become actively involved in implementing interventions. Parent involvement can benefit not only the child but also the parent by reducing stress and increasing parenting self-efficacy. This chapter will investigate parent involvement in communication interventions, considering factors related to family-centered practice and family routines. Challenges for parents and professionals are considered across the lifespan of the individual with ASD.

10.1 Child, Parent, and Family

Family involvement in the development and implementation of interventions for individuals with disabilities is encouraged by educators and professionals, supported by researchers, and required by the USA law (Bruder, 2010; IDEA, 2004). Parents support their child's development in various domains including communication, language, and social skills (Hart & Risley, 1995) they could be considered as their child's first teachers (Kaiser & Hancock, 2003). A child's overall development is supported and influenced by the specific social and cultural contexts in which he or she is nurtured.

Bronfenbrenner (1992) argued that in order to understand a child's development, we must consider the entire ecological system in which the child grows. The ecological system is organized in five subsystems that support the child's development. The subsystems range from microsystems that include the relationship between the child and his or her immediate environment (e.g., family), to the

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macrosystem which includes the overarching cultural context (e.g., belief system, body of knowledge, economy). The family of the child with a disability is at the center of the ecological microsystem. Therefore, to understand the child and to develop an appropriate and effective intervention, the family ought to be involved.

When designing interventions for individuals with disabilities, in addition to exploring the context in which a child develops, it is necessary to examine the family as a whole. Turnbull, Turnbull, Erwin, Soodak, and Shogren (2011) recommended this approach, arguing that understanding family patterns of interaction is necessary to understand a child with a disability, and vice versa. According to Turnbull et al., within a traditional nuclear family there are four major subsystems: (a) the marital subsystem that includes interactions between spouses or significant others who function as marital partners, (b) the parental subsystem that includes interactions between parents and their children, (c) the sibling subsystem that includes interactions among brothers and sisters, and (d) the extended family subsystem that includes interactions among members of the nuclear family and other relatives. Because there are bidirectional relationships among all subsystems and the child's development is related to and influenced by all family members, individuals from each subsystem within the family system should be considered when developing an intervention.

Meadan, Halle, and Ebata (2010) used Turnbull et al.'s (2011) family subsystems framework to review the literature related to stress of and support for families with individuals with ASD. The findings of 57 journal articles were organized in sections with information related to stress and support, including: stress in the marital subsystem; stress in the parental subsystem; stress in the sibling subsystem; coping strategies employed by families; and informal and formal sources of support used by families. Many researchers have reported that parents, especially mothers, of individuals with ASD experience high levels of stress and depression (Falk, Norris, & Quinn, 2014; Keen, Couzens, Muspratt, & Rodger, 2010). The review of literature revealed that parents and families who use a variety of active coping strategies not only experience decreased levels of stress, but also enjoy the benefit of increased family cohesiveness. Meadan et al. highlighted three topics that emerged as critical support strategies to foster the well-being of families with individuals with ASD: (a) quality care and respite services benefitting all family members, (b) informal and formal supports for parents and siblings, and (c) educational programs that offer parents and families access to trained personnel and other services and benefits.

Meadan et al. (2010) reported that most of the research on families of individuals with ASD focuses on the influence of having an individual with ASD on family members' stress and well-being, but suggested that family members' behavior could also have an impact on the individual with ASD and other subsystems within the family. The notion that effects could be reciprocal through bidirectional or transactional (i.e., mutual influences over time) processes was hypothesized, but the authors found only limited evidence for this notion in the literature reviewed. In this chapter we will focus on the parental subsystem, but it is important to consider involvement of other family members, particularly siblings.

Researchers have reported that when parents are involved in their children's interventions, there are better outcomes and when practices are family-centered the services benefit the child, the parents, and the family as a whole (Dunst & Trivette, 1996). A family-centered approach draws from a number of theories, including Bronfenbrenner's (1992) ecological theory described above, together with help-giving theory (Trivette, Dunst, & Hamby, 1996), empowerment theory (Rappaport, 1981) and social support theory (Cohen & Wills, 1985). Central to a family-centered approach is supporting families in their natural care-giving and decision-making roles by building on their strengths as individuals and as a family unit (Brewer, McPherson, Magrab, & Hutchins, 1989).

Family-centered practice involves a set of values, skills, behaviors, and knowledge that recognizes the importance of families in the lives of children. Family-centered planning places the family unit and the strengths, needs, and hopes of individuals with disabilities and their families at the center of service planning, development, implementation, and evaluation (McWilliam, Snyder, Harbin, Porter, & Munn, 2000). According to Dunst and Trivette (1996), family-centered practices have both relational and participatory components. The relational component includes practices associated with good professional skills (e.g., active listening, compassion, respect) and professional beliefs about parenting capabilities and competencies. The participatory component includes practices that (a) are individualized, flexible, and responsive to family concerns and priorities; and (b) provide families with opportunities to be actively involved in decisions and choices and family-professional collaboration. Both relational and participatory practices are highly correlated, directly and indirectly influencing parent self-efficacy, parent well-being, and child development (Dunst, Trivette, & Hamby, 2010).

In the early childhood years, the benefits of family-centered services on child and family outcomes have been well documented (Dempsey & Keen, 2008, in press). Similarly, Kim and Turnbull (2004) argued that person-family interdependent planning (a combination of family-centered planning and person-centered planning) for delivering transition services to young adults with disabilities and their families enhanced the quality of life for both.

10.2 Parent Involvement in Communication Interventions

Many individuals with ASD have deficits and delays in communication skills, and it is estimated that 40 % of these individuals will never develop speech (Sigafoos, Arthur-Kelly, & Butterfield, 2006). Communication competence has been linked to a child's abilities to develop relationships, manage his or her own behavior, and learn from others and the environment. Because of the predictive nature of early communicative competence and what is known about the positive effects of well-designed communication interventions, many interventions focus on increasing the capacity of children with ASD to communicate and respond to the communication

of others. An essential component of communication interventions for individuals with ASD, therefore, is parental involvement, as parents are an essential communicative partner for their child. Parent involvement can facilitate successful integration of language and communication interventions in the home with their children with ASD (Moore, Barton, & Chironis, 2014). As a communicative partner, parents' responsiveness to their child's communication is also critical to language development over time (Siller, Hutman, & Sigman, 2013). Using evidence-based parenting strategies that facilitate responsive communication can help parents to support their children's communication development (Peterson, Carta, & Greenwood, 2005; Stoner, Meadan, & Angell, 2013).

Years of research have demonstrated that the education of children with disabilities can be made more effective by strengthening the role and responsibilities of parents and ensuring that families have meaningful opportunities to participate in the education of their children (Turnbull et al., 2011). Turnbull et al. describe eight major roles that parents play over time, including (a) the source or cause of their child's disability, (b) organization members, (c) service developer, (d) recipients of professionals' decisions, (e) teachers, (f) political advocates, (g) educational decision makers, and (h) partners with professionals. In the past, service delivery practices followed a medical model in which the professionals were the experts who worked directly with the child with ASD. Parents could observe the intervention, but did not participate in it. However, recent practices emphasize active family involvement in their children's interventions.

Parents are key communication partners because they can provide various experiences and opportunities to facilitate communication development for their children (Kaiser, Hancock, & Hester, 1998). Furthermore, the home environment provides a natural context within which children can develop their communicative competence. A significant challenge for children with ASD in developing their communication skills is to be able to generalize these skills to different contexts and communication partners (Durand, Berotti, & Weiner, 1993). Home-based interventions have the advantage of providing a natural context for learning, with parents being a constant communication partner in the child's life and the home being the place where much of this communication occurs.

Parents can learn new teaching strategies and implement them with fidelity (Meadan, Angell, Stoner, & Daczewitz, 2014) and teaching parents to be responsive and supportive of their child's communication development is associated with improved outcomes for the child (Baggett et al., 2010; Dunst & Trivette, 2009; Kong & Carta, 2013). Kaiser and Roberts (2013) describe three specific roles parents can assume in supporting their child's communication development, explaining that "the roles fit along a continuum from most similar to typical parenting roles to most like a systematic interventionist teaching specific language skills" (p. 98). At the more naturalistic end of the continuum, the parent assumes the role of communication partner and as such, teaches communication and language informally using modeling and responding. Moving along the continuum, the next role is one of parent as co-interventionist. In this role, the parent works with the professional while implementing an intervention. The final role is that of primary interventionist whereby the parent implements a systematic teaching strategy.

Parents can move between roles, depending on the needs of the child and on the parents' own skills, preferences, interests, needs and resources. Kaiser and Roberts argue that regardless of the role a parent adopts, education and support from professionals is important.

Although most of the research on parents' involvement in their child's communication intervention focuses on young children with disabilities, parents and the whole family unit can be involved with the child's communication development throughout the life span. Repetti, Flook, and Sperling (2011) state that, in general, family involvement and influence on a child's development is expressed in different ways over the lifetime. There is very limited information about parents' involvement in communication intervention across the life span, but we anticipate the parents' roles and goals will change over time. When children are young, parents might focus on teaching their children, in their natural environments, to communicate their needs and wants and develop relationships with peers and other adults. When children age, parents might focus on teaching communication skills in the community or workplace that could facilitate transition to adulthood, including independent living and employment skills.

10.3 Parent-Mediated Communication Interventions

Parents can be involved in different ways in the development of their child's communication interventions; however, for the purpose of this chapter, we will focus on the role of parents as the primary interventionist, or parent-implemented and parent-mediated interventions. In 2014, Wong and colleagues in the Autism Evidence-based Practice Review Group at the Frank Porter Graham Child Development Institute completed a systematic review of the literature and concluded that parent-implemented interventions are an evidence-based practice for children with ASD. They defined parent-implemented interventions as structured programs in which "parents learn to deliver interventions in their home and/or community," including clinic settings, laboratories, research spaces within large universities, and preschools specifically for children with autism (p. 20).

Parent-implemented or parent-mediated interventions are developed to enhance parents' knowledge and practices to promote their children's development and learning (Barton & Fettig, 2013). The effectiveness of parent-implemented interventions for children with disabilities has been repeatedly reported by researchers (e.g., Kaiser, Hancock, & Nietfeld, 2000; Kaminski, Valle, Filene, & Boyle, 2008; Meadan et al., 2014; Mobayed, Collins, Strangis, Schuster, & Hemmeter, 2000; Roberts & Kaiser, 2011; Schultz, Schmidt, & Stichter, 2011; Smith, Buch, & Gamby, 2000). Lang, Machalicek, Rispoli, and Regester (2009) found that parent-implemented communication interventions have the potential to promote skill generalization and maintenance while also reducing parental stress and increasing quality of life.

For years, researchers have documented the effectiveness of naturalistic teaching strategies in promoting and enhancing communication skills (e.g., Halle, 1982; Hart, 1985; Hart & Risley, 1975; Kaiser & Roberts, 2011). Milieu language teaching that includes modeling, mand-model, time delay, and incidental teaching is a naturalistic teaching program with prodigious empirical support (Hart, 1985; Kaiser & Roberts, 2011). Being competent in the use of these strategies, parents can capitalize on children's interests in an object, event, or activity by using the strategies to teach communication during naturally occurring opportunities. This is particularly relevant to individuals with ASD who are prelinguistic communicators. For these individuals, communicative attempts may be infrequent and communicative behaviors can be idiosyncratic and difficult to interpret (Keen, 2014). Increasing communicative interactions by utilizing the child's interests provides opportunities to shape their communicative behaviors into more intentional and symbolic modes that are more easily understood. This approach to addressing communication holds promise not only for enhancing the communication skills of children with ASD and limited expressive language, but also for improving their quality of life and that of their family members (Meadan, Stoner, & Angell 2015).

An example of a program that aims at improving the communication skills of children with ASD and other developmental disabilities who are prelinguistic communicators is the work of Meadan and her colleagues (Meadan et al. 2015, 2014, in press). The Parent-Implemented Communication Strategies Program (PiCS) was designed to improve the social-communication skills of young nonverbal children with ASD and other developmental disabilities. Parents were taught and coached, in person in their homes, to implement milieu teaching strategies (i.e., modeling, mand-model, time delay and environmental arrangement). After training and in collaboration with the project coaches, parents developed social-communication goals based on their children's home routines (e.g., meal time, free play). Then, parents were coached, in person in their home, two or three times each week until they reached an established performance criterion for implementing each strategy (Stoner et al., 2013). Data were collected on both parent and child behavior during naturally occurring parent–child interactions. The data resulting from piloting the PiCS intervention program were promising: parents learned the new strategies and implemented them with high fidelity. In addition, parents reported that their children's social-pragmatic communication skills improved (Meadan et al., 2014; Stoner, Meadan, Angell, & Daczewitz, 2012).

A logical next step in this line of research was to evaluate the effectiveness of the newly developed in-person PiCS intervention program with additional families. However, it was difficult to implement this program with multiple families over a large geographic area due to its intensity and the in person contact with parents that includes frequent home visits. Issues such as travel time and staffing resources contributed to the costs of implementing this approach with families who were geographically dispersed. Therefore, a new iteration of the program, called i-PiCS (Internet-based Parent-Implemented Communication Strategies Program), was designed to explore the use of Internet technology to train and coach parents (Meadan et al. 2015, Meadan-Kaplansky, Snodgrass, Palomo, & Halle, in press).

Internet-based and computer-mediated interventions have become practical solutions to the barriers associated with home- or clinic-based service delivery by increasing the potential for reaching many individuals and families that need services and support (Wainer & Ingersoll, 2013, 2014). Internet-based interventions are accessible, cost efficient, flexible, and provide structure that promotes treatment integrity (Baggett et al., 2010). In the i-PiCS program, the same intervention package used in the PiCS program was implemented, but all communication between the parent and coach was conducted via online videoconferencing (e.g., Skype). The findings from the pilot i-PiCS program were promising and similar to the findings from the PiCS program that was conducted in-person in family homes.

10.4 Teaching and Coaching Parents

In the past, the concept of coaching was commonly associated with sporting situations; however, recently it has been applied to many different fields including education, counseling, and business. Coaching has been used in early intervention and early childhood education by occupational therapists, physical therapists, and speech-language pathologists to support families of children with disabilities and to facilitate interventions in early childhood programs (Rush & Shelden, 2005, 2011).

Coaching can be implemented to enhance existing practices, develop new skills, and promote self-reflection and learning. Rush and Shelden defined coaching as "an adult learning strategy in which the coach promotes the learner's ability to reflect on his or her actions as a means to determine the effectiveness of an action or practice and develop a plan for refinement and use of the action in immediate and future situations" (2005, p. 8). In addition, Rush and Shelden described five key characteristics of coaching: (a) *joint planning*: agreement on the actions or opportunities to practice between coaching sessions; (b) *observation*: evaluation of actions or practices to be used to develop new strategies; (c) *action*: spontaneous or planned events in the natural environment that will allow the coachee to practice; (d) *reflection*: analysis of existing strategies to decide about needed changes; and (e) *feedback*: information provided by the coach to expand the coachee's current level of understanding and practice.

Many researchers have investigated the effectiveness of training and coaching practices and described the essential components of effective training and coaching (e.g., Trivette, Dunst, Hamby, & O'Herin, 2009). In addition, Joyce and Showers (2002), who analyzed research on teachers' training and coaching, reported that when coaching within natural settings was added to training, large gains were seen in knowledge, skills demonstration, and use of the new skills in the natural settings. Joyce and Showers concluded that coaching facilitates the transfer of training by providing targeted support over time. Providing coaching in addition to training can lead to an increase in both the knowledge of the targeted content and the implementation of the skills.

Although many researchers have investigated effective training and coaching practices, there is limited information about the contexts in which these activities occur and the influence of these contexts on the effectiveness of the training and coaching efforts. Meadan et al. (in press) described a framework for training and coaching programs that can guide researchers and professionals when they develop and implement training and coaching programs. The Training and Coaching Contexts Framework is guided by three questions that are linked to decisions that need to be made: (a) *who* will provide the training/coaching, (b) *where* will the training/coaching take place, and (c) *how* will the training and coaching be delivered to the recipients. These questions and associated decisions must be made about both the training and the coaching program models (see Fig. 10.1).

Who Researchers or service providers (e.g., teacher, speech therapist) who are trained in the program procedures can deliver training and coaching to the parents. Alternatively, training can be completed independently through the use of prepared materials, such as online training modules or instructional videos; this option, however, is only available for training, as coaching, by definition, always requires interaction and collaboration with at least one other person.

Where Training and coaching can be delivered in (a) authentic settings that the parents already access and in which they will apply the target skills, such as home and community settings; or (b) controlled settings that are structured for the intervention, such as clinic or therapy room.

How Training and coaching can be delivered to an individual or to a group of parents either in person or from a distance through the use of technologies, such as online videoconferencing or modules, telephone calls, or videos. A combination of in-person and distance training and coaching is also an option. If interventionists choose to provide training and/or coaching from a distance, they must then determine if the training and/or coaching will be delivered synchronously or asynchronously. That is, they must determine if the trainer/coach will deliver services live and in real time to the recipient (i.e., synchronously) or if the services will be

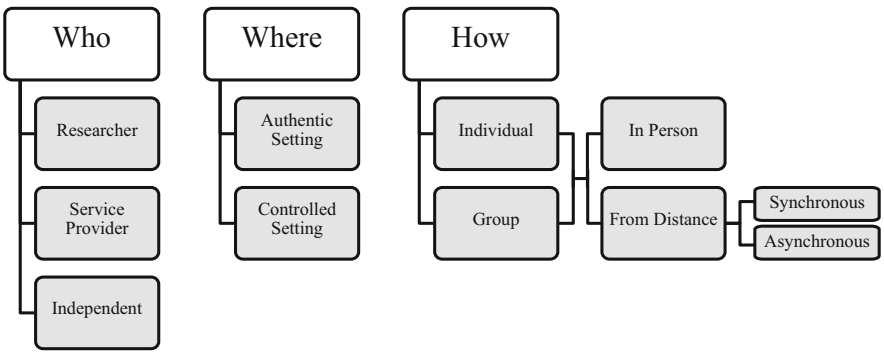

Fig. 10.1 Framework for training and coaching programs

delivered via a prerecorded or programmed venue, such as a training video or online modules (i.e., asynchronously).

Meadan et al. (in press) reviewed 40 studies that included parent-implemented communication interventions and identified the contextual features (i.e., who, where, how) under which training and coaching occurred. The reviewed studies included different combinations of the contexts described in the training and coaching models framework. Almost half of the researchers engaged service providers in delivering training (44 %) and coaching (42 %) to the parents. In addition, many of the researchers selected authentic settings to conduct training (39 %) and coaching (42 %).

Although a majority of the articles provided sufficient documentation of the contextual features, Meadan et al. (in press) reported that some researchers failed to include sufficient information to clearly identify the contexts in which they provided training and coaching. Clearly identifying the contexts in which programs are delivered is critical to the successful replication of research findings and to the establishment of an evidence base for the practice and for translating these research programs into applied practice (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). The authors recommended that researchers include more specific and detailed information about *who* conducted the training and coaching, *where* the program was conducted, and *how* it was implemented, and refer to the Training and Coaching Contexts Framework as a guide.

10.5 Challenges and Implications

We have argued in this chapter that when parents are involved in communication interventions for their children with ASD who are prelinguistic communicators, outcomes for both the child and family can be enhanced. We examined more closely the use of parent-mediated interventions where parents actively implement an intervention directly with their child. There are, however, many challenges for families and professionals when attempting to actively involve parents in their child's communication intervention. These challenges include, but are not limited to, (a) the changing needs of individuals with ASD over time and across different contexts; (b) family characteristics, resources and circumstances and how these may influence the effectiveness of interventions; (c) issues related to offering parent education across contexts, settings, and throughout the lifespan of individuals with ASD; and (d) issues related to the feasibility and practicality of parent-mediated communication interventions.

10.5.1 Changing Needs of Individuals with ASD

There has been a strong research focus on early intervention for children with ASD over the past few decades. Our understanding of early intervention for this population has grown significantly and with it our knowledge of parenting strategies that can support the communicative development of young children with ASD. Many of these strategies employ play-based approaches and joint-action routines to increase the frequency of communicative acts, foster joint attention behaviors and build communicative functions (Green et al., 2010; Rogers et al., 2012).

There has, however, been relatively little research involving adolescent and adult populations (Jang et al., 2014) for whom play-based approaches may no longer be developmentally appropriate. This dearth of research is not only evident in relation to prelinguistic communication development in this older population, but also holds true for the way parents are, or can be, involved in facilitating their child's communication across a range of educational and work contexts. Research is needed to build our knowledge about the developmental trajectories of individuals who have failed to progress beyond the prelinguistic stage of communicative development once they begin school. We know little about patterns of development over the lifespan, whether more intentional and symbolic forms of communication may emerge for some individuals, and if so, what variables may predict or be associated with this course of development. Longitudinal studies that follow children through adolescence and into adulthood may be particularly helpful in this regard. However, to date, longitudinal studies have often relied on standardized language assessments that may not adequately capture or be sensitive to changes in prelinguistic communication development.

10.5.2 Family Characteristics and Circumstances

Parental characteristics can be critical to the development and implementation of effective communication interventions yet there has been only limited research investigating the relative contribution of these variables. Factors such as parent education level, family income, physical, social and emotional resources, and parent mental health may affect intervention outcomes. For example, Randolph, Stichter, Schmidt, and O'Connor (2011) examined the effects of parental education on the fidelity and effectiveness of Pivotal Response Training (PRT) implemented by caregivers without college degrees. This small-scale study found that two of the three caregiver-child dyads benefited from the intervention. The authors argued that caregivers' level of education may not be as critical to successful implementation of PRT compared with other variables such as consistency of training sessions and other family dynamics. While research has demonstrated that parent-mediated interventions can be effective under certain conditions, the gap between research and real-world practice is significant (McConachie & Diggle, 2007). Research to

identify the relative contribution made by various family-related factors to successful participation of parents in communication-based interventions is needed to ensure the effectiveness of parent-mediated intervention in the community. In addition, research is needed to identify proximal and distal outcomes of communication interventions for children, parents, and families.

10.5.3 Providing Parent Education

There has been wide-scale adoption of family-centered approaches in the provision of early intervention services for children with ASD. Fundamental to these approaches is that parents are partners with professionals in facilitating their child's development and this has led to funding for parent education programs and parent-mediated interventions in children's early years. Once the child enters school, family-centered philosophy is generally evident by the importance placed on the home-school partnership; however, service provision tends to become more child focused, prioritizing educational programs for the child within the school context over parent-mediated or home-based interventions. This can be illustrated by considering the individualized education planning (IEP) process where parent involvement is viewed as a central component. Parent training, particularly parent coaching, has been viewed favorably by parents and can assist them to be more involved and satisfied with their child's program (Ingersoll & Dvortcsak, 2006). However, education and advocacy programs that could facilitate parental involvement are few, despite research indicating that the inclusion of parents in the IEP process is often poor (Blackwell & Rossetti, 2014; Ruble, McGrew, Dalrymple, & Jung, 2010). It would appear that parent education and parent-mediated interventions have gained traction in the early years, a period when the young child spends much of his/her time in the family home. Once the child enters school, these parent-focused approaches are no longer given the same priority and this pattern continues through adulthood.

By the time typically developing children reach adulthood, they have generally achieved independence and assumed primary responsibility for meeting their own health, education and employment needs. This often is not the case for many adults with ASD. According to Howlin, Moss, Savage, and Rutter (2013), a large percentage of adults with ASD in their study were socially isolated and had continuing high dependency on aging parents. In this context, parents of adults with ASD may continue to play a key advocacy and support role and their involvement in communication interventions might still be essential to achieving positive outcomes. A key challenge in the future is not only to improve our knowledge and understanding of effective ways to provide parent education and coaching across the lifespan of the child with ASD, but also to secure the necessary resources to enable implementation of these programs.

10.5.4 Feasibility and Practicality of Parent-Mediated Interventions

Although parent-implemented or parent-mediated communication interventions are considered evidence-based practice, there are still many challenges for training and coaching parents and ensuring that the parent implements the targeted teaching skill with fidelity across settings and activities (i.e., generalization) and over time (i.e., maintenance). More research is needed to examine the intensity of parent training and coaching that is required to produce outcomes that are generalized and maintained. Many published studies provide minimal information about both the intensity of the parent training and coaching program and the generalization and maintenance of parents' knowledge and use of teaching strategies. Researchers should evaluate these outcomes to allow for replication and comparison across different intensity levels.

Another issue related to the feasibility and practicality of the intervention is *who* conducts the parent training and coaching program and *where* this training takes place. As described in the Training and Coaching Contexts Framework (Meadan et al., in press), parent programs can be delivered by different people (who), in different places (where), and with different methods (how). In more than half of the studies reviewed in a recent review of the parent training literature (Meadan et al., in press), the researchers implemented the training and coaching; in many other studies, the researchers supported service providers in implementing the programs. More research is needed to explore how newly developed programs can be scaled up and be implemented by service providers, therapists, teachers, and other professionals who are working with parents. In addition, more studies are needed on the use of long-distance, Internet-based programs. Internet-based technology (i.e., telepractice) can help providers reach parents of individuals with ASD across large geographic areas and support parents in implementing communication interventions with thier children of varying different ages and with diverse needs.

10.6 Conclusion

Parental involvement in communication interventions for individuals with ASD who are prelinguistic communicators can enhance child and family outcomes. Positive results are being achieved through parent-mediated interventions, and there have been advances in the use of digital technologies. These technologies are providing new opportunities to consider larger scale implementation of these interventions by addressing potential barriers arising from limited resources and geographically dispersed populations. A number of areas remain under-researched in relation to parental involvement in communication interventions including, but not limited to, the communication trajectories of minimally verbal children with ASD and the role of parents of these children who have reached adolescence and adulthood.

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Chapter 11
Translating Research to Practice in Prelinguistic Communication

Deb Keen, Jessica Paynter, David Trembath, and Kate Simpson

Abstract Implementation of evidence-based intervention practices into every day settings in the community has been a serious challenge for researchers in the field of autism spectrum disorder (ASD). There is general agreement that a gap exists between research and practice and that this must be broached if we are to achieve the best possible outcomes for individuals with ASD. This gap is all too evident in the sub-group of prelinguistic communicators with ASD who may be even more likely to receive experimental approaches as they fail to respond to interventions that have proven effective for other sub-groups of children.

In this chapter, we explore the research-to-practice gaps associated with implementing interventions for individuals who have not progressed past the prelinguistic stage of development. In so doing, we consider the need to support professionals to engage in data-driven decision making and to provide parent and professional education that increases knowledge and use of evidence-based practices. We detail how this alone is insufficient, with unproven and disproven practices persisting in the community, despite research evidence that they are ineffective. The spread of misinformation, particularly via the internet, can be powerful and persuasive and research is needed to better understand how the use of these unhelpful practices can be prevented. Recommendations for future research into the implementation of interventions for prelinguistic communicators with ASD are discussed.

The focus of this book is on prelinguistic communication in ASD, inclusive of individuals who fail to progress beyond this stage of development and remain nonverbal throughout their lives. There has been little research conducted on this particular sub-group.

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11.1 Current Research on Prelinguistic Communicators

A multidisciplinary workshop was convened in 2010 by the National Institutes of Health (NIH) to discuss knowledge about, and research opportunities for, nonverbal school-aged children with ASD (NIH, 2010). The workshop participants discussed three themes: definition, assessment, and intervention. We provide an overview of definitional issues below and then for the remainder of the chapter focus primarily on factors associated with translating knowledge of assessment and intervention practices in the community.

11.1.1 Definition

A significant challenge faced by researchers and clinicians who seek to better understand this population is how to ensure we are actually identifying and describing similar individuals. In general, there seems to be agreement about what is referred to as the prelinguistic stage of development as it relates to children under 5 years of age (see for example Chap. 2 in this volume). However, when children fail to develop functional speech by the time they reach 5 years, a variety of different terms have been applied (Tager-Flusberg & Kasari, 2013). These individuals who remain in the prelinguistic stage of development have been referred to as preverbal, nonverbal, non-linguistic, or minimally verbal.

There appears to be no consistency in use of terminology. This lack of consistency contributes to issues of definition and variability in prevalence rates, and generally undermines efforts to learn more about the characteristics of this sub-group. One of the terms used with increasing frequency is "minimally verbal". To illustrate, we conducted a comprehensive search of the PsycINFO, ERIC, ProQuest Educational Journals, CINAHL, Medline, and SAGE databases for the periods 2006–2010 and 2011–2015 using the terms "autis*", "min* verbal", and "minimally verbal". We included only peer-reviewed articles and excluded studies where minimally verbal language was an outcome measure. The period 2006–2010 yielded only one publication, a case study of the impact of an intervention to enhance the communication and socialization skills of a minimally verbal child with autism (Baharav & Darling, 2008). The period 2011–2015 yielded 18 publications. The lack of publications involving the sub-group of individuals who are minimally verbal prior to 2011 lends weight to the claim that the estimated 30 % of children with ASD who have not developed spoken language by 5 years of age have been the "neglected end of the spectrum" (Tager-Flusberg & Kasari, 2013). It may also reflect a trend in the use of the term "minimally verbal" to identify this particular sub-group of individuals.

To gain further insight into the type of research being conducted with this sub-group, we categorized each of the 18 papers identified through the comprehensive search in the period 2011–2015 according to the three major themes discussed

Table 11.1 NIH workshop themes, publications and book chapters

NIH workshop theme	Publications 2011–2015	Related chapters in this volume
Theme 1: Who are these children? What do we know about their , developmental trajectories?	Haebig, McDuffie, and Weismer (2013a)	Crais & Ogletree (Chap. 2)
	Haebig, McDuffie, and Weismer (2013b)	Braddock & Brady (Chap. 3)
	Norrelgen et al. (2015)	
	Tager-Flusberg and Kasari (2013)	
	Thurm, Manwaring, Swineford, & Farmer (2015)	
	Weismer and Kover (2015)	
	Woynaroski, Yoder, & Watson (2015)	
Theme 2: How can we assess their skills and knowledge across different domains, with special reference to those abilities relevant to language acquisition (e.g., verbal comprehension, sensory and motor skills, apraxia)?	Hartley and Allen (2015)	Trembath & Iacono (Chap. 5)
	Kasari, Brady, Lord, & Tager-Flusberg (2013)	Brady & Keen (Chap. 6)
	Plesa Skwerer, Jordan, Brukilacchio, & Tager-Flusberg (2015)	Sigafoos et al. (Chap. 7)
Theme 3: What treatments/ interventions are effective in improving spoken language and communication in these children (augmentative and non-augmentative methods)?	Allen, Hartley, & Cain (2015)	Shire et al. (Chap. 8)
	Goods, Ishijima, Chang, & Kasari (2013)	Reichle et al. (Chap. 9)
	Kasari et al. (2014)	Meadan & Keen (Chap. 10)
	Mucchetti (2013)	Keen et al. (this chapter)
	Paul, Campbell, Gilbert, & Tsiouri (2013)	
	Schneider and Hopp (2011)	
	Schreibman and Stahmer (2014)	
	Shire et al. (2015)	

at the NIH workshop. The results are displayed in Table 11.1. We also categorized the chapters in the current volume according to each of the three themes (see Table 11.1).

The least researched theme was assessment (three papers) while factors related to definition/developmental trajectories or interventions were reported in seven and eight papers respectively. It is evident that although the number of studies being published has increased in recent years, research involving this sub-group is still in its infancy, leaving many gaps in our knowledge. This contrasts with the volume of research in prelinguistic communicative development for children with ASD under 5 years of age. For example, there has been a great deal of research interest in joint attention skills for children with ASD in the early years (see for example Chap. 3 in

this volume) and this research spans the three NIH workshop themes. Our knowledge base of the prelinguistic period is thus much more expansive in the early years of development for children with ASD. Of course a considerable proportion of these children do go on to develop at least some language. There is clearly a need for ongoing research in the early years but there is also an imperative to increase our knowledge about those children who fail to develop language. It is our intention in this chapter to consider issues of translating research to practice across the lifespan and we will therefore focus primarily on issues of assessment and intervention for the remainder of the chapter.

11.1.2 Assessment

The emergence of techniques including eye-tracking and measures of brain activity have opened up new ways of investigating language development in prelinguistic communicators. Use of these techniques is in its infancy, but the techniques provide a promising line of enquiry for researchers. In practice, however, there seems to be general agreement that our ability to assess prelinguistic communicators with ASD is limited (Kasari, Brady, Lord, & Tager-Flusberg, 2013). The chapter in this volume written by Trembath and Iacono provides an excellent overview of standardized assessments and highlights ways in which clinicians can make use of some of these measures despite their limitations when applied to this particular sub-group. Brady and Keen then go on to review various informal and individualized assessment approaches that can also be useful when profiling the communication skills of prelinguistic communicators. Plesa Skwerer, Jordan, Brukilacchio, and Tager-Flusberg (2015) support this individualized approach, and provide useful information on the assessment of receptive language using standardized tests, eye-tracking, and the use of touch screens. These individualized approaches can help practitioners to assess communicative forms, functions, and spontaneity of social communication and to measure how different interventions affect child outcomes. This is critical in enhancing our understanding of how individual children respond to specific intervention strategies and what intervention approaches will work best for which children. Implementing these assessment practices can be challenging for those working in the community who may lack the knowledge, skills, or time necessary to undertake this type of assessment. We shall return to these issues later in the chapter.

11.1.3 Intervention

Building our knowledge of what interventions work best for prelinguistic communicators with ASD is an important priority for researchers. In Chap. 8, Shire et al. review a large number of social communication intervention studies for

children with ASD under 8 years of age. Child outcomes resulting from many of these interventions were encouraging, with most children showing improvement in skills. While this highlights that the evidence is building in relation to effective interventions targeting social communication, a number of challenges remain for enhancing the language skills of prelinguistic communicators.

First, we need to improve uptake of these interventions in the community and reduce the use of unsupported practices. Numerous studies have found that the knowledge and use of evidence-based practices by parents of children with ASD and professionals working with these children and their families are limited (e.g., Carter et al., 2011; Paynter & Keen, 2015). Furthermore, unsupported and even harmful practices are in use within the community. We examine these issues in more detail shortly. Second, we know that some children with ASD remain minimally verbal, particularly if at least single-word speech has not been acquired by 8 years of age (Pickett, Pullara, O'Grady, & Gordon, 2009). This failure to develop speech occurs for some children despite access to quality early intervention. We need to learn more about this group of children and to investigate new ways of intervening that may reduce the number of children who fail to develop spoken language. In the following section we consider intervention practices supported by research evidence, some of the barriers to their uptake in the community, and the persistent use of unsupported practices with prelinguistic communicators.

11.2 Research to Practice

Research into what works best for prelinguistic communicators has not led to one single best recommended assessment or treatment. This is perhaps not surprising given the heterogeneity in the ASD population, including variability in response to treatment (e.g., Kamio, Haraguchi, Miyake, & Hiraiwa, 2015; Trembath & Vivanti, 2014). Further, strategies found to be effective for other sub-groups may not be effective for this group. As such, clinicians are advised to select interventions using an evidence-based practice (EBP) framework (e.g., American Speech Language Hearing Assocation, 2006; National Autism Center [NAC], 2015; Speech Pathology Australia, 2010). Such a framework is broadly accepted to encompass three elements: using the best available evidence; clinical expertise/judgment; and client values, preferences, and priorities to guide practice (e.g., APA Presidential Task Force on Evidence-Based Practice, 2006; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). However, concerns raised about implementation of EBP in practice (e.g., Drake, Merrens, & Lynde, 2005) may be magnified in this area. These include a lack of consensus regarding the best available evidence and challenges of limited or absent research; a disconnect between practices used in the community and the available research; proliferation of misinformation; potential for professional bias in decision making; and challenges with balancing parental priorities and preferences that may conflict with the evidence base.

11.2.1 Best Available Evidence

There is broad consensus that when available, systematic reviews provide the highest level of evidence, followed by randomized control trials, cohort studies, controlled case studies and so forth (e.g., National Health and Medical Research Centre, 2009). Treatment guidelines for ASD are available internationally and provide broad recommendations for interventions and treatments based on the best available research evidence across the spectrum, but do not give guidelines for prelinguistic communicators. For example the Australian, *Guidelines for Good Practice* (Prior & Roberts, 2012) provide broad recommendations for ASD intervention including using individualized programming, relevant program content, and visual supports. However, they also fail to provide explicit guidelines on what specific interventions or treatments to use, or indeed not to use. In contrast, the NICE guidelines from the UK (National Institute for Health and Clinical Excellence, 2013), although again focusing on ASD broadly, offer some specific guidance on intervention practices to use broadly (e.g., psychosocial treatments) and on treatments not to use (e.g., potentially harmful treatments such as secretin). Such guidelines are helpful in providing general guidance of components of effective interventions, but fail to give fine-grained information on intervention practices.

Systematic reviews of the literature provide more fine-grained analysis of specific practices, although again they focus on the spectrum as a whole. A number of reviews have been released recently including the National Standards Report by the National Autism Center (NAC) (2009, 2015) and reviews by Odom, Wong, and colleagues (Odom, Boyd, Hall, & Hume, 2010; Wong et al., 2013, 2015). To date, no systematic review has focused on prelinguistic communication specifically, but recent EBP reviews (NAC, 2015; Wong et al., 2013, 2015) have included analysis of communication interventions for young children that may be considered in sourcing the "best available evidence," at least for young children who are prelinguistic. There is a clear gap in reviews for older children or adults who have failed to develop spoken language. In the reviews mentioned above, the evidence base for strategies to increase communication as a whole may be included but are not specific to prelinguistic communication. For example, in the area of communication, *pivotal response training* is listed across reviews as having an evidence base for young children (NAC, 2015; Wong et al., 2013, 2015), and would be an appropriate intervention. In contrast, *scripting* is listed in the NAC review as a suitable communication intervention for young children, but requires verbal ability and is unlikely to be suitable to this population. Thus, interpretation of these reviews for this population relies on clinical judgment that should be informed by appropriate assessment of the child, which poses its own challenges as outlined in Chaps. 5, 6 and 7.

A list of practices that may be appropriate to prelinguistic communicators is considered in the two recent major reviews (NAC, 2015; Wong et al., 2013, 2015)[1]

[1] Note: Wong et al. (2013) and Wong et al. (2015) include the same content.

and is overviewed in Table 11.2. It is important to note that not all practices are covered in each review (e.g., time delay, standard echoic training, and language training) and the same practices are sometimes classified differently. As shown in Table 11.2, the NAC has classified some practices as "emerging" (Picture Exchange Communication System, augmentative and alternative communication, and technology-based interventions) that have been classified as EBP by Wong et al. (2013, 2015). These discrepancies can be explained by the use of different classification criteria used in each review. Adding to this confusion, one intervention (joint attention-symbolic play instruction) that is a combination of two EBPs (discrete trial teaching and naturalistic intervention) is classified as having "some support" rather than as an EBP by Wong et al., raising the question of whether combining two EBPs would be considered appropriate. These changing goal posts and questions about combining interventions can be a source of confusion for professionals and parents when selecting and implementing EBPs.

Table 11.2 Intervention practices for prelinguistic communication in NAC (2015) and Wong et al. (2013, 2015) reviews

	NAC (2015)	Wong et al. (2013, 2015)
Joint attention interventions	Established[a]	Classifies "Joint attention –symbolic play instruction" as having some support
Standard echoic training	Established[a]	[b]
Discrete trial training (DTT)	Established[a]	EBP
Time delay	[b]/Established[a]	EBP
Language training (production)	Established	[b]
Modelling	Established	EBP
Naturalistic teaching strategies/ interventions (NI)	Established	EBP
Pivotal response training	Established	EBP
Augmentative and alternative communication devices (AAC)	Emerging	EBP (Technology-aided instruction and intervention)
Imitation-based interventions	Emerging	Some support
Language training (production and understanding)	Emerging	[b]
Picture Exchange Communication System (PECS)	Emerging	EBP
Sign instruction	Emerging	[b]
Technology-based intervention	Emerging	EBP (Technology-aided instruction and intervention)
Reciprocal imitation training	[b]	Some support
Aided language modeling	[b]	Some support
Facilitated communication	Unestablished	[b]

[a]Classed under "behavioral interventions" with joint attention, standard echoic training, and DTT given as examples, time delay is not explicitly mentioned, although arguably it would be classed in this category.
[b]Indicates this practice is not discussed in the review

Adding to potential confusion, most clinical guidelines (e.g., Prior & Roberts, 2012) and reviews (e.g., Odom, Collet-Klingenberg, Rogers, & Hatton, 2010; Wong et al., 2013, 2015) provide information on practices that have an emerging or established evidence base, but fail to highlight those that have been shown not to work. Only the NAC highlights one unestablished practice of relevance to prelinguistic communication, facilitated communication (FC). This practice involves a "facilitator" using physical contact with a body part of a person with a disability (including ASD) to support selection of a symbol (letter, word, picture etc.) on a keyboard or other augmentative and alternative communication (AAC) system, selection that is then interpreted as their communication. Lilienfeld, Marshall, Todd, and Shane (2014) highlight that high quality studies have consistently shown the facilitator rather than the person with the disability to be responsible for the communication. This has been harmful to individuals and their families in some cases, leading to life-altering accusations and court cases. The continued use of this practice, as outlined below, highlights the need to not only improve the evidence base for interventions for this population, but to also discourage and minimize the use of unproven or even harmful practices.

11.2.2 Practices Used in the Community

Little is known about the frequency of use of practices in the community for the prelinguistic population specifically. However, a significant research-to-practice gap is apparent in the field of ASD broadly (e.g., Cook, Cook, & Landrum, 2013; Cook & Odom, 2013) and emerging research suggests this extends to prelinguistic communication. For example, although research suggests generally positive attitudes towards EBP by parents and professionals (e.g., Aarons, 2004; Auert, Trembath, Arciuli, & Thomas, 2012; Stahmer & Aarons, 2009), the continued use of unsupported practices including FC has been found in recent studies (Deyro, Simon, & Guay, 2014; Hess, Morrier, Heflin, & Ivey, 2008; Paynter et al., 2015).

In a study of parent interventions, Deyro et al. (2014) found FC was ranked as the eighth most commonly used intervention strategy by parents, and was used more often than other strategies that have an established evidence base in this area such as joint attention intervention (11th), naturalistic teaching (15th) and pivotal response training (17th). Only 12.7 % of parent participants were aware that FC was ineffective and/or harmful and 66.7 % thought FC was an emerging or established intervention. This is consistent with research with teachers of children with ASD that has found many believe they are using EBPs, when in fact they are not (Stahmer, Collings, & Palinkas, 2005).

Thus, a challenge in translating research to practice is not only disseminating evidence of practices found to be effective, but also discouraging the use of debunked practices and combating misinformation (e.g., beliefs that FC is evidence based). A significant challenge to this is the persistence of FC in academic and

institutional settings (Lilienfeld et al., 2014), as well as the spread of misinformation, particularly via the internet and social media (Hemsley & Dann, 2014).

11.2.3 Challenge of Misinformation

Recent years have seen an explosion in information available on ASD from a range of sources including popular media and the internet. However, this does not necessarily translate to accessibility of high-quality information by all stakeholders as there can be both tangible (e.g., financial, pay-walls) and cognitive (e.g., unintelligible terminology) barriers to access (Trembath, Paynter, Keen, & Ecker, 2016). In contrast, low-quality information including anecdotal information, such as advice from colleagues, may be more accessible and trusted (e.g., Boardman, Argüelles, Vaughn, Hughes, & Klingner, 2005). Further, accessible sources of information such as the internet, social media, and popular media (particularly with a tendency for false balance when there is clear evidence for one side) can easily spread and maintain misinformation (e.g., Clarke, 2008; Scanfeld, Scanfeld, & Larson, 2010). Thus the quality of information accessed, including exposure to misinformation, can influence knowledge translation.

As discussed earlier, even the best available information can be difficult to understand for parents and professionals. In addition to needing the cognitive resources and motivation to seek out this information, limitations in terms of time may mean it is impossible to thoroughly assess available evidence to inform decision making in the real world (Trembath et al., 2016). This can lead to a reliance on poor-quality information that may be easier to understand, seems more plausible, and fits with individuals' worldviews, and may sustain the use of debunked practices such as FC (Trembath et al., 2016). It should also be acknowledged that information is not the only factor that influences choice of intervention strategies in community settings, with parent priorities and professional attitudes also likely to impact on whether information from research translates to practice.

11.2.4 Parent Priorities

It is not surprising that parents want to adopt effective interventions and are interested in EBPs (e.g., Auert et al., 2012). Yet, recent research suggests that parents prioritize other factors (child's individual needs, staff attributes, ASD-specific nature of intervention, intuition) over research evidence when selecting intervention practices for their children with ASD (Carlon, Stephenson, & Carter, 2014). Consistent with this, parents of children with ASD report using a large number of different interventions, many with little or no research evidence (e.g., Carter et al., 2011; Green et al., 2006). Such interventions include FC,

highlighting that this is a problem in the area of prelinguistic communication as well. Thus, it appears that in selecting interventions for their children, parents may consider a range of factors.

Recent research has suggested a behavioral economic viewpoint to understanding parent intervention choices (Call, Delfs, Reavis, & Mevers, 2015). Call and colleagues asked 18 parents to rate their knowledge of treatments and perceived effectiveness. They were then given tokens to distribute, representing allocations of resources to interventions they were currently using or would use if that were viable (e.g., financially). Finally, they were asked to distribute tokens to hypothetical interventions where they were only given information about immediacy of outcome and empirical support. Interestingly, when resources (time, cost) were not an issue parents distributed tokens broadly, but showed a preference for empirical support over immediacy of outcomes. Call et al. interpret these findings in line with a common stock market investment approach. In this way, parents invest most of their resources in the option most likely to produce gains, but also invest a small proportion in "high risk, high reward" options. Such an approach may explain the appeal of so-called "cutting-edge" (as FC was in the 90s) or unsupported (as FC is now) treatments and the continued use of such in the face of supported treatments. This preference for eclecticism by at least some parents may pose a challenge to professionals using an EBP framework who may feel under pressure to honor parent preferences (Trembath et al., 2016).

Call and colleagues' (2015) research is of interest when parents have access to or have sought out the empirical evidence for interventions; however, parents may not actively seek this out and may instead rely on other factors in informing their treatment choices. For example, Auert et al. (2012) conducted a focus group study with parents of children with ASD on their perspective on evidence-based speech-language pathology services. Parents tended to report that their priority was to find experienced clinicians who could engage with their children and showed good communication skills. They also expected speech-language pathologists to use only evidence-based interventions, and few indicated they explicitly sought information on the evidence base of the interventions provided. Similarly, Trembath, Vivanti, Iacono, and Dissanayake (2015) found that professionals reported parents tended to trust their clinical experience and knowledge of evidence and rarely asked for information on the evidence base of interventions provided. Consistent with these findings, in a large survey of 552 parents, almost half (48 %) rated professionals (e.g., their child's therapist) as the most trusted source of information when selecting treatments for their children (Deyro et al., 2014). Thus, professionals play a vital role in bridging the research-to-practice gap in supporting knowledge translation; however, this may be limited by their own knowledge and attitude towards EBP.

11.2.5 Professionals

Given that parents rely on professional's knowledge and use of evidence-based interventions, it is vital they themselves are up to date with the latest evidence. However, this is often not the case. While reviews of the research and treatment guidelines for ASD are freely available via the internet (e.g., NAC and Wong et al. reviews); these may not be widely accessed or read by practitioners. For example, in our Australian study of early intervention practitioners (Paynter & Keen, 2015), we found only 60 % reported having read the Australian *Guidelines for Good Practice* (Prior & Roberts, 2012). Participants instead were more likely to have received information from internal professional development, workshops or training outside the organization, or therapists within their organization, and reported high levels of trust of this information. As discussed earlier, this can bring challenges including promotion of misinformation.

When the "best available evidence" is accessed, it may be difficult to interpret in the context of prelinguistic communication as discussed above in terms of practice guidelines and reviews. Specific information on prelinguistic communication is somewhat limited and is generally published in academic journals not necessarily accessible to practitioners, who may lack the resources (e.g., access, cost, time) or ability to interpret and understand a wide array of information. Additionally, the EBP framework approach requires professionals to have a detailed understanding of an individual's strengths and needs in order to individualize treatment (Volkmar, Reichow, & Doehring, 2011). Limitations of both informal and formal assessments as discussed earlier (see also Chaps. 7, 8 and 9) present additional challenges to identifying these individual strengths and needs.

In addition to challenges with accessing accurate information, practitioners are subject to a range of organizational and attitudinal factors that may affect their use or non-use of EBPs in practice. For example, they may feel EBPs are incongruent with the everyday realities of practice (Kratochwill & Stoiber, 2002) and/or may place more weight on clinical judgement (e.g., Wilson, 1996a, 1996b), posing a challenge to knowledge translation. In our own research we found attitudes towards EBP and organizational factors were significantly linked to reported use of EBPs in early intervention for children with ASD (Paynter & Keen, 2015).

Paynter and Keen (2015) completed questionnaire measures with 99 professional and paraprofessional staff across a statewide early intervention service in Australia. They found that although staff reported attitudes generally supportive of EBP, the use of unsupported practices including FC, albeit less frequently than EBPs, persisted. Perhaps not surprisingly, greater knowledge of EBPs was linked to greater use; however, a range of attitudinal and organizational factors were also linked to levels of use of EBP. This study suggested that greater vulnerabilities to the use of unsupported practices may be found in regional areas, among paraprofessionals (e.g., teaching assistants) as opposed to professionals (e.g., therapists), and when individuals have an attitude that is not supportive of EBP, or perceive their workplace culture does not support EBP.

We found similar results in a follow-up study that collected data across a range of ASD early intervention organizations (Paynter et al., 2015). It is worth noting that participating organizations provided services across the autism spectrum, but did include children with ASD who were prelinguistic communicators. Consistent with the EBP framework, participants reported the child's strengths and needs, family values, professional judgement, and research evidence were somewhat or very important factors to consider in making intervention choices. However, a challenge to knowledge translation may occur, as has been seen in the case of FC when the family values using strategies that are unsupported by evidence.

In summary, there is an increasing amount of research into interventions in ASD; however, there is a need for further study and reviews of interventions specific to prelinguistic communication in ASD. Current reviews consider communication interventions as a whole, rather than linking interventions specifically to the sub-group of prelinguistic communicators. Differences in classification systems between clinical guidelines and treatment reviews may further complicate the decision-making process with apparently conflicting information available between reviews published in the same year. Parents and professionals tend to endorse the EBP framework; however, the use of practices that lack empirical support such as FC persist in the community. Parents tend to trust clinicians to use EBPs, but may value eclecticism in their treatment selection and seek to "hedge their bets" by using a range of practices simultaneously. In the face of limited research for this population, clinicians may struggle to access specific information, and balance what may be competing priorities of parents, limited research, and their own clinical judgment. Knowledge translation may be impeded by the reliance on practitioners who trust anecdotal or less reliable sources of information such as other practitioners, professional development events, and training, and are guided by their own attitudes to EBP and the culture of their organization. Finally, a challenge exists in not only disseminating accurate information, but also dispelling misinformation that is prevalent (e.g., FC, complementary and alternative medicines), particularly in the time of "balanced reporting" and proliferation of information on the internet and social media, and relative silence in treatment reviews on "what not to do".

11.3 Implications for Research and Practice

Given the challenges, how should clinicians, educators, and parents proceed in their efforts to support the learning, independence, and participation of prelinguistic communicators? Clearly, a narrow approach to assessment will be inadequate; relying solely on research evidence to select interventions is problematic; and an assumption that parents and professionals will select only evidence-based interventions would be inaccurate. Instead, the facts presented throughout chapters in this book make the case for the need for a sophisticated, thoughtful, data-driven approach to identifying, understanding, and addressing the communication needs of prelinguistic communicators. The sophistication and thought must come from

human minds – from parents, partners, and professionals who are dedicated to meeting this challenge – working within a framework for scientific decision making.

While "research evidence" is commonly cited as the first central tenet of the EBP framework, Sackett et al. (1996) emphasized the essentiality of *individual clinical expertise*, defined as "the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice" (p. 71). They noted that "Without clinical expertise, practice risks becoming tyrannized by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient" (p. 72). Yet ironically, to date, initiatives to support EBP in the disability field have focused on (a) increasing the amount and quality of scientific research, and (b) making this research evidence accessible, with far less regard to nurturing the development and sharing of clinical expertise. Arguably, all practice is research, or at least can be, with the right training and commitment, enabled by creative thinking and technology.

11.3.1 Practice Is Research

Practicing clinicians and educators, in an ordinary month, may potentially work with more individual clients than there are participants in the largest randomized control trials relevant to prelinguistic communicators. Often, they provide these services to the same clients over a number of years, while intervention trials rarely extend beyond 1 year. Thus, practicing clinicians and educators have the capacity to generate an astonishing amount of knowledge and clinical expertise, for the benefit of their own clients and of other prelinguistic communicators. Capitalizing on the lessons that can be learned from this natural experiment requires clinicians and educators to operate in a deliberate, systematic, and individualized approach with each client, consistent with the recommendations of preceding chapters.

In research, single case experimental designs (SCEDs) are highly regarded designs for evaluating intervention outcomes for heterogeneous populations, such as prelinguistic communicators (Horner et al., 2005; Kazdin, 2011). They involve the experimental manipulation of an independent variable (i.e., the intervention) to examine its effect on one or more dependent variables (i.e., the skills or behaviors we are seeking to increase, decrease, or modify). SCEDs are ideal for testing the safety of new interventions and are thus considered Level 1 (highest) evidence in treatment decision making by the Oxford Centre for Evidence-based Medicine (Howick et al., 2011). That is, they are ideally suited to monitoring the effects of (a) interventions for which there is little or conflicting research evidence (i.e., the majority of interventions for prelinguistic communicators), (b) interventions which are supported by research but which must be delivered in an adapted form due to client factors (e.g., different age group to those studies) or contextual constraints (e.g., decreased intervention intensity due to financial constraints), as well as (c) interventions derived from creative clinician practices that may ultimately

prove worthy of formal research evaluation. Thus, SCEDs provide a framework for consistently and scientifically measuring the effects of an intervention for a particular individual as the basis for data-driven decision making about whether to continue, stop, modify, or switch interventions.

The process of using SCEDs to support clinical decision making when working with prelinguistic communicators (and other clinical populations) involves a series of important steps. First, the clinician or educator works with the client, his or her family, and significant others to identify an intervention goal. For a prelinguistic child, a goal might be to make requests using a symbolic form of communication. For a minimally verbal adult, a goal might be to choose between two real objects (e.g., swimming goggles and movie ticket) to select a preferred recreational activity. The goal needs to identify the specific behavior that will be measured (e.g., handing a picture to an adult to request a preferred snack item; touching the goggles or movie ticket to request the preferred activity) to ensure progress towards achieving it can monitored. Second, an intervention (independent variable) needs to be selected. In the case of the child, and with reference to the key EBP guidelines (NAC, 2015; Wong et al., 2015) the Picture Exchange Communication System (PECS) could be selected. The fact that PECS is classified as "emerging" by the NAC (2015) report, but as "evidenced based practice" by Wong et al. (2015), highlights the imperative to monitor outcomes for each individual client. In the case of the adult, the choice-making intervention could be broadly described as AAC (emerging according to NAC, 2015; EBP according to Wong et al., 2015). Yet here, the exact tailored method used for this client is unlikely to replicate a previous intervention exactly, let alone draw from an unequivocal evidence base, again highlighting the need to carefully monitor his or her response to the intervention.

The third step in using SCEDs is to establish the context in which the intervention will be trialed, and to measure the client's skills before, and after, the intervention is delivered. The measurement prior to intervention is referred to as "baseline", and can occur as soon as the target behavior is identified, while the team is making decisions regarding which intervention to implement. The clinician, educator, parent, or significant other monitors the child's or adult's behavior over time (e.g., each time the opportunity to make the request occurs). Typically, the information is charted on a graph so that the individual's pattern of behavior, before and after the intervention, can be observed. Various experimental design elements and manipulations (e.g., targeting the same behavior across multiple contexts, or multiple goals in the same context), naturalistic reliability and validity checks, and methods for visual and statistical analyses can be incorporated.

While providing training in the application of these elements is beyond the scope of the current text (see Kazdin, 2011), the examples briefly outlined illustrate several advantages of using SCEDs over other methods for assessing outcomes when working with prelinguistic communicators. First, using SCEDs provides an integrated framework for making and documenting clinical decisions, from the point of goal selection during the assessment process (see Chaps. 4 and 5) to intervention selection, implementation, and evaluation. Second, the focus on ongoing monitoring of clinically relevant client behaviors means that the individual's

progress can be observed and discussed, and changes made in a timely fashion, in order to maximize intervention outcomes. Third, unlike the use of pre-post measures that leave uncertainty about whether the intervention or other factors led to change in behavior, SCEDs enable clinicians to account for these other factors (e.g., maturation in young children). Finally, the use of a consistent method for evaluating client outcomes, that is relevant for use with individuals across the lifespan, with individual goals, receiving a variety of interventions, can create a common platform on which clinicians can share information about intervention successes, and otherwise, to improve assessment and intervention practices.

11.3.2 Sharing and Progress

Traditionally, clinicians, researchers, clients, and caregivers have shared information through informal consultations (e.g., colleagues talking, parents talking to other parents), semi-formal meetings (e.g., conferences), and formal publication of data (e.g., research publications). Yet, as noted earlier, the advent of social media and the infusion of technology into practice is opening new pathways for the creation and sharing of information, that will have bearing on future research and practice relating to assessment and intervention for prelinguistic communicators. In some instances, technology will influence, and in some cases re-define, traditional modes of information sharing. For instance, parents and colleagues can now share information through social media rather than meeting face-to-face. The use of webinars and online conferences is reducing financial and geographical barriers to accessing the latest research evidence and practice innovations from around the globe. Traditional paper-based research publications are being replaced with online, in some cases open-access (no cost to view) digital versions. In other cases, technology will create new ways to create and share information, which will open the door to new and possibly more effective assessment and intervention practices.

With regards to assessment of prelinguistic communicators, a seemingly obvious application for existing technology, and the infusion of future technology, is in the assessment of comprehension. In Chap. 6, Brady and Keen outlined how eye tracking, conducted in research settings, has been used to assess speech comprehension in 14 children with ASD. In a separate study, Trembath et al. (2015) examined the relationship between visual attention to AAC and task performance in a group of children with ASD, a number of whom were minimally verbal, during simulated teaching scenarios presented using eye tracking. At the same time, publishers are releasing web-based administration, scoring, and reporting packages for standardized language assessments (e.g., Wiig, Semel, & Secord, 2013), and eye tracking is now a common feature in AAC devices and is anticipated to enter the consumer market within years (Olson, 2014). It takes little imagination to foresee the future integration of these technologies, leading to a portable eye-tracking-based assessment of comprehension skills in prelinguistic communicators,

delivered by a consumer-grade smart phone or tablet PC, with the data automatically scored, stored, and shared with permission on a cloud-based platform.

Similarly, technology is set to further influence, and hopefully enhance, the delivery and evaluation of interventions. Implementing interventions with fidelity is a key challenge to engaging in EBP, and the increasing availability of online video demonstrations of intervention practices, combined with the use of inbuilt cameras to record and then review implementation, bodes well for improving clinician and parent skills in this area. With regard to monitoring intervention progress, automated language sampling and analysis systems (e.g., Language Environment Analysis [LENA]) with automated measures of vocalizations, turn taking, and environmental conditions (e.g., partner communication, noise, television) have the potential to track the emergence of language in children across multiple contexts, and increase the efficiency and coverage of highly ecologically valid language sampling. A logical next step will be for these systems to be integrated into wearable technology, and for automated measurement, analysis, and sharing of language (and other social-communicative behaviors) to be achieved as easily as occurs for exercise data with the advent of wearable fitness devices.

11.4 Conclusion

Taken together, the implementation of a systematic, clinically-relevant approach to monitoring intervention outcomes, combined with new and existing technology, has the potential to improve assessment and intervention practices for prelinguistic communicators. Such approaches are consistent with Sackett et al.'s (1996) emphasis on the importance of *individual clinical expertise* and thus avoidance of "cook book medicine" involving the non-critical selection and use of interventions based solely on their research evidence. After all, as Sacket et al. affirmed:

> External clinical evidence can inform, but can never replace, individual clinical expertise, and it is this expertise that decides whether the external evidence applies to the individual patient at all and, if so, how it should be integrated into a clinical decision. (p. 72)

A positive future for research and practice in supporting prelinguistic communication relies upon the integration of all key elements of EBP, and the thoughtful and creative use of current and emerging technologies. Efforts to support EBP must attend equally to (a) the need for a stronger and broader evidence base, and (b) nurturing the development and sharing of clinical experience. Such an approach is most likely to result in the selection of appropriate goals based on appropriate comprehensive assessment and individualized goal and intervention selection. Indeed, such an approach will ensure measurement of progress towards these goals, to recognize, understand, and celebrate the steps, whether they are big or small, one or many at a time, that each person makes towards greater learning, independence, and participation.

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