

# Chapter 2

## AAC for Individuals with Autism Spectrum Disorder: Assessment and Establishing Treatment Goals

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### Introduction

An area of great interest to clinicians, holding promise with current technology to support the individual with autism spectrum disorder (ASD), is that of augmentative and alternative communication (AAC) as part of a comprehensive intensive treatment approach to address communication needs. Although great strides have been made in the area of technology to support the use of AAC with individuals with communication disorders, the use of AAC with the ASD population is often the least understood by the practicing clinician in terms of efficacy and how to establish a foundation for developing an effective language and communication system that sustains over time. Due to the many behavioral challenges found with ASD, basic pre-linguistic behaviors necessary to benefit from AAC are often overlooked in the early stages of assessment and treatment, and the advanced AAC systems put into place frequently become abandoned due to the lack of engagement with the technology on the part of the individual with ASD, resulting in minimal improvements in functional communication. Despite the challenges that exist when introducing AAC to children or adults with ASD, establishing a foundation for where to begin, promoting successful engagement with the device as a communication tool, and developing a true language system for the child are all attainable goals if comprehensive evaluation of behavior and language are completed prior to the introduction of any AAC device. The remainder of this chapter will focus on evaluation and development of language and communication skills necessary to support the introduction of AAC, emphasizing the introduction of technology to young children with a diagnosis of ASD, although a similar approach can be taken with older adolescents and young adults as well. Given what is known about the plasticity of the brain early in development (Dawson 2008; Helt et al. 2008), and given current

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outcome data related to intensive early intervention with a focus on the functional analysis of behavior and language development (Dawson et al. 2010; National Autism Center 2015), the information presented hereafter related to assessment and establishing treatment goals will be provided using the lens of early intervention to support optimal response to the introduction of AAC. The reader must bear in mind that principles for applying the use of AAC to individuals with autism do not change due to an individual's age, but are best applied early on in development, so as to capitalize on the development of a true language system by targeting key characteristics of behavior and communication that result from neurologic deficits known to be present in the ASD brain. Such deficits may include difficulty with motor planning and coordination of oral musculature to produce oral speech, difficulty with auditory comprehension of language, slow processing of synaptic activity between brain regions resulting in delayed responding or complete lack of response, and difficulty with inhibition of impulsive behavior due to differences in amygdala response and frontal lobe activity (Amaral et al. 2008). It is important to consider these behaviors in the context of implementing AAC in order to increase the response to intervention by merging behavioral intervention with cognitive and language intervention that supports increasing synaptic pathways that facilitate expressive language and potentially, verbal speech production.

Given the heterogeneity of the ASD presenting phenotype, this chapter will examine current technology regarding options available for low-level basic communication needs and explore high-tech options available to address early literacy and social/pragmatic needs for individuals diagnosed with ASD with less impacted language skills, but for whom social pragmatic deficits pose difficulty in more advanced use and understanding of abstract language and socially appropriate behaviors. Recent changes to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition-DSM-5 (American Psychiatric Association 2013), identify individuals with ASD in terms of the level of support needed in an attempt to subtype varying degrees of severity of ASD. As the individual with ASD develops skills, the diagnosis may remain, but the level of support may change over time. An interpretation of "Level of Support" as described under the Autism diagnostic criteria in the DSM-5 may be interpreted by what supports may be needed in the form of physical assistance, medications, and potential AAC, among other interventions. Just as the range of behaviors and needs are varied with the diagnosis of ASD, so are the AAC options to support language and communication, regardless of level of severity on the spectrum.

## **AAC: Defining AAC: Implications for the Application of AAC to the ASD Population**

To fully understand the various types of AAC available and what type of technology may best support the individual with autism, background knowledge about types of AAC and frequently used terminology is helpful in determining the options

that may be available, and those options most likely to offer success in terms of their use with ASD. The American Speech-Language Hearing Association (2014) defines AAC as including "...all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas. We all use AAC when we make facial expressions or gestures, use symbols or pictures, or write." Implied within this definition is the use of conventional forms of communication and abstract language, which poses the greatest challenge to the child with ASD. Given the complexity of the needs and behavioral challenges, when considering the use of AAC with the autism population, the process for assessment should include an inter-professional team with specialized knowledge and skills related to AAC. To offer full potential for successful introduction to AAC technology, in addition to experience with AAC, each member of the team should also hold some degree of expertise in treating individuals with autism, as the unique nature of the associated behaviors requires an understanding of how to address challenging behavior, typical patterns of difficulty related to learning verbal speech and language, and how to incorporate AAC intervention within the broader behavioral program that addresses other developmental domains such as adaptive skills, cognitive skills, and social interaction and play. Effective treatment for speech and language intervention when paired with AAC requires ongoing continuing education and clinical training in terms of knowledge and application of skills that include the use of evidence-based practices (American Speech-Language Hearing Association 2004). Typically, an AAC team serving individuals with ASD includes the clinical psychologist or school-psychologist, the speech-language pathologist, the certified behavior analyst, the occupational therapist, the parent or caregiver, and other special education educators and personnel interacting daily with the child. The speech-language pathologist often will guide development of the treatment goals, given the expertise in the area of language development. Collaboration and consultation among team members is essential to achieve goals related to communication. The complexity of the AAC intervention program is as unique and varied as the individuals identified with ASD and should adapt and change as the individual's needs and skills change. Therefore, collaboration and ongoing dynamic assessment throughout the AAC intervention program is necessary. A foundation of understanding among team members regarding AAC options, AAC terminology, and the current research related to AAC and autism is helpful as teams embark on this aspect of the individual's treatment program.

## **Types of AAC: Unaided and Aided**

There are two primary forms of AAC used with individuals with communication disorders: *unaided* and *aided* AAC. Whereas aided AAC requires the use of adaptive equipment and tools, unaided AAC does not require additional equipment to support the alternative communication use in the absence of verbal speech. The individual uses his or her body to convey messages, ideas, and needs, and this form

of AAC may include sign and gestures. The most commonly used form of unaided alternative communication includes the use of sign language. Although universally accepted as an effective communication tool for the deaf population with an established language system, the use of sign language tends to be less effective in building language for individuals with ASD due to inherent challenges with imitation, difficulty with initiation of communication, and the lack of understanding of sign by the communication partners encountered throughout one's day (Frost and Bondy 2002; National Autism Center 2015). Quite often in cases of ASD, the speech-language pathologist may introduce AAC by supplementing it with the use of simple signs to convey messages to the individual paired with behavioral intervention, such as presenting the signs for "Stop," "More," "Help," and "All done." However, it is important to note that the use of these functional signs would mostly be considered unaided AAC in the form of *gesture, as opposed to sign language*, because these signs are often taught as a way of providing visual support for communication attempts and comprehension of early language forms. The signs are not used to build an expressive language system. Given that the visual modality is often an area of strength for the child with ASD, these simple gestures may be used with repetition when paired with verbal reinforcement to help the child with ASD begin to associate the sound of words with meaning. Therefore, simple signs may be used to supplement initial stages of teaching related to imitation and understanding of abstract language concepts. The emphasis on the gestural aspect of these signs, paired with behavioral reinforcement and verbal speech models are the key components supporting those very early stages of communicative interactions for the individual with ASD and do not support the development of a long-term signing vocabulary or sign language system. The use of unaided AAC in the form of sign language is of little support to the individual with ASD because children with ASD do not follow a typical trajectory for language and cognitive development, which relies heavily on established pre-linguistic behaviors such as imitation, pointing, joint attention, initiating communication with caregivers, and understanding cause and effect (Kaderavek 2011). These challenges related to the use of pre-linguistic behaviors are often accompanied by extreme difficulty expressing wants and needs, resulting in the use of unconventional forms of communication to get needs met, such as screaming, lying on the floor, hitting others, or grabbing objects. Since the child with ASD typically may not possess imitation skills, gestural skills, or a functional emerging language system in the absence of verbal speech, as opposed to infants and toddlers with delayed expressive language, or as with children who are deaf or hard of hearing, when an adult signs to the child with ASD, there is little generalization toward language use.

The most effective form of AAC for children with ASD is the use of aided AAC, relying on visual support in the form of objects, pictures, and video. Based on a review of 389 studies regarding treatment efficacy, the National Standards Report (National Autism Center 2015), considered among ASD research scientists and specialists to be the guiding document for the use of evidence-based practices, identified the use of AAC as an "emerging" treatment, considered to hold positive outcomes for children of all ages and levels of severity on the spectrum. Further

research regarding specific components that support the effectiveness of AAC intervention with the ASD population is still needed to fully understand the critical elements of its use with language intervention impacting long-term outcomes. The current body of the research literature related to AAC and autism is limited in its generalization due to the small samples sizes and the heterogeneity of the samples. However, when paired with intensive interventions utilizing principles of applied behavior analysis, results have been replicated indicating AAC as an intervention holding promise in promoting an increase in expressive language and functional communication (Dawson et al. 2010; National Autism Center 2015).

It is widely understood by clinicians who work with individuals with ASD that often there is a need to provide visual support to improve the child's response to intervention, and that most effective intervention programs include some form of explicit visual teaching (Mesibov et al. 2004; National Research Council 2001; Dawson and Osterling 1997). However, of recent interest in the literature, is what individuals with ASD pay attention to in terms of visual processing, as a way of understanding how best to use AAC. The use of eye-tracking technology is improving our understanding of this aspect of behavior that has a direct impact on outcomes related to AAC intervention (Gillespie-Smith and Fletcher-Watson 2014). In a study by Hernandez et al. (2009), significant differences in visual attending and eye gaze were found in individuals with ASD when compared to controls, with the ASD group demonstrating a lack of visual attention to faces in comparison with objects, reduced fixation toward the eyes, and an increase in observation toward the mouth when viewing human faces. These findings have been replicated (Pelphrey et al. 2002; Riby and Hancock 2009) and offer support for translating this research into the use of AAC, given the heavy reliance on the visual system to benefit from this technology. As children with ASD are acquiring language, often there exists sensory overload in terms of noise, touch, and scent, which impact their ability to process incoming verbal information. fMRI research in the area of audio-visual integration in the ASD brain indicates difficulty with unimodal stimuli, but an increase in cortical activation and connection when individuals with ASD are trained to listen and watch at the same time, thus providing the basis for using visual support in teaching language-based concepts and verbal speech (Williams et al. 2004). Capitalizing on the use of visual support with aided AAC helps the individual with autism increase focus and attention to visual stimuli that may be paired with verbal input to increase the association between abstract language and verbal speech. The additional benefit of aided AAC is that visual stimuli can be adapted to meet the needs of the individual in terms of presentation, such as the use of black and white symbols, line drawings, photos, and even objects if needed.

Aided AAC is frequently the first line of intervention early on as speech-language pathologists' work with children with ASD because of its emphasis on visual support. Whereas it is necessary to determine where to start with AAC and where to go with it in terms of language development, as AAC is implemented with the child with autism, verbal speech may begin to emerge when intervention is paired with some form of visual support. Mirenda et al. (2013) analyzed treatment outcomes for a cohort of 191 Canadian children diagnosed with ASD who had

received intensive early intervention and AAC support, which yielded interesting results regarding the attainment of verbal speech by six years of age. 38.2 % of the children had a baseline vocabulary of 5 words or fewer at the time of initial diagnosis and represented only 10.5 % of children remaining in need of AAC at six years of age. 31.4 % of the children had single words and no phrases and comprised 14.1 % of the low-verbal group at six years of age. These changes represented a collective reduction from 69.4 to 24.6 % of children in need of AAC support, indicating a trend toward acquisition of verbal speech when intensive early intervention had been provided, commensurate with current findings related to early intervention treatment outcomes for programs emphasizing language and behavioral intervention (Dawson et al. 2010). Thus, the AAC may serve as an initial catalyst to teach the abstract language and may be faded out in the intervention process as verbal speech is acquired and an emerging language system is developed. In other cases, the AAC will become a lifelong need, specifically when there is comorbid apraxia of speech or other difficulty with motor planning for speech production, and cognitive deficits. In the former case, consideration for AAC use as an advanced language system including the development of literacy will need to be addressed early in the establishment of treatment goals.

## **Introduction of AAC: Transitioning from Low- to High-Tech AAC Options**

Most clinicians working with individuals with ASD can identify a family or two for whom they recall the parent holding the perception that the promise of an iPad® might be the “window to their child’s voice” and the hope of “opening the door for communication.” Often it may have been perceived that if only they had this high-tech device, everything else would fall into place on its own. Unfortunately, whether it is an iPad®, a Vanguard®, or a GoTalk20®, if assessment is not thorough relative to the pre-linguistic behaviors and unconventional forms of communication currently observed, the outcomes for functional communication and/or verbal speech based on the use of these advanced or high-tech options may be limited. When a thorough, comprehensive evaluation regarding essential pre-linguistic skills is completed, the AAC technology truly does open a whole new world to the child. As assessment is discussed, the reader will have a more thorough understanding of decision-making relative to the use of high-tech AAC options, well beyond knowledge of brands or commonly recognized devices. It is important to establish some preliminary observations relative to the use of AAC in order to establish treatment goals and to determine the capabilities of the child to grow with a device, as well as to match the capabilities of the device over the long term to support the child’s needs.

Given this path of dynamic assessment as a process toward developing functional AAC use, often it is best to initially consider some low-tech options as a way

of measuring the potential for success, in order to put into place some immediate visual support to address behavior and to begin the early intensive teaching process. Low-tech options include the use of picture boards, “Big Mac” buttons that initiate a question or comment, and the use of the Picture Exchange Communication System (PECS, Frost and Bondy 2002). All of these systems are effective for establishing some initial communication and for completing informal observations during evaluation of pre-linguistic communication skills such as demonstration of cause and effect, imitation, joint attention, visual discrimination, and initiations. Low-tech options fail children with ASD when a team has recommended its use and then did not follow through to advance the child beyond these simple forms of communication fairly early on in the treatment program. A plateau will occur and the child will not use the emerging language skills if the AAC does not advance and adapt. When used as part of the initial assessment process and during the early stages of intervention to teach basic skills, low-tech options can be quite productive to establish basic communicative behaviors without the distraction of high-tech devices that often create more intrigue for the child in terms of visual display, noise, and light, resulting in counterproductive behaviors. Although highly motivating to the child with ASD in terms of engagement with these high-tech devices, when introduced too early without establishing the aforementioned basic communicative behaviors, the use of AAC sometimes becomes a behavioral intervention challenge more than a language system intervention. Thus, it behooves the conscientious clinician to begin with low-tech AAC in order to establish baseline behaviors related to functional communication, and then gradually transition to high-tech options as these skills emerge. This approach often does not take much time at all and can be accomplished over a series of 8–10 sessions or a few weeks, if paired with intensive behavioral support.

Before examining the assessment process in more detail, in order to make these difficult decisions regarding device choice, one must have an understanding of the types of technology options available on various devices. Given how much has changed over the past decade or so in terms of the technology, a number of speech-language pathologists and behavior interventionists have chosen to specialize in the area of AAC in order to stay abreast of current technology. The twenty-first century has seen exponential growth in technology options available for AAC ranging from traditional dedicated speech generating devices to the recent cost effective application options available on most operating system platforms which are easily accessible to the general public. Given this technological world we now live in, it is quite common for typically developing children and adolescents in public school settings to be familiar with AAC devices and see their peers using these devices, in comparison with the use of AAC prior to 2000. Therefore, the use of AAC devices within the common population is increasing and widely accepted among society, much like the use of sign language. Just as with other forms of technology, the development of innovative AAC technology options for individuals with communication needs has emerged as an area of economic growth, while also improving quality of life and independence for people with a variety of communication disorders.

## Types of High-Tech AAC Options

The following types of options are available on most high-tech devices and are commonly used terms to describe the capability of AAC systems: *fixed display*, *dynamic display*, *visual scene display (VSD)*, and *speech generating device (SGD)*. In a fixed display option, symbols and messages remain static on the screen after a symbol is selected, therefore nothing changes and images are always present in the same position, regardless of whether a symbol is chosen or not. The use of a fixed display is helpful early in the process of teaching AAC use, especially with children with ASD, because it offers preliminary practice with cause and effect and visual discrimination. The fixed display allows for ease of self-correction for mis-hits, and is fairly easy to use because there are limited navigation challenges, as there are with devices that use dynamic displays. In addition, predictability and routine are intricately connected to the use of the fixed display, as all symbols are always found in exactly the same place; the predictability can be very helpful for the individual with ASD struggling with emotional regulation, because less cognitive demand is placed on expressing wants and needs in the moment when trying to communicate.

By contrast, the dynamic display option offers a great amount of flexibility in terms of access to vocabulary and conceptualization of the vocabulary and tends to offer a more advanced language system feature for developing stronger semantic skills and syntax variability, both skills necessary for developing advanced language and literacy. A dynamic display option changes the screen display once a symbol is selected. For example, by selecting a symbol that looks like an apple, the screen may then open to a new screen with a variety of food options. Therefore, the symbol for apple becomes representative for the category of “foods.” One can see how quickly the cognitive demands change from the fixed display option to the dynamic display option. The person using AAC with the dynamic display option and the example above now must have an understanding of categories, multiple steps related to cause and effect, and reasoning skills to begin to put ideas together, in comparison with the more simplistic process of selecting a picture that holds a one-to-one correspondence with the object or concept, as with the fixed display option. Dynamic displays offer much more in terms of options for the device to evolve as the child’s language development evolves, and therefore they are often used with children for whom there is higher receptive language ability and a need for more complex language use.

Whereas both the fixed display and dynamic display options focus on the use of symbol cells (boxes on the screen with a symbol embedded within each box), which are selected to communicate, VSD options embed pictures of desired objects, needs, and ideas, within visual context. The message is conveyed by selecting an image from a visual scene depicting a picture that includes the communication “symbol” or image, within a scene holding some relevant meaning or context for its use. For example, instead of selecting an icon for “food” such as an apple icon, a bowl of fruit on the table in a picture scene of a kitchen becomes the symbol to select communication messages about food, specifically fruits and vegetables. Emerging



studies in the area of autism research have focused on the use of VSDs and visual processing (Wilkinson et al. 2012). Of critical importance to access the available AAC technology options is the consideration of eye-tracking data cited in studies of ASD to measure attention to the visual stimuli and selection of symbols for communication. In a study analyzing gaze fixation, Wilkinson and Light (2014) found that school-age children with ASD paid visual attention to faces of people embedded within picture scenes, even in the presence of other distracting objects, supporting the use of VSDs with the ASD population. Given the characteristic challenges with eye contact, and a preference of individuals with autism to attend to objects more than faces (Hadjikhani et al. 2004), the focus on objects within an environment that are contextually rich and include “hot spots,” or specific areas of the picture, lends itself very well to supporting the individual with ASD in acquiring language. VSDs tend to be more concrete than isolated symbolic icons and provide a context for using and understanding the language associated with the vocabulary incorporated into the scene (Beukelman and Mirenda 2013). The use of VSDs offers a new format for using AAC with the ASD population and addresses some of the challenges related to the generalization of communication skills to other contexts, since the vocabulary is used within the specific context or setting it would be anticipated to most often be needed.

Regardless of whether or not a fixed display, dynamic display, or VSD option is selected, all of these options can be found in a SGD. The SGD provides voice output as the child selects the picture or symbol to communicate. SGDs provide a verbal model for the individual, reinforcing the use of the word with the symbol as the child uses the SGD to communicate wants and needs. In addition, because the device “speaks” for the child, there is no need for the communication partner to understand a different language system, and the child begins to be reinforced for communication attempts that follow the typical grammatical pattern for using oral language. SGDs are also available in the form of applications on mobile and tablet devices and are therefore cost-effective options for meeting basic communication needs out in the community and in the home with familiar communication partners. In the case of children with ASD who may already possess some verbal ability, the use of the SGD may promote an increase in social initiations and fewer communication breakdowns with unfamiliar communication partners and is emerging in the research as a preferred mode of communication among young children with autism (van der Meer et al. 2012). Furthermore, it is imperative that clinicians explain the relationship between verbal language development and the use of AAC to families when considering AAC as part of their child’s intervention program. Sometimes parents may be concerned that the use of PECS or SGDs may hinder their child’s oral language development. However, the current empirical literature in the area of ASD and AAC use indicates that the use of AAC does not inhibit the development of verbal speech and may, in fact, promote acquisition of verbal speech, if intervention is provided at an intensive rate early in development (Mirenda 2013). Parents can be reassured that the AAC may be used to provide a tool to the child for basic communication and to teach language, and if the child

begins to demonstrate verbal ability, the AAC supplements the use of verbal speech and may serve to foster more advanced verbal language development.

The distinction in AAC as a *tool for communication as opposed to the language system for communication* is essential to the understanding of the strengths and limitations of AAC with the ASD population. The AAC alone does not teach the child language nor does its use suddenly make the non-verbal child verbal and socially engaging. The AAC is the scaffold by which the speech-language pathologist and other specialists support communication to meet daily needs and to help the child benefit from intervention targeting more advanced language use. AAC use focused on basic communication in the absence of explicit, structured language intervention to promote a more sophisticated language system, results in little positive long-term outcomes related to cognitive and academic skills, often resulting in a plateau in terms of progress. Much like tapping into the full range of potential of a complex computer system, without basic knowledge of the underlying language needed to use the AAC, the user does not fully realize its optimal use. If we do not build the child's language system taking a developmental approach, there will be gaps in the child's communicative competence and an unsteady foundation upon which the AAC is being used. It is essential that the technology being used match the child's emerging developmental language level.

## **Primary Areas to Address When Assessing for AAC and Education for the Family**

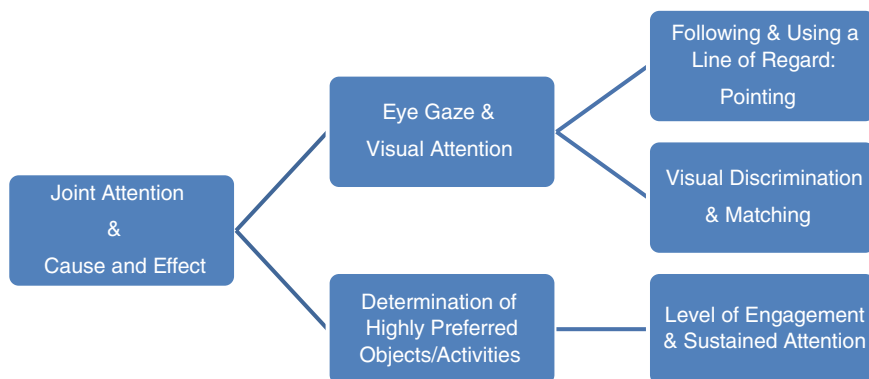
The primary goal of an evaluation for AAC with a child diagnosed with autism should be to fully assess the pre-linguistic behaviors needed to benefit from learning and those skills needed to understand the use of the AAC as a communication tool. The most frequently identified goal for the family of a child with autism is the desire to communicate with their child and understand what the child wants. The impact of the autism diagnosis on the family is unlike that of any other childhood communication disorder, and the use of AAC holds promise for those families. When measuring cortisol levels, Mailick Seltzer et al. (2009) found that the stress level in mothers of adolescents with ASD was comparable to that of combat veterans presenting with symptoms of post-traumatic stress disorder. The constant management of safety needs and intense behaviors due to the lack of communication ability also takes its toll on families. Hartley et al. (2010) examined the divorce rate among parents of children with ASD and found that divorce rate was slightly higher than typical families, falling at 23.5 % regardless of the age of the child, in comparison with a representative sample of parents without a child with ASD, at 13.8 %. There is no doubt the impact of ASD among the general population has risen to a level of public health concern in the USA, as well as across the globe (Centers for Disease Control and Prevention 2014; World Health Organization 2013), with parents looking for that silver bullet to make their child's

life better and to bring a “voice” to their child who can only express himself/herself through unconventional means of communication. Implementation of AAC should be carefully explained to families in terms of its potential to resolve communication challenges, but it should also be emphasized that there will still be the need for intensive language and behavioral intervention to make its use successful.

There is often urgency around providing some form of communication for the individual to express wants and needs, due to the severity of behaviors and due to the intense desire of parents to communicate with their child. Under these circumstances, parents and providers alike sometimes believe if only the child had the means to communicate, everything would be different. In this kind of scenario, often the use of AAC is viewed by families as the means by which the child’s challenges will be solved and the bridge to communication will be established. When implementation of AAC is done well, this may very well be the case; when done out of urgency, without proper consideration of all aspects of the child’s developmental areas, and when monitored by clinicians not familiar with the complexities of the development of linguistic competence, often parents’ hopes of communication and building a relationship with the child may be lost. It is not uncommon for specialists in the area of behavior intervention to propose the use of AAC or even recommend a particular device for the child with autism, without possessing the knowledge and skills related to the complexities of language development. This approach can be problematic when AAC recommendations are given from a behavioral standpoint related to functional communication, as opposed to providing recommendations from a broader developmental standpoint that includes analysis of behavior, adaptive skills, and specific cognitive skills related to the development of language. In order to fully realize the optimal benefit of AAC technology, fundamental pre-linguistic skills and behaviors must be in place to support use of the AAC and careful assessment of these skills will support more successful use of AAC for improving communication and developing language skills.

Prior to learning oral language, typically developing children demonstrate specific skills that are conducive to further developing communicative competence and subsequent oral language which include skills related to object permanence, cause and effect, joint attention, and imitation (Piaget 1953; Kaderavek 2011). Figure 2.1 illustrates a conceptual framework for considering key elements in the evaluation process that includes assessment of fundamental skills and analysis of motivation to use AAC, which should be considered at the initial stages of assessment as part of a comprehensive evaluation for the individual with autism. In addition to cognitive skills, other fundamental skills such as joint attention, eye gaze, engagement with tasks, and visual discrimination are essential to establish a foundation for determining a baseline upon which to begin to build the AAC relative to the child’s developmental level.

Thorough assessment of cognitive ability and pre-linguistic behaviors must be addressed as part of comprehensive assessment, which may also include analysis of



**Fig. 2.1** Fundamental cognitive and behavioral skills to assess during the initial stages of comprehensive AAC evaluation for individuals with ASD

factors related to behavioral reinforcement and motivation. The AAC needs of the individual with ASD are unique when compared to other users of AAC, due to the hallmark deficits in social reciprocity and social communication from a pre-linguistic standpoint. Whereas non-verbal children with other communication disorders such as cerebral palsy, childhood apraxia of speech, and childhood deafness will rejoice in the opportunity to communicate and be “heard,” the child with autism does not see an AAC tool in the same way. Therefore, basic social interaction and non-verbal expressive language skills must be taught first, which is why assessment of fundamental skills early in the process of AAC evaluation is necessary.

In addition to observation and analysis of fundamental communicative skills and behaviors, a forced-choice preference assessment (Fischer 1992) should also be given, to assess the level of reinforcement particular objects or activities may have, so as to offer an initial repertoire of items and activities that may motivate the child to use the AAC. In a forced-choice preference, assessment pairs of objects are presented randomly and the object the child touches first is recorded each time, which results in a percentage of preference of objects relative to others. The power of the reinforcement for each item is also deduced through this process, as the child may select a particular object 100 % of the time, while selecting another preferred object at 75 % of the time, and a “non-preferred” object 0 % of the time. Adding this component to the assessment process is valuable to the clinician posed with the challenge of finding reinforcing items and activities for which the child will communicate. Although parents and familiar caregivers may offer suggestions about preferred items, often there may be a “satiation effect,” in which the items have been used too often in attempts to reduce negative behavior, and therefore, the use of these items as reinforcers, especially to teach new skills, has limited power in terms of increasing motivation.

## The Evaluation Process and Tools for Assessment

Given the heterogeneity of the ASD population, what is the best approach to take in order to assess pre-linguistic skills? Typically, there are a number of standardized language tests, social/adaptive scales, and cognitive tools administered which may confirm a diagnosis of ASD, but these tools provide little valuable information relative to the development of specific language goals and where to begin the treatment process relative to the use of AAC. Most children diagnosed with autism have typically been evaluated using tools such as the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al. 2001), considered the gold standard for sensitivity and specificity for the Autism diagnosis. The Autism Diagnostic Interview-Revised (ADI-R; Le Couteur et al. 2003) may also have been given, providing some picture into the history of the child's development across key developmental domains and specific behaviors, providing useful information relative to acquisition of skills and any regression in skills. The Childhood Autism Rating Scale (CARS; Schopler and Van Bourgondien 2010) is also a typical screening tool used early in the diagnostic process that provides some information related to communication partners and style of communication in terms of gesture and verbal speech. These tools are all essential to diagnose autism and differentiate the disorder from other developmental delays; however, a useful tool to the speech-language pathologist for measuring communicative behaviors in the non-verbal child with ASD is the Communication Matrix© (Rowland 2004). This criterion-referenced tool breaks down very early communication skills ranging from pre-linguistic to abstract language use in four domains identified as the primary reasons for communicating: social interaction, obtain things, refuse things, and seek and share information. This tool breaks down communication into seven stages of language development, which begin at unconventional levels of communication in the absence of symbolic language, building in complexity from pre-linguistic behaviors to abstract language use, including verbal speech. The seven stages of communication measured on the Communication Matrix are outlined in Table 2.1. These behaviors should be observed in more than one setting over multiple observations, with more than one communication partner, in order to identify the most commonly used forms of communication.

Determining these baselines of communication ability allows the speech-language pathologist, together with the family and other team members, to determine stages at which to begin the use of AAC and to establish a path by which the communication system will develop relative to the individual's use of existing pre-linguistic behaviors. Instead of looking primarily at communicative contexts and partners throughout the individuals daily routines, as most other tools for AAC assessment do, this analysis focuses on prerequisite skills needed to communicate with those partners in varying contexts, resulting in treatment goals that facilitate the incorporation of the AAC tool with the use of evidence-based intervention practices such as Pivotal Response Training (PRT; Koegel and Koegel 2006), Early Start Denver Model (ESDM; Rogers and Dawson 2009), or the Social Communication Emotional

**Table 2.1** Summary of seven stages of communication matrix© and observable behaviors

Stage	Form	Symbolic level	Function	Behaviors	PECS phase
I	Pre-intentional behavior	Pre-symbolic without intent	Expresses discomfort, pain, hunger	Vocalizations; facial expressions	
II	Intentional behavior	Pre-symbolic with intent	Expresses interest, pain, hunger, desire to seek out	Vocalizations; eye gaze; facial expressions	
III	Unconventional communication	Pre-symbolic behaviors used to intentionally communicate and considered unconventional because socially unacceptable	Uses behaviors to get needs met; demonstrates an increase in these behaviors when reinforced	Crying; screaming; body movements such as: kicking, hitting, and tugging on others to get needs met	
IV	Conventional communication	Conventional means are used to communicate	Uses communicative initiations and hands and body for interaction	Gesture; nodding or shaking head; looking from object to person; pointing	Phases 1 and 2
V	Concrete symbols	Symbol is physically similar to what is represented: toy teacup for “cup” or “drink”	Initiates communication and one-to-one correspondence with photographs/objects	Pictures, objects given to others to express wants, needs, and ideas	Phase 3
VI	Abstract symbols	Symbolic: may not physically look like the object or idea it represents; e.g., stop sign for “stop”/“all done”	Symbols used one at a time to express ideas	Written words, signs, braille, line drawings	Phase 3
VII <sup>a</sup>	Language	Grammatical rules followed representing abstract concepts	Used in two or three symbol combinations	“I want juice”; “Truck go!”; may be verbal or non-verbal	Levels 4, 5, and 6

Adapted from: Rowland (2004)

<sup>a</sup>Transition to AAC most optimal at communication stage VII and Phase 4 of PECS

Regulation Transactional (SCERTS; Prizant et al. 2006) model to teach the necessary pre-linguistic skills. As previously mentioned, the AAC is the tool, and an evidence-based language intervention will need to be paired with it to yield positive outcomes related to its use. The assessment process within the initial stages of evaluation provides a foundation upon which to establish treatment goals for determining social interaction using pre-linguistic behaviors that promote effective use of the AAC for conventional use of communication and advancement toward more sophisticated development of language. Although the Communication Matrix© is a measure that explicitly describes levels of communication and language, meant to pinpoint where to begin AAC treatment goals, the comprehensive AAC evaluation should also include other measures of adaptive and cognitive tools as well. The reader is referred to Beukelman and Mirenda (2013) for a thorough review of cognitive tools available to supplement the AAC evaluation process, as well as other key features of a thorough AAC evaluation regardless of disability.

As cited previously, often the individual with ASD may begin with AAC to benefit from intensive early intervention, and as the speech-language pathologist works with the child, emerging language begins, often resulting in the use of verbal speech. A second form of dynamic assessment for AAC that may be embedded within the preliminary intervention approach is the use of the Picture Exchange Communication System (PECS, Frost and Bondy 2002), which can be used to observe pre-linguistic behaviors and early emerging skills related to competent AAC use, such as cause and effect, visual discrimination, early syntax use following a developmental sequence for oral speech, and left-to-right correspondence for emerging literacy. As treatment goals are established, the PECS system may be used to introduce the concept of AAC to the child in order to obtain desired items and activities, and to socially interact with others. Frost and Bondy (2002) report that PECS was not designed with an outcome of verbal speech as the goal; however, it is often the case that verbal speech begins to emerge when the PECS system is followed. The PECS system relies heavily on principles of applied behavior analysis, and is considered an emerging evidence-based practice within ASD interventions (National Autism Center 2015). When used with fidelity, the PECS system often results in one of two decision-making outcomes on the part of the clinician: (1) continue language development using the verbal speech modality if verbal speech has emerged or (2) continue language development using a more advanced AAC device once initial behaviors such as initiating, requesting, commenting, visual discrimination, and combining symbols have been observed with the PECS system. PECS is a low-tech AAC tool that facilitates the transition to more advanced AAC options because the system addresses the necessary pre-linguistic skills needed for AAC use and communicative competence through an explicit, sequenced hierarchy, and structured teaching approach. In addition, the key component of PECS that lends itself well to bridging skills for AAC use is the emphasis on initiating communication attempts to others. Without that essential communication skill, an AAC tool will be of little use to the child with autism. Often clinicians or parents may indicate that PECS had been tried in the past, with

no success; however, it is critical to reassess the child's use of PECS taking the strict sequencing and prompting approach outlined in the system, in order to ensure it has been implemented with fidelity before assuming the system "did not work." This process can be done in a very short period of time and lays the ground work for moving the child forward with AAC that is meaningful and predictable following a similar pattern of communication the child had been trained on. Children performing at Phase 4 of the PECS system, which requires putting symbols together independently on a PECS sentence strip and initiating an exchange with a communication partner, should be able to transition to a SGD with little difficulty if the child will physically point to each symbol on a PECS strip as the communication partner reads the message out loud. If the child is not yet pointing, this behavior can be encouraged through physical prompting and positive reinforcement using preferred items and activities paired with verbal modeling (Frost and Silverman-McGowan 2014).

It is of paramount importance that in attempts to create AAC for basic communication needs throughout the child's day that clinicians not inadvertently ignore the development of more sophisticated forms of language as the child demonstrates progress with any AAC device. It is still very important that the team of professionals working with the child consider how the child is using language relative to the sequence of language development observed in typically developing children. Given a critical window for developing language, the reader is encouraged to review Brown's (1973) stages of morphological development in order to understand the complexity of the early developing language system, whether oral- or AAC-assisted. These morpho-syntactic features of language are essential in building and expanding expression and comprehension of language. The AAC must encompass the use of these morpho-syntactic features as part of its design and should allow flexibility in developing the system in accordance with the level of language development the child demonstrates. The speech-language pathologist should be consulted as the AAC system evolves in order to align with the language level of the child as these skills emerge.

## **AAC Tools and Technology Recently Developed to Support Communication for ASD**

As the area of technology is constantly changing, new approaches to its use for AAC will grow in scope, as it applies to autism. By the time of this publication, it is feasible that a number of new developments will have been made, thus a brief overview of existing high-tech tools will be discussed to illustrate the current technology. An emerging area within the realm of augmentative alternative communication and assistive technology includes software programs and apps that capitalize on recent autism research related to visual attention and eye tracking. Innovative technologies to increase the child's response to visual stimuli have



emerged with the promise of promoting increased attention to verbal speech and increased observation of socially appropriate behaviors. Just as in the case of AAC for communication, the use of these therapy tools for teaching oral speech requires that the child possess some basic pre-linguistic skills such as engagement with tasks and activities, joint attention, and initiations before implementing them. Such technology includes apps that focus on the mouth as verbal speech is successively increased through the introduction of phonemes, then to full communication messages, combining two words, then sentences, with a video model to support the teaching process. An example of this technology is the app known as Inner Voice®, which is based on empirical research related to the use of video modeling (Cardon and Azuma 2012; Charlop-Christy et al. 2000; Vivanti et al. 2008) as the basis for the AAC technology. This SGD app not only includes dynamic displays with basic icons for functional communication, but also includes the added feature of a video image of the child producing the verbal message as the message is spoken. Research in the area of video self-modeling indicates that when the child with autism observes him- or herself performing a given behavioral act, as with other forms of video modeling, the likelihood of the child exhibiting the behavior increases (Bellini and Akullian 2006; Wert and Neisworth 2003) when compared to other methods. The Inner Voice® app is also based on emerging research indicating that individuals with autism respond to intervention utilizing avatars, resulting in an increase in social interaction and emotion recognition (Hopkins et al. 2011), providing the rationale for including the option of adding an avatar or character performing the messages if desired. It has been suggested by the makers of Inner Voice® that this app may promote an increase in verbal speech, taking the focus off of the therapist for learning the communication targets, while utilizing highly motivating visual stimuli based on basic research in the area of visual processing and eye gaze in the ASD population. This area of AAC research is relatively new, and although based on empirical evidence to support the approach to gain visual attention and focus, outcomes regarding clinical trials using this specific app have yet to be completed.

Apps based on typical AAC formats and emerging research regarding VSDs are now commonly found. It is important to note that parents are often accessing these communication systems prior to having their child formally evaluated, so it is not uncommon to work with a child with autism who has had some exposure to AAC, albeit with limited structure or explicit teaching involved in the process of introducing the technology. An example of an app available to consumers utilizing a picture cell-based format is the Proloquo2Go® application, available for download on mobile devices and tablets. Proloquo2Go® is a commonly used AAC SGD which has the potential to expand vocabulary and language beyond simple communication messages. Messages are selected from symbol cell page layouts with dynamic displays and can be simplified to as few as 4 cells on a page as the child is learning to use the AAC, to more than 20 cells on a page, as the child's abilities increase. This app is more like other traditional AAC devices in its design and lends itself well to transition from a basic AAC system or low-tech system such as PECS. An example of a current SGD app built on the use of VSDs is the AutismMate®,

designed to incorporate vocabulary within the context of picture scenes, and has the option of traditional cell-based page layouts. Just as with InnerVoice®, the AutismMate® capitalizes on emerging visual processing research and eye gaze data to support the foundation for AAC use and the autism population. For the three examples presented, there are a number of variations of these formats put out by other companies. In addition to apps, there still exist the more traditional dedicated AAC devices, which include the VanguardPlus®, Dynavox®, and the lower-tech, but functionally useful, GoTalk20®. Familiarity with these devices is helpful as device options are discussed. It is also important to bear in mind physical needs of the child, the potential for any damage to the type of equipment being recommended, as well as cost.

Although all of these apps and AAC options hold promise for children with ASD, the technology alone does not replace the need for specialized skill and training in the area of AAC and the need for a comprehensive evaluation of communicative behaviors. As discussed, evaluation of visual discrimination, ability to combine symbols, pointing, and use of communication initiations paired with highly motivating items and activities are necessary before introducing any form of AAC. Given the rate at which technology is evolving, a single app or AAC device by name should not be what is sought out for the child with ASD so much as attention to the evaluation process, to ensure successful transition and use of the chosen device. Additionally, existing research in the area of early intervention and essential components to early intervention programs in terms of long-term outcomes should not be ignored. In a seminal review of research that included the establishment of essential components of effective early intervention programs for ASD, Dawson and Osterling (1997) found that the inclusion of predictability and routine, paired with strong visual support, and parental involvement all yielded more positive outcomes for preschool children with ASD receiving early intervention. These same components should be considered as AAC is introduced to the child with ASD and should include education for the parent regarding treatment goals and rationale for goals, as well as ways in which the parent can promote the use of the AAC in the home through application of behavioral intervention and reinforcement for communication attempts, both pre-linguistic and language-based.

## **Initial Treatment Goals**

Once a thorough assessment has been conducted, initial goals for introducing the AAC technology must be established based on assessment results and goals of the family. Collectively, the team develops initial targets, with the knowledge that AAC intervention with the child with autism is an ongoing form of dynamic assessment, in which the direction of its use will constantly change as the child and communication partners adapt to the AAC system. Although the needs will vary from individual to individual depending upon presenting behaviors, a typical path regarding development of initial treatment goals follows the sequence below:

- (a) Initiating a communicative exchange using a 1:1 correspondence of symbol to object;
- (b) Requesting a preferred item when given a choice of two symbols on the AAC;
- (c) Initiating functional communicative phrases within play routines and daily activities (e.g., “My turn,” “Good morning,” “All done!”);
- (d) Matching vocabulary on the AAC device to objects within categories to build expressive vocabulary (e.g., dress, pants, shoes; truck, car, boat);
- (e) Combining symbols to request (e.g., “red car,” “brown crayon”) and comment (“Truck go!”); and
- (f) Expanding communicative partners and contexts.

The sequence described builds on the use of initiations, visual discrimination, and emerging use of abstract language. An emphasis on building expressive vocabulary helps the individual with autism begin to develop schema that is required in order to use more sophisticated forms of AAC. From a behavioral standpoint, developing goals related to social engagement with others, especially with multiple communicative partners in varied settings, is a critical step in the use of AAC. The child with ASD will quickly learn that the use of the AAC provides a sense of control and predictability, when others respond in the same way to the use of the AAC. Emotions, and basic wants and needs related to self-help, should also be incorporated into the basic vocabulary, but must also be taught in explicit, concrete terms.

Data collection with careful consideration of prompting and fading of cues is also a critical step in the introduction of AAC. The goal is independent use of the AAC, and an increase in the use of pre-linguistic behaviors to support its use without dependence on an adult.

## **Why AAC Often Fails or Becomes Minimally Supportive for Communication**

This chapter provides a framework for developing an evaluation of communication and language needs that is comprehensive and guides the development of initial treatment goals relative to AAC use. Although specific AAC options have been discussed, the options shared are broad-based examples of various forms of AAC currently used with the ASD population and should not be considered exhaustive of all options. The basic premise of thorough evaluation and specific targeting of pre-linguistic behaviors to yield more productive AAC use guides the clinician in understanding why AAC may not be working for the individual with ASD. Lack of success with AAC use may be the result of: (i) introducing the AAC too early or prior to the development of fundamental pre-linguistic behaviors, (ii) lack of intentional sequencing of teaching communicative behaviors and subsequent combination of communication symbols using the device chosen, or (iii) lack of identifying communicative contexts that promote the use of the device with both familiar and unfamiliar communication partners based on daily routines and meeting wants and needs.

When determining the initial stages of developing the communication page layout, one should bear in mind that following a typical sequence for oral language should apply with the AAC as well. For example, teaching the child to point, use single-word vocabulary and one-to-one correspondence with a symbol and object, then begin to combine two “words” or symbols, follows a typical pattern of oral language development in typical children, and allows expansion of language skill in the AAC user. Often this path of acquiring language is ignored by providers, and icons are randomly presented based on preferred objects and immediate needs only. In addition to purposely designing the language capability, the AAC team serving the child with ASD should work to identify and contrive specific opportunities that require the child to use the device and build on success as the child begins to show communicative competence. Beukelman and Mirenda (2013) is an excellent resource for teams seeking out templates to guide the development of these contexts in daily interactions with the AAC user. Attention to behavioral reinforcement should also be considered as AAC is introduced. In the case of autism, often undesirable forms of communication, specifically unconventional means of communication such as screaming or hitting, may be reinforced by others as opposed to differential reinforcement of other behaviors that are more appropriate. In this case, if the AAC is not being used, it is essential that the team analyze the behaviors that are occurring and determine ways to differentially reinforce the desired behavior, which is using the device to communicate, as opposed to hitting or screaming to get needs met. In a case such as this, a functional behavioral analysis (FBA) may be helpful. Last, a common reason the AAC device may not be successful with the child with ASD may be due to the chosen technology, which may not be in alignment with the neurologic behaviors and cognitive ability of the child. Based on this brief review of neuroscience research related to visual processing and analysis of cognitive skills necessary to use various forms of AAC, assessment tools have been referenced to help teams avoid this error. If an advanced AAC option has already been selected by the parent, the supportive clinician may encourage a family to scaffold to a temporary device option that more closely matches the needs of the child as initial goals are developed. In this case, education to the parent, as well as providing a rationale for AAC choice, should be given. Parents should be given training on promoting optimal use of the AAC in the form of hands-on support as the parent interacts with the child, and through the use of video demonstration of interaction with the speech-language pathologist and other communicative partners.

## **A New Era in ASD Intervention and Hope for the Future**

To summarize, thorough evaluation of pre-linguistic behaviors is necessary before implementing AAC, transitioning from low-tech to high-tech options may be prudent in most cases, and consideration of the neural challenges associated with

ASD, such as eye gaze, visual attention, and visual discrimination, should be considered as part of a thorough assessment when introducing AAC technology.

As technology continues to advance in the area of AAC, and as our understanding of the ASD brain evolves, there is hope for meeting the communication needs of this population, and there is hope for the families in relating to their children in new ways. Given the promising preliminary results of early intervention outcome data related to ASD intervention, paired with innovative technological advances for ease of use and access to tools for communication, the next decade offers a new era in ASD research and examination of treatment efficacy related to AAC use. Collaboration among professionals is the key for promoting the most optimal outcomes as AAC is addressed, and operating from the understanding that each discipline offers specific expertise in the ongoing analysis of treatment outcomes related to the AAC use is essential to ensure success.

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