Interventions for Individuals with Autism Spectrum Disorder and Complex Communication Needs

AAC Series

Jennifer B. Ganz
Richard L. Simpson

Series Editors:
David R. Beukleman
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AAC Series

Interventions for Individuals with Autism Spectrum Disorder and Complex Communication Needs

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Interventions for Individuals with Autism Spectrum Disorder and Complex Communication Needs

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Series Preface

The purpose of the *Augmentative and Alternative Communication Series* is to address advances in the field as they relate to issues experienced by individuals with complex communication needs across the life span. Each volume is research based and practical, providing up-to-date information on recent social, medical, and technical developments. Each chapter is designed to synthesize the research related to a specific issue or communication group and to consider implications for practice to improve outcomes for individuals that require augmentative and alternative communication (AAC). To help ensure a diverse examination of AAC issues, an editorial advisory board assists in selecting topics, volume editors, and authors. Prominent scholars, representing a range of perspectives, serve on the editorial board so that the most poignant advances in the study of AAC are sure to be explored.

There are many reasons for maintaining the AAC series, but foremost has been the number and diversity of people who experience complex communication needs and require AAC. AAC needs are not delineated by specific age parameters; people of all ages who have developmental and acquired disabilities rely on AAC. Appropriate interventions for individuals across a wide range of disabilities and levels of severity must be considered. The series is intended to advance research and improve practice in AAC, benefiting many stakeholders including individuals that use AAC and their families, speech-language pathologists, occupational therapists, physical therapists, early childhood educators, general and special educators, school psychologists, neurologists, and professionals in rehabilitative medicine and engineering.

Fundamentally, the field of AAC is problem driven. We, the members of the editorial advisory board, and all professionals in the field are dedicated to solving problems in order to improve the lives of people with complex communication needs. The inability to communicate effectively is devastating. As we chronicle the advances in the field of AAC, we hope to systematically dismantle the barriers that prevent effective communication for all individuals.

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Edited by Jennifer B. Ganz, Ph.D., BCBA-D, and Richard L. Simpson, Ed.D.

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Dr. Ganz is Professor of Special Education at Texas A&M University. She received her doctorate at the University of Kansas, with a concentration in autism spectrum disorder and behavioral disorders and is a Board Certified Behavior Analyst-Doctoral. Her research focuses on the use of technology to improve social-communication deficits in people with autism spectrum disorder (ASD) and other developmental disabilities. Dr. Ganz has worked in general and special education and as an educational consultant; she continues to consult and present in Texas to schools and parents on topics relating to ASD and other developmental disabilities. She has also been a speaker at regional, national, and international conferences on topics including interventions for behavior and ASD, including strategies to address social and communication skills. Dr. Ganz has received several grants to fund research and service projects involving students with ASD and intellectual disabilities and a personnel preparation project for professionals working with children with disabilities. In addition, Dr. Ganz has authored or co-authored numerous articles, books, and chapters.

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Dr. Simpson was Professor of Special Education at the University of Kansas, where he directed numerous University of Kansas and University of Kansas Medical Center demonstration programs for students with autism spectrum disorder (ASD) and other disabilities and coordinated a variety of federal grant programs related to students with ASD and other disabilities. Dr. Simpson also worked as a special education teacher, school psychologist, and coordinator of a community mental health outreach program. He authored numerous books, articles, and assessments on a variety of topics connected to students with disabilities. Dr. Simpson is the former senior editor of the professional journal *Focus on Autism and Other Developmental Disabilities*. His awards include the Council for Exceptional Children Research Award, Midwest Symposium for Leadership in Behavior Disorders Leadership Award, Autism Society of Kansas Leadership Award, and numerous University of Kansas awards and distinguished roles, including the Gene A. Budig Endowed Teaching Professorship of Special Education.

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Volume Preface

Meaningful and functional participation in the human experience requires the ability to communicate with others. Unquestionably, this is true for individuals with complex communication needs (CCN; this terminology is consistently used by all chapter authors to refer to individuals with severe language challenges, including those with minimal and no speech or capacity to use spoken words). In particular, this book focuses on individuals with autism spectrum disorder (ASD). Children, adolescents, and adults with CCN and ASD require specialized, multidisciplinary interventions and supports leading to development of functional communication assets and capacity. Outcomes of strategic and evidence-based communication-focused time and resource investment for individuals with CCN are noteworthy, including enhanced engagement with others, improved school and postschool experiences, increased opportunities for independence, and enhanced quality of life.

This book, an addition to Paul H. Brookes Publishing Co.'s Augmentative and Alternative Communication Series, was inspired and motivated by the need for widescale access to high quality and scientifically supported assessments and interventions for individuals with CCN. Both experienced and neophyte practitioners from multiple disciplines—including educators, speech-language pathologists, other related-service school professionals and staff members, and community professionals—require practitioner-friendly and up-to-date, evidence-supported information and methods they can use with students and clients with CCN. Professionals assigned the critical and demanding responsibility of designing, implementing, and monitoring first-rate programs for individuals with CCN can achieve positive assessment and intervention outcomes as a result of applying the most effective methods. We, as this book's editors and contributors, are hopeful this resource will contribute to the improvement of this significant challenge. We are certainly heartened by our experiences that have time and again demonstrated that individuals with CCN working with multidisciplinary professionals who are knowledgeable and skilled in using appropriate methods and intervention strategies demonstrate significant progress and enhanced positive outcomes.

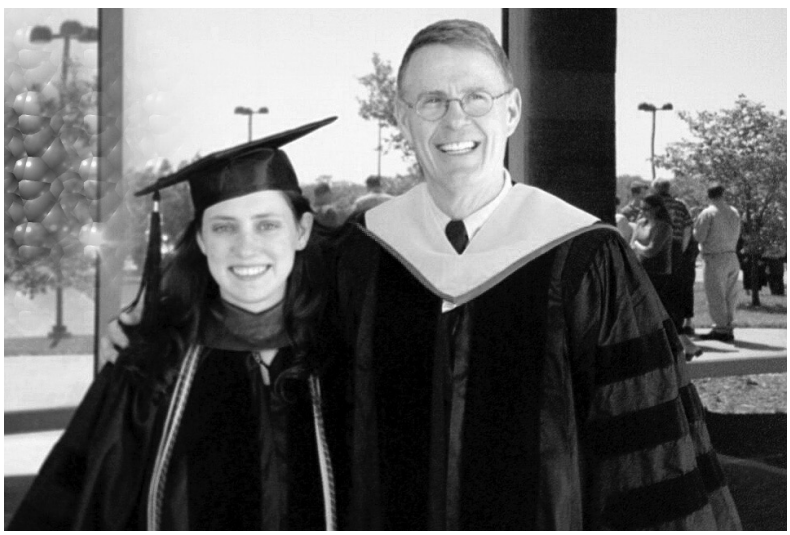
Chapters included in this book were authored by experienced and internationally recognized authorities in speech-language pathology, behavior analysis, and special education. Each chapter contributes to improved understanding of individuals with ASD and CCN and addresses the current CCN "research-to-practice gap" by providing practitioner-friendly information and methods with potential to make positive differences in the lives of individuals with significant communication impairments. Chapter 1 overviews characteristics of children and

adolescents with ASD who have CCN, therein creating a foundation for examining various elements of methods, supports, and interventions in subsequent chapters. Chapter 2 focuses on assessment, with emphasis on collection and analysis of multifaceted and multidisciplinary formal and informal data and related information that informs maximally effective instruction and intervention planning. Chapter 3 examines the state of the science related to the evidence for educational and behavioral interventions linked to improving outcomes for individuals diagnosed with ASD and CCN. Chapter 4 provides an overview of augmentative and alternative communication (AAC), including an examination of various tools and intervention options and their utility with learners with distinctive characteristics. Chapter 5 gives specific attention to "low-tech" AAC options; Chapter 6 concentrates on "high-tech" AAC modes and applications. Chapter 7 examines the communication–behavior connection, with a spotlight on functional communication training. Chapters 8, 9, and 10 address the needs and options for specific age groups: Chapter 8 focuses on early childhood populations, Chapter 9 addresses school-age groups, and Chapter 10 discusses evidence-based practices for older adolescents and adults. Chapter 11 is devoted to naturalistic interventions for individuals with ASD and CCN, in particular the role and capacity of Naturalistic Developmental Behavioral Interventions as elements of effective practice programming. Chapter 12 highlights the crucial role that parents/families and peers of individuals with CCN play in supporting and using communication-enhancement methods and interventions. Chapter 13 offers a comprehensive look at the visual and environmental methods that support the needs of individuals with CCN. Finally, Chapter 14 synthesizes salient content presented by chapter authors along with a research-focused pathway for advancing the capacity of the field to better serve the needs of children, adolescents, and adults with CCN.

This volume is dedicated to Rich Simpson, the co-editor of this book and my first and best academic mentor. Rich was pivotal in my career as an autism researcher and in the careers of countless other academics, service providers, and policy makers. He was a pioneer in the field of special education and autism as an author and researcher; his body of work has helped shape the services provided to children and youth and has greatly advanced the evidence base in autism education research. This book is dedicated as a thank you to Rich for his steadfast support and guidance and enduring partnership. It was his hope, as it is mine, that this book improves the lives of individuals with autism spectrum disorder and their families. It is also my hope that this book extends rather than concludes Rich's legacy.

Rich, my dear friend and colleague, passed away during the final stages of this project. His fingerprints are on every page. He said, in reference to this book, "It is one we'll be proud to claim!" He was right.

—Jeni



Courtesy of Jennifer B. Ganz

4

Overview of AAC for Individuals With Autism Spectrum Disorder and Complex Communication Needs

Pat Mirenda

Manisha is a 12-year-old girl who has autism spectrum disorder (ASD) and limited speech. Despite these challenges, she is a successful communicator both at school and at home. When she wants something that is visible to her, she leads a family member, classmate, or teacher to it and vocalizes and gestures. When she wants something that is out of sight, she points to pictorial symbols in a communication book. When she wants a break from work or needs help with an activity, she uses the manual signs for break and help, respectively. Manisha also uses pictorial symbols for her daily schedule and as a component of her reading curriculum. During recess and lunchtime, she and her friends enjoy using her iPad with an AAC app that allows her to "talk" to her classmates while they look at photos of Manisha and her family engaged in fun activities (like their recent trip to Disneyland). During activities in her classroom, Manisha uses a computer with adapted software for writing because she has difficulty holding and using a pencil. Last but not least, Manisha uses speech to say "hi" when she meets someone, to say "no" when she doesn't like what is happening, and to ask for help ("hep") when necessary.

Because a single AAC technique will *never* meet all of an individual's communication needs, Manisha uses a combination of approaches, depending on the message and context. It is clear that she has been supported by family members and school personnel who understand that her inability to speak does not mean she has nothing to communicate and who have made systematic efforts to provide her with an individualized, multimodal augmentative and alternative communication (AAC) system. In this chapter, the combination of all of the symbols and devices used by an individual is referred to as his or her AAC system.

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WHAT IS AAC?

The term augmentative and alternative communication (AAC) refers to interventions designed to compensate for impairments of both speech comprehension and production (Beukelman & Mirenda, 2013). The word *augmentative* suggests that these interventions can be used to improve upon the effectiveness of communication through existing means (including speech and gestures), whereas *alternative* implies that a person uses systems that temporarily or permanently replace speech.

Why AAC?

Several rationales underlie the use of AAC by individuals with ASD. First, some individuals with ASD have difficulty producing complex motor movements such as those required for speech (Tierney et al., 2015). However, the motor movements required to produce a manual sign or point to/exchange a pictorial symbol are less complex and thus easier to teach than those required for speech. Second, learning to associate a symbol such as a manual sign or picture with a referent may be less demanding than speech in terms of verbal memory and abstract understanding. This may be especially true with regard to pictorial symbols, which require recognition rather than recall memory for accurate production. Recall memory requires a search of one's memory for potential symbols (e.g., manual signs) that convey a particular message, while recognition memory does not require this search because the symbols used (e.g., pictorial symbols on a communication display) are readily visible. Cognitive scientists would argue that discriminations that require recognition rather than recall memory are easier to achieve because fewer cognitive resources are involved (Cabeza et al., 1997). Third, many individuals with ASD show evidence of both auditory processing deficits, particularly for nonspeech stimuli (O'Connor, 2012) and relatively strong visual-spatial skills (Mitchell & Ropar, 2004), the latter of which may facilitate the learning and use of pictorial or text symbols such as photographs or line drawings. In addition, the results of recent research suggest a possible advantage of pictures over spoken words in access to semantics for individuals with ASD (Kamio & Toichi, 2000). Finally, AAC may help to overcome the negative learning history associated with speech production that many individuals with ASD experience as a result of prolonged lack of progress. AAC provides an alternative learning path that can support language, literacy, and sometimes even speech development at the same time as providing a means of functional communication (Beukelman & Mirenda, 2013).

AAC strategies and techniques can be used with individuals with ASD across the range of age and ability. AAC can play an important role in early communication intervention because it provides young children with an immediate way to communicate with their parents and other communication partners until they develop speech. AAC may also decrease the likelihood that problem behaviors will emerge early in life by providing young children with socially appropriate strategies for requesting desired items or activities, escaping or avoiding undesired interactions or events, sharing information, and engaging in enjoyable social interactions and routines (Romski et al., 2009). If functional speech fails to develop,

AAC can be used for ongoing communication interactions by school-age children, adolescents, and/or adults. It can also be used to support language learning and comprehension in individuals with ASD of all ages (Drager et al., 2006; Mirenda & Brown, 2009).

AAC and Speech Development One of the most common concerns expressed by parents and teachers regarding the use of AAC techniques with individuals with ASD is how it is likely to affect speech development. In 2006, researchers reviewed six studies in which AAC intervention involved the use of manual signs (Millar, Light, & Schlosser, 2006). Of the 72 children exposed to manual signs, none showed a decrease in speech production; in fact, those children with good verbal imitation skills showed improved speech production secondary to the introduction of manual signs. These researchers also reviewed 10 studies that involved the use of low-tech AAC systems, such as the Picture Exchange Communication System (PECS; Frost & Bondy, 2002). All of the 167 children involved in these studies showed improvements in either verbal approximations or speech production. Finally, the same authors reviewed two studies in which the AAC intervention involved the use of a speech generating device (SGD; a digital device that "speaks" a message when an individual presses one or more buttons on a display). All nine of the children involved in the SGD studies demonstrated improvements in speech production. In 2009, one of the authors of this review (Millar) updated it with additional studies that involved individuals with ASD. These studies also showed that AAC does not appear to interfere with speech development and, for some individuals, can support speech production.

When considering the potential problems that can develop when children with ASD do not have a means with which to communicate (e.g., problem behavior, loss of learning and social opportunities), it is clear that a wait-and-see approach to AAC intervention can be detrimental (Schwartz & Davis, 2014). Based on current information, it is better to introduce AAC early. Some children may develop sufficient speech and no longer require AAC, some may continue to use AAC along with speech, and some may continue to rely on AAC entirely (Hanson, Beukelman, & Yorkston, 2013). Withholding AAC intervention while waiting for the possibility of speech to develop may result in the child developing additional problems such as problem behavior. Instead, it makes more sense to provide AAC early. This will help the child to communicate with greater ease, thereby reducing frustration.

MESSAGES

Perhaps the most important decision to be made in the selection and design of a multimodal AAC system involves the messages an individual needs to communicate in various contexts. Communicative messages can be divided into four main categories, according to their functions (Light, 1988):

- Wants and needs
- Information sharing
- Social closeness
- Social etiquette

Wants and Needs

Messages that enable a person to communicate about his or her wants and needs are among the easiest to teach and acquire. Young children first communicate about wants and needs when they learn to say, for example, "I want _____"; "Give me _____"; "No"; and "I don't want _____." An AAC system should contain symbols that a person can use to make requests for food, activities, desired items, and people. There should also be symbols that can be used to say "no," ask for a break, ask for help, and ask to be left alone.

Information Sharing

Messages that can be used to share information with classmates, teachers, family members, and others are also important. For example, most parents ask their children, "What did you do at school today?" when they come home after school and then expect a response. In addition, students often have a need to exchange more complicated information, such as when they want to ask or answer questions in class. Symbols that correspond to the vocabulary of academic lessons (e.g., Halloween symbols in October, symbols for animals when learning about mammals) can help children share information and allow them to participate in these types of interactions.

Social Closeness

Often, the purpose of communication is simply to connect with other people for the sake of social interaction. For individuals with ASD, social closeness interactions include those that get the attention of other people; facilitate back-and-forth, conversational interactions; ask partner-focused questions, and allow them to use humor to connect to other people. At least some of the symbols in their communication systems should be related to messages for social closeness (e.g., "Let's go play!" "That was great!" "I like that").

Social Etiquette

Finally, a fourth purpose of communication has to do with the routines for social etiquette that are customary in specific cultures. In North America, for example, people are expected to say "please," "thank you," and "excuse me" in certain situations. It is also considered polite to say "hello" or "goodbye" when meeting or leaving someone and to shake someone's hand if it is offered. Students who rely on AAC need to be provided with symbols that enable them to interact with others in ways that are culturally acceptable and respectful.

Determining which messages of the four types should be included in a communication system for an individual with ASD display can involve a number of simple questions. First, what messages will be used on a regular basis (i.e., daily) or frequently (i.e., several times in a day)? Some examples might include greetings, requests for help, "yes," "no," requests related to basic wants and needs (e.g., bathroom, water, food), and social etiquette messages. Second, what messages will facilitate participation (e.g., information sharing) in family, community, medical, and/or school activities? For example, a student might tell his mother what he did at school today by showing her remnant symbols that are associated with various

activities, such as paper scraps from his art project or the flyer he got at the school assembly. Third, what messages will enable the person to participate in social interactions? For example, a high school student at a pep rally might need a message in his single-switch device that says "Go, team, go!" Individuals of any age might want to talk about their family members, a recent vacation, or favorite topics using a speech-output "app" with photographs on a tablet device. From these examples, it should be evident that AAC communication is a multi-modal endeavor—no single technique or device is likely to meet all of any individual's ongoing, daily communication needs. It might be appropriate to begin by teaching an individual to communicate wants and needs, as these messages are likely to be among the most motivating. However, an AAC communication system must be able to accommodate a sufficiently large number of messages to meet students' social, learning, and other needs as well.

TYPES OF AAC SYMBOLS

Communicating without speech requires the use of symbols that represent messages. A symbol is something that stands for something else; the "something else" is referred to as a referent (Beukelman & Mirenda, 2013). There are two main types of AAC symbols: unaided and aided. Unaided symbols do not require any equipment to produce and include natural gestures, body language, vocalizations, and manual signs (among others). Aided symbols require a device that is external to the individual who uses it, such as a communication book, SGD (including a tablet device such as the iPad), and computer. The following section reviews the most commonly used *unaided AAC* symbols and discusses some of the primary advantages and disadvantages of each.

Unaided AAC: Natural Gestures and Body Language

Before children learn to use speech, they engage in a wide array of communicative gestures. Some of these gestures appear to be natural extensions of other actions. For example, pointing is very similar in form to reaching for something. Others seem to develop as an extension or a pantomime of actions. For example, a child may stop talking when he sees someone place a finger to their lips because he has learned to associate this gesture with the "shhh" sound that means "be quiet." Still other gestures are more formal and, like spoken words, have meanings only within a given culture. For example, in North America, most people know that the "thumbs up" gesture means "that's right," "that's good," or another positive affirmation. Although many gestures involve hand motions, people also use other parts of their bodies to convey messages. In North America, many people shrug their shoulders in doubt, frown in puzzlement, or fold their arms in front of them to indicate displeasure. Perhaps the most familiar gesture involves nodding and shaking the head to mean "yes" or "no."

People use gestures to communicate many types of messages. Perhaps the most obvious is communication about wants and needs. For example, a parent may hold out two toys to a child, say, "Which one do you want to play with?", and expect the child to point to or simply reach toward the desired toy. Similarly, before they are 2 years old, typically developing children learn that they can get help from adults by bringing objects to them. They also learn that they can get people to look

at objects or events of interest by pointing to them. Other gestures, such as waving hi or bye, blowing a kiss, and playing Peekaboo, are used for purely social reasons. Still, they are very important for developing smooth social interactions between friends or between children and adults.

Unaided AAC: AAC systems that do not require external equipment; unaided AAC includes manual sign languages, gestures, and other formal or informal approaches to nonverbal communication.

Why Are Gestures Important? A common mistake in teaching communication skills to children with ASD is neglecting the importance of natural gestures as components of a communication system. This mistake often occurs because many parents and teachers tend to view communication as an "either-or" skill: either the child communicates this way (e.g., with pictures, with an iPad) *or* the child communicates that way (e.g., with gestures)—which, of course, is not the case! Because children with ASD have difficulty learning what communication is all about, it is important to respond to and encourage them to use *all* forms of communication, as long as those forms are understandable and socially acceptable. For example, when Jonathan leads his father to the cupboard to ask for a treat, or when Penny cries after she falls down and skins her knee, they are communicating messages ("I want something" and "Ow! That hurt!") that should be respected and acknowledged.

Encouraging Gestural Production Most children with ASD have difficulty learning to communicate through gestures, at least in part because of their known difficulty with imitation (Rogers, Hepburn, Stackhouse, & Wehner, 2003). However, young children with ASD are likely to benefit from naturalistic interactions that encourage them to use gestures to communicate in the context of motivating routines. An example is the Pat-a-cake game that Jon's dad plays with him every evening before bedtime. Jon and his father sit on the floor facing each other and dad moves Jon's hands through the corresponding motions as he voices the Pat-a-cake rhyme. After he has done this a few times, Jon's dad pauses in the rhyme and waits for Jon to move his hands or indicate with his voice that he wants Dad to continue. When they first started playing this game, Jon did not know what to do and would often just sit there when his dad paused. But little by little, Jon started to use body language and vocalizations during the pauses, and his dad responded right away by continuing the chant. By responding to Jon's behaviors, his dad taught Jon to ask for "more!" Soon, Jon began to pull on people's hands and to vocalize in other situations as well when he wanted "more." This example shows how easy it is to practice using gestures in the context of playful interactions and routines.

Teaching Gestural Comprehension It is important to teach children with ASD to understand gestures as well as to use them. Otherwise, it is difficult to communicate messages efficiently and rapidly in many situations. For example, one important gesture for a child to understand is what we, as interventionists, mean when pointing to something. Usually, we want the child to look at what we are pointing to, at a minimum. Sometimes, we also want the child to retrieve the item

that is pointed out ("Get that"), to put something in the direction we point ("Put it there"), or to remain in the place we point to ("Wait right here"). We usually accompany pointing with verbal directions to clarify the exact message, but the pointing itself is a critical part of the interaction. Similarly, gestures that involve social routines, such as waving goodbye, giving a "high five," or clapping to show approval, are important for the child to understand if communication is to be effective and efficient.

As with gestural production, it is important to teach gestural understanding in situations in which the meaning of a gesture is motivating to the child. For example, Peter likes to stack blocks and knock over the resulting tower and thus enjoys getting each block to complete this task. His mother decides to put all of the blocks in a box except for the first few, to provide a motivating context for teaching Peter to understand what she means when she points. When Peter begins to look for the next block, she points to the box and then immediately taps it with her finger. Peter looks at the box when he hears the tap, lifts the lid, and takes out a block. Over the next several pieces, instead of immediately tapping after pointing, mom gradually increases the delay between the two actions. Over time, Peter learns to respond to her point as a signal to get the next block. This technique can be adapted to teach children to understand other types of gestures as well.

Unaided AAC: Manual Signs

Most people are familiar with the manual sign language systems that are used by people who are deaf. Individuals with ASD who are able to hear but have difficulty understanding and/or producing speech may also use manual signs for both language input (i.e., to support comprehension) and output (i.e., to support production). Manual sign *input* occurs when communication partners use signs in addition to speech to communicate to an individual with ASD. For example, Felicia's teacher speaks at the same time she signs the key words in her message. So, when it is time for lunch, she tells Felicia to "Get your lunch and eat it" while signing GET, LUNCH, and EAT. She does this because Felicia seems to pay attention more readily and follow directions more accurately when she is provided with signed information in addition to speech. Manual sign *output* occurs when an individual with ASD uses manual signs to communicate to others. For example, when Felicia wants to use the computer in her classroom, she asks the teacher to turn it on by signing WANT COMPUTER.

Manual Sign Systems There are several different manual sign systems, all of which involve the use of hand and finger movements (augmented by other body actions) to represent letters, words, or phrases. In the United States and most of Canada, American Sign Language (ASL) is used within the Deaf community for face-to-face interactions; Deaf communities in other countries have their own distinct languages (e.g., Auslan in Australia, Swedish Sign Language in Sweden). Signing Exact English, a manual sign system that codes English word order, syntax, and grammar, is sometimes used in North America as an alternative to ASL. For individuals with ASD, the most common approach involves using manual signs from one or more of these systems to produce short phrases concurrent with speech for the critical (i.e., "key") words in a sentence; this has been referred to as

"total communication" (Casey, 1978). Thus, the spoken sentence "Go get the cup and put it on the table" might involve use of the signs GET, CUP, PUT, ON, and TABLE while the entire sentence is spoken. Interventions combining speech, manual signs, and other AAC techniques are also appropriate, in many cases.

Advantages and Disadvantages of Manual Signs Manual signing was the most commonly used system of communication for people with ASD who relied on AAC in the 1970s and 1980s. A primary reason for this is that manual signs are totally portable and require no external devices to use. However, most parents, teachers, and classmates are not fluent in manual signing, and some individuals with ASD do not have the fine motor/finger dexterity skills that are needed to produce signs accurately. Thus, someone who is familiar with the (often idiosyncratic) manual signs made by a person with ASD has to be available at all times to translate their meanings to unfamiliar communicative partners. This is one of the reasons that manual signing has fallen out of favor as a primary mode of communication for people with ASD.

Another reason that manual signing is now used less than previously is that the extent to which it can be considered an evidence-based practice is a matter of some debate. In a 2006 systematic review, Schwartz and Nye concluded that "there is little compelling evidence that sign language provides substantial improvements in either oral or sign language communication" (p. 15) for individuals with ASD. In contrast, Wendt (2009) reached a different conclusion in his systematic review, stating that, for individuals ASD, "The available body of research on manual signs . . . reveals strong intervention effectiveness scores for symbol acquisition and production, as well as for related outcomes such as speech comprehension and production" (p. 93). Finally, a middle-ground conclusion was reached by the review panel of the National Standards Project (National Autism Center, 2015), who deemed manual signing as an "emerging" intervention that requires additional research before it can be considered evidence-based. At this point in time, there are no clear, empirically validated guidelines to use when making decisions the appropriateness of manual signing, either alone or in combination with other techniques. Regardless, the available evidence suggests that manual signing does not appear to reduce an individual's motivation to speak and may, in fact, enhance it (Millar, 2009).

Aided AAC

Aided symbols can be arranged on a continuum of iconicity, a term that refers to "any association that an individual forms between a symbol and its referent" (Schlosser, 2003, p. 350). At one end of the iconicity continuum are transparent symbols, in which "the shape, motion, or function of the referent is depicted to such an extent that meaning of the symbol can be readily guessed in the absence of the referent" (Fuller & Lloyd, 1991, p. 217). At the other end are opaque symbols, "in which no [symbol–referent] relationship is perceived even when the meaning of the symbol is known" (Fuller & Lloyd, 1991, p. 217). For example, a color photograph of a cup is transparent because it looks like a real cup, whereas the written word *cup* is opaque because it does not have any visual resemblance to its referent. Between the two extremes are translucent symbols, "in which the meaning of the referent may or may not be obvious but a relationship can be perceived between the symbol and the referent once the meaning is provided" (Fuller & Lloyd, 1991, p. 217). So, for example,

a cup handle can be used as a symbol for *cup,* but its meaning may not be obvious without explanation. Many types of aided symbols are used to support individuals with ASD, including tangible symbols, pictorial symbols, and alphabetic symbols.

Aided AAC: AAC systems that require external equipment to be used, such as a picture board or an electronic communication device.

Aided AAC: Tangible Symbols

Tangible symbols are "permanent objects that can be touched or manipulated" (Roche et al., 2014a, p. 28). First described by Rowland and Schweigert (1996), they include real objects (e.g., a spoon to represent food/eating), miniature objects (e.g., a doll-size sock to represent dressing), and partial objects (e.g., a swatch of carpet to represent "circle time," when each student sits on a specific carpet square). Although tangible symbols are primarily used by individuals with severe intellectual disability in addition to blindness or a significant visual impairment (Roche et al., 2014a), they can also be used by individuals with ASD. For example, Terri uses tangible symbols to ask for what she wants and to share information with others. When she's thirsty, she brings her teacher a cup to ask for something to drink. When she wants to use the slide at her local park, she gives her mom a card with piece of shiny metal attached to it, similar to the metal of the slide. And, when she comes home from the park, she can tell her sister what she did by showing her the slide symbol and the Frisbee that she enjoys using there. For Terri, the cup, metal swatch, and Frisbee are symbols representing "I'm thirsty," "I want to go on the slide," and "I played Frisbee at the park." She has learned from experience to associate the symbols with the activities they represent.

Advantages and Disadvantages of Tangible Symbols Some authors have suggested that "the three-dimensional aspect of [tangible] symbols could possibly facilitate learning" (Roche et al., 2014b, p. 250) because they place relatively low demands on memory and representational skills, compared to other types of symbols. A few examples from the research literature provide some support for this suggestion with regard to individuals with ASD. For example, Rowland and Schweigert (2000) taught nine students with ASD and additional disabilities to use a wide range of tangible symbols as part of a larger study with 41 participants. Other authors adapted the PECS protocol to teach students with ASD and blindness or severe visual impairments to use tangible symbols to request preferred objects (Ali, MacFarland, & Umbreit, 2011; Parker, Banda, Davidson, & Liu-Gitz, 2010). Most recently, Roche et al. (2014b) taught two boys with ASD to use tangible symbols, pictorial symbols, and an iPad to request preferred cartoons. Both boys learned to make requests using all three methods at comparable rates but preferred to use tangible symbols over the other two options.

Despite these reports, a systematic review by Roche et al. (2014a) concluded that because only a few studies of tangible symbol use employed rigorous experimental designs that provide conclusive evidence of an intervention effect, "the generally positive outcomes…must be interpreted with caution" (p. 38). Additional disadvantages of tangible symbols include their limited portability (which may be

improved by use of miniature objects, in some cases), the related risk that they will be unavailable when needed, and the fact that they can be used solely to represent referents that can be symbolized readily. In addition, their meanings may not be transparent to unfamiliar communication partners; for example, a miniature shoe could be used to convey the literal message, "(I want the) shoe" or could be used to mean "Let's go for a walk."

Aided AAC: Pictorial Symbols

Pictorial symbols include both photographs and line drawing images and can be either black and white or colored.

Photographs As part of an AAC system, photographs may be used to represent specific people, places, activities, or items. Photographs can be produced with a camera; downloaded online; or obtained from catalogs, magazines, coupons, product labels, or advertisements. For example, Tanisha uses photos of food items to ask for her lunch in the high school cafeteria. She can interact with her classmates about her family by showing photos of them on her iPad, and she can also tell her teachers that she went to San Diego over the holiday break by showing them postcards and photos of the places she visited.

The advantage of photographs is that they are easier to carry around than are tangible symbols. Their meanings are also transparent, in most cases, because they depict realistic images (e.g., digital pictures, color photographs) and/or people and objects in relation to one another, the natural environment, and the central action of an activity. The disadvantage is that they have to be collected in some way, so they can be somewhat time consuming to produce. On the other hand, anyone with a smartphone has easy access to a camera that can be used to produce high quality "in the moment" photos of virtually any activity. These photos can also be shared digitally and, if necessary, printed in hard copy format.

Pictorial (Line Drawing) Symbols Many pictorial symbol sets are commercially available in a variety of sizes and forms. They all use simple line drawings (black and white, colored) to depict people, places, activities, objects, actions (e.g., eat, sit, sleep), feelings (e.g., happy, angry, bored), descriptors (e.g., hot, cold, big, little,), social etiquette messages (e.g., please, thank you), and other parts of speech. The symbol sets most often used with individuals with ASD are described in the next sections.

Pictorial Symbol Sets One of the most commonly used symbol sets in North America is the Picture Communication Symbols set from Mayer-Johnson LLC (PCS; see Figure 4.1 for examples). The PCS library consists of over 11,000 pictorial graphics that represent words, phrases, and concepts on a range of topics. Both PC- and Macintosh-based versions of the Mayer-Johnson Boardmaker family of software and cloud-based products can be used to generate communication displays made of either black-and-white or color PCS in 44 languages. Animated PCS for many verbs (i.e., action words) are also available in several of the Boardmaker products.

Another pictorial symbol set in widespread use is Symbolstix. This set includes over 30,000 color line drawing symbols that depict activities and people as lively stick figures. Symbolstix are used in many tablet-based AAC applications ("apps"). Symbolstix Prime is a cloud-based symbol creation tool that can be used

to create communication displays in either print or digital form. Figure 4.1 displays examples of Symbolstix.

Pics for PECS is a set of 3,200 color images that include vocabulary words for adolescents and adults as well as children (e.g., yoga, motor scooter). The set, available on a CD, was designed to be used in conjunction with PECS but can also be used more widely. Figure 4.1 displays examples of Pics for PECS.

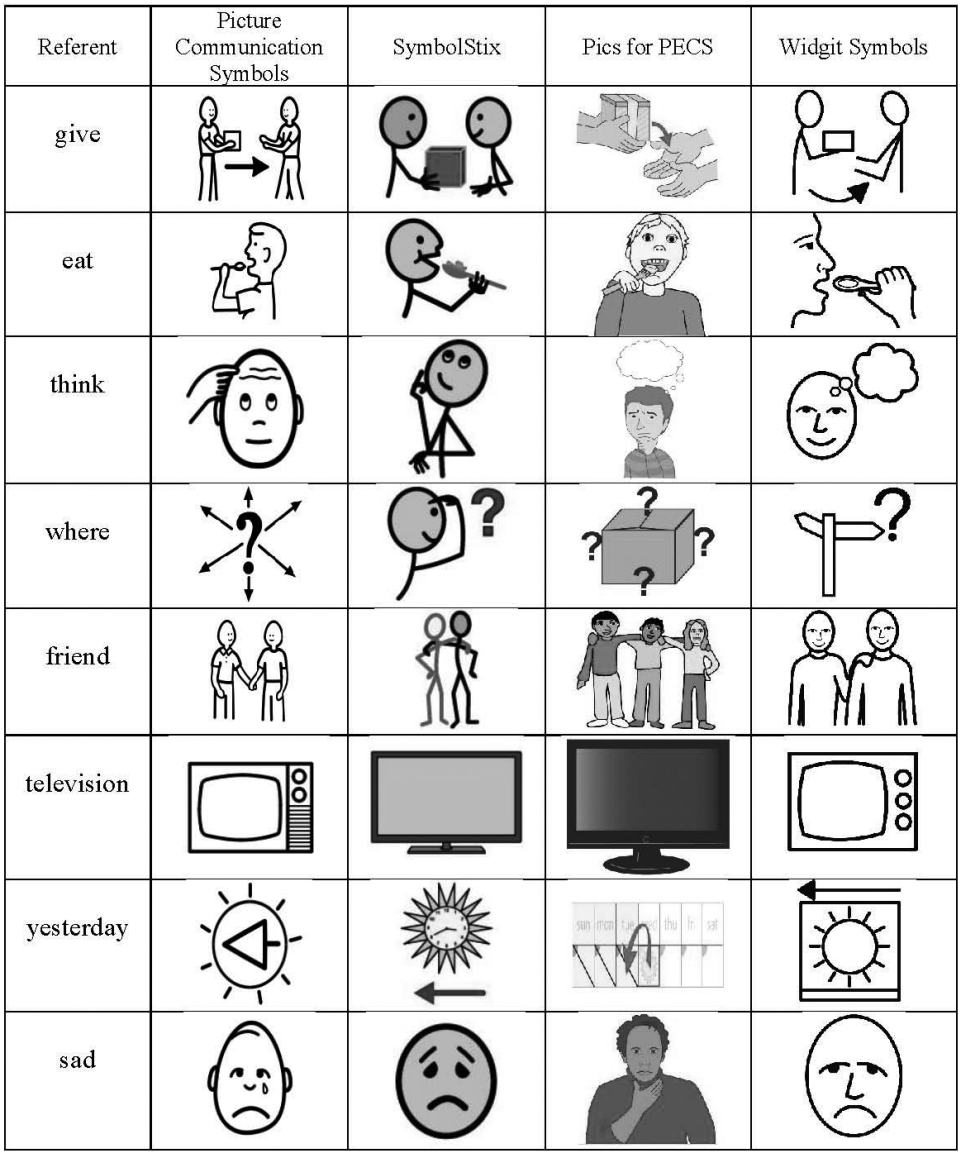

Figure 4.1. Examples of Picture Communication Symbols, Symbolstix, Pics for PECS, and Widgit Symbols. (The Picture Communication Symbols ©1981–2015 by Mayer-Johnson LLC a Tobii Dynavox company. All Rights Reserved Worldwide. Used with permission. Boardmaker® is a trademark of Mayer-Johnson LLC. Copyright Symbolstix, LLC. 2016. All rights reserved. Used with permission. Pics for PECS® images used with permission from Pyramid Educational Consultants (www.pecs.com). All rights reserved. Widgit Symbols © Widgit Software 2002–2018 www.widgit.com.)

Finally, the Widgit Symbols set has been developed over the past 30 years and contains more than 12,000 symbols that cover an English vocabulary of over 40,000 words. Widgit Symbols are available in 17 languages and are designed to conform to a set of standards and conventions (referred to as "schema") and can be used to support both communication and literacy development. Figure 4.1 displays examples of Widgit Symbols.

Aided AAC: Alphabet Symbols

The letters of the alphabet and the words that are spelled with them are also aided symbols. Even individuals who cannot read fluently might be able to recognize printed words to communicate some messages. For example, Alfredo can recognize the printed words for many of the foods and drinks he consumes regularly, such as *Cheerios* and *Coke.* He has several pages of printed food words in a communication book that he carries around with him. When he wants to ask for something he likes to eat, he simply points to the word in his book.

The advantages of printed words include the fact that many of them can be placed on a single page, and they are easily understood by communication partners who can read. On the other hand, it is important to be able to distinguish between word-calling—the ability to decode a written word—and comprehension—the ability to use that word appropriately or act on that word as equivalent to what it represents. People with ASD must have the latter skill in order to use alphabet symbols functionally.

AIDED AAC TECHNIQUES

Aided AAC symbols—including tangible, pictorial, and alphabet symbols—are the basic building blocks used to convey messages by many people with ASD. But aided symbols have to be provided in a way that makes them readily accessible to an individual with ASD at all times. Both nonelectronic (i.e., low-tech) and digital (i.e., high-tech) AAC techniques can be used with individuals with ASD to accomplish this successfully (Ganz, Earles-Vollrath, et al., 2012).

Low-Tech Aided AAC

Low-tech aided AAC techniques include pictorial symbol displays, letter displays, and picture exchange systems. The common feature of these AAC options is that they involve some type of aided symbol to represent messages, are portable, and do not rely on digital technologies. The most common form of low-tech AAC is a communication book that contains symbols to point to or symbols that are attached (e.g., with Velcro) and can be readily removed for exchange. Communication boards or wallets with laminated pictorial symbols (e.g., photographs, line drawings) are additional options for displaying aided symbols and facilitating portability.

There are both advantages and disadvantages to using low-tech aided techniques for communication. The advantages are that they are relatively inexpensive; can be designed so they are easy to transport or carry around; and can be used in flexible, individualized ways. For example, Harold has a few symbols representing outside play equipment attached to a loop that hangs on his belt so that he can use his hands freely on the equipment and also choose where he wanted to play

next (e.g., on the swings, on the slide). The disadvantage is that someone must take responsibility for keeping the system updated with symbols representing messages that the individual needs to communicate. Of course, this is also the case with high-tech AAC options.

High-Tech Aided AAC

Numerous digital or high-tech communication devices that require some type of external power source (e.g., rechargeable batteries) are also available for use with individuals with ASD. The primary advantage of high-tech communication devices is that they produce speech or print output that can be readily understood by communication partners. Although many high-tech devices can be operated using alternative access methods in addition to simple touch, individuals with ASD are able to select items directly from a display by pointing, in most cases. For example, when Harriet touches a symbol on her AAC device, it speaks the message that was programmed for the symbol, and the printed word also appears on a display screen. Some high-tech devices are quite complex and expensive whereas others are relatively simple to program and operate. They range from single/serial message devices to those with static, dynamic, and/or visual scene displays (VSDs).

Single/Serial Message Devices A number of battery-powered, microswitch-activated devices that can be programmed to speak single or serial messages can be used to support communication that is context specific. Some of these devices play a *single, recorded message* (usually, up to 2–3 minutes in length) when activated. Recording a message into the device takes only seconds, using the voice of whoever sets it up, and new messages can be recorded over old ones throughout the day. So, for example, with the assistance of an aide who is responsible for recording the messages, a student with ASD might use one of these devices to greet his teacher and classmates on arrival at school ("Hi, how are you today?"), then recite the *Pledge of Allegiance* with his classmates, and then participate in a language arts lesson by repeating the line of a story the teacher is reading (e.g., "I do not like green eggs and ham; I do not like them, Sam I am"; Seuss, 1960).

Serial message devices work in a similar way, except that a series of messages (for a total of 2–4 minutes of recording time, depending on the device) can be programmed to speak out loud *in the order they are programmed,* one message per successive activation. For example, most elementary school students in North America are familiar with the turn-taking routine of a "knock-knock" joke. Emilio, a student with ASD, uses his serial device to tell a "knock-knock" joke to a classmate as shown in Figure 4.2.

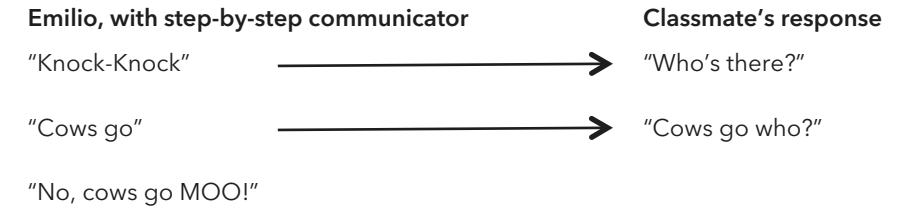

Figure 4.2. How a student can use a serial device to tell a "knock-knock" joke to a classmate.

Finally, a series of spoken messages can be produced *in random order* using a device that features this option. These devices can be set such that once a random message is played, it is not played again. So, for example, Arthur uses his randomizer device to call out letter and number combinations when he and his friends play bingo at recess (e.g., "B-59," "N-4"). Because the device speaks the combinations in random order without repetitions, no two bingo games are ever the same. From these examples, it should be obvious that, while these simple devices require the support of a facilitator to program contextually relevant messages and are unlikely to meet all of an individual's communication needs, they can be used in creative ways to support active participation of individuals with ASD in a wide range of school- and community-based activities.

Static Display Devices Static display devices employ aided symbols that are "fixed" in a particular location—that is, their positions on the device are static. Typically, the symbols are printed on laminated paper "overlays" that are affixed to the device by hand; when a symbol is activated (i.e., touched), a message that has been programmed in a corresponding location on the device is spoken out loud and/or appears on a small screen. Usually, static display devices are designed to accommodate messages that are programmed on multiple "levels," wherein each level corresponds to a different overlay of topical symbols.

The number of aided symbols available on a static display device is usually dictated by a person's visual, tactile, cognitive, and motor capabilities. Many individuals with ASD who use static display devices are beginning communicators who have difficulty visually locating a desired symbol from a large array of options and/or have difficulty activating small symbols on more complex devices for other reasons (e.g., motor limitations). For example, Jackie is an adult with ASD who also has a visual impairment and thus needs large symbols to represent messages. When Jackie and her dad go out for lunch at a fast-food restaurant, she uses the 12 symbols on Level 1 of her device to order food at the counter. After she has ordered, her dad changes the display to a paper overlay of 12 new symbols that depict Jackie's favorite activities and friends. He also switches her device to Level 2, which has messages that correspond to the new overlay and enable them to talk about what Jackie did last weekend. This example illustrates two of the major disadvantages of static display devices—namely, that the number of vocabulary items available at a time is limited and that facilitator assistance is required to change displays and levels to make additional vocabulary available. On the other hand, static display devices might be appropriate for beginning communicators like Jackie whose abilities constrain the number and/or size of messages that they can use in specific contexts.

Dynamic Display Devices Dynamic display devices feature computer/digital screen displays with aided symbols that are programmed into the device itself and produce high-quality synthetic speech when activated. They include both dedicated AAC devices (i.e., those that are specifically designed for communication by people who require AAC) and iOS or Android tablet devices with one of the many AAC apps that provide dynamic display features (Lorah, Parnell, Whitby, & Hantula, 2015). There are usually at least two types of symbols in these devices—those that produce a spoken message and those that change the display itself when activated. When a *message* symbol is activated, the printed message appears on a

small screen display and the device speaks the associated message out loud. When a *change* symbol is activated, the display screen automatically changes to a new set of programmed symbols. For example, on Ramon's device, his home screen displays symbols related to a number of topics, such as hockey, jokes, personal care, news, and family. When he touches the HOCKEY symbol, the screen changes to display symbols/messages related to hockey, which he then uses to interact with his friends while watching the game. When a break occurs at halftime, Ramon touches the HOME symbol to return to the initial screen and selects the FOOD symbol, which changes the screen to symbols of food options and enables him to order his own meal at the arena. After he eats, he can go back to the hockey symbols by touching HOCKEY again, or he might elect to change to the JOKES page to interact with his friends in this way.

The advantage of dynamic display devices is that they can contain many more messages and phrases than static display devices; with some iOS or Android apps, for example, thousands of messages are available. In addition, many dedicated dynamic display devices have other features as well, including print displays, calculators, large memory capacities for storing lengthy text and speeches, and the ability to interface with standard computers. The majority of modern dynamic display devices produce high-quality digitized speech that is available in both child and adult and both male and female voices across numerous languages. Virtually all such devices allow customization of symbol size, the number of symbols available a time, and many other features.

Aside from the cost (which can vary widely), one of the major disadvantages of dynamic display devices is that, because they are digital in nature, they are more complex to program and more vulnerable to simple wear and tear than are low-tech or static display options. They can break down, their batteries can run down or fail, and they require someone to program messages into them on a regular basis. In addition, it is important to emphasize that having an iPad or another type of digital device does not make a person a good communicator any more than having a piano makes someone Elton John! Digital AAC devices are *tools* for communication, and individuals with ASD will need to be taught how to use them in meaningful ways, just as they are taught to use other communication techniques.

Visual Scene Displays A VSD is a picture, photograph, or virtual environment that depicts and represents a situation, place, or activity. Individual elements such as people, actions, and objects appear within the visual scene (Blackstone, 2004). For example, in a photograph of Max's birthday party, people, food, and gifts all appear in a single image. Spoken messages, such as the names of the birthday guests and the food items that were served at the party, can be accessed by touching "hot spots" associated with corresponding parts of the image. So, when the birthday cake is touched, the message "I love my birthday cake!" is spoken. When Max's picture is touched, the message "I'm 21 years old today" is activated. From these examples, it should be apparent that VSDs are quite different from the grid displays that are used in most high-tech AAC devices. The visual scene depicts a set of elements (people, actions, objects) within a coherent, integrated visual image, while a grid display arranges elements in separate boxes that are usually organized in rows and columns. Figure 4.3 depicts both a grid display and a VSD for a birthday party activity. VSDs are featured in a number of apps for tablet devices.

Figure 4.3. Top: Grid display for a birthday party. (The Picture Communication Symbols ©1981–2015 by Mayer-Johnson LLC a Tobii Dynavox company. All Rights Reserved Worldwide. Used with permission. Boardmaker® is a trademark of Mayer-Johnson LLC.) Bottom: Visual scene display for a birthday party. Hot spots (rectangles) show areas that speak a related message when activated (e.g., from left to right: *mom, present, candle, cake, dad, balloon*); hot spots are invisible on the actual display. (Photo courtesy of Pat Mirenda.)

AAC INSTRUCTION

It is beyond the scope of this chapter to provide detailed information on the numerous instructional techniques that can be used to teach the use of AAC techniques. Readers are referred to the chapters in Parts III and IV of this book, and to both Beukelman and Mirenda (2013) and Johnston, Reichle, Feeley, and Jones (2012) for specific information in this regard. In the sections that follow, three of the most commonly used instructional approaches—PECS, naturalistic/milieu teaching, and aided language modeling—will be described briefly.

The Picture Exchange Communication System

The Picture Exchange Communication System is an AAC instructional approach (Frost & Bondy, 2002) that is based on research and practice in the area of applied behavior analysis. PECS instruction begins by teaching a learner to *exchange* graphic symbols to request desired items rather than point to them on a communication display. In PECS, an individual learns to communicate first with single pictures (or real objects; see Ganz, Cook, Corbin-Newsome, Bourgeois, & Flores, 2005), then to choose among two or more pictures, and finally to combine pictures to produce a variety of grammatical structures, semantic relationships, and communicative functions.

PECS instruction begins after an assessment of potential reinforcers (i.e., preferred items or activities) for the person who is learning to communicate. In Phase I of PECS, the person learns to pick up a single symbol (e.g., photograph, line drawing) and hand it to a communication partner (i.e., adult or child), who then gives the person the associated item (e.g., food, drink, toy). Initially, once the learner reaches toward the desired item or activity, an assistant to the partner provides only physical and gestural cues (i.e., no verbal cues to ask "What do you want?" or "Give me the picture") to prompt the learner to exchange the symbol. Over time, the assistant gradually fades the prompts until the symbol–item exchange is made unassisted. In Phase II, the assistant gradually moves away so that the person learns to find the symbol, take it to the partner from a distance, and exchange it for the desired item. In Phase III, the number of symbols available is increased from one to two (and eventually more) and procedures for teaching symbol discrimination are implemented. The next three phases extend instruction to teach the learner to construct simple sentences (e.g., "I WANT ____" in Phase IV and "I SEE ____" in Phase VI), respond to a partner's question "What do you want?" (Phase V), and employ descriptive symbols related to color, size, number, and so forth (see Frost & Bondy, 2002 and Bondy & Frost, 2009 for additional information).

Several systematic reviews and meta-analyses of the research on PECS have been conducted to examine efficacy and the variables that influence outcomes (e.g., Flippin, Reszka, & Watson, 2010; Ganz, Davis, Lund, Goodwyn, & Simpson, 2012). In some reviews, authors noted that, in the majority of research studies to date, participants have demonstrated mastery of PECS Phases I–III only; thus, empirical support for the efficacy of Phases IV–VI is lacking (Ganz, Davis, et al., 2012; Sulzer-Azaroff, Hoffman, Horton, Bondy, & Frost, 2009). Nonetheless, the general consensus across the reviews is reflected by Ganz, Davis, et al. (2012): "PECS appears to be a promising augmentative system that . . . has moderately positive effects on functional communication skills . . ." (p. 415). In addition, Yoder and Lieberman

(2010) provided evidence that PECS instruction can result in the ability to engage in picture exchanges under different conditions (i.e., novel contexts and with novel people) than those in which training occurred.

Naturalistic/Milieu Teaching

Jones and Feeley (2012) noted that naturalistic/milieu teaching "capitalizes on ongoing interactions about materials/activities within the learner's environment to prompt more sophisticated communicative acts . . ." (p. 163). These authors noted that the defining characteristics of this approach include the following: 1) instruction is provided in naturally occurring contexts by the communicative partners with whom the target skills are meant to be used (e.g., parents, teachers, peers), 2) communicative opportunities are either learner initiated or naturally occurring throughout the day (e.g., whenever a person has difficulty completing a task, she is provided with instruction aimed at teaching her to use her AAC system to ask for help), and 3) natural consequences are provided contingent on AAC use (e.g., when the person asks for help, assistance is provided). A variety of instructional techniques are employed in this regard, including incidental teaching, the mand-model procedure, a wide range of strategies for prompting and fading, time delay, behavior chain interruption, and embedded instruction (see Beukelman & Mirenda, 2013; Feeley & Jones, 2012).

Naturalistic/milieu teaching has been used in many studies with individuals with ASD, primarily to teach requesting. These studies have focused on the use of manual signs (e.g., Kouri, 1988), graphic symbols either on picture cards or in communication books (e.g., Hamilton & Snell, 1993), and SGDs (e.g., Olive et al., 2007). Interventionists include teachers, other direct care staff, or in some cases parents (Nunes & Hanline, 2003; Stiebel, 1999) or peers (Trembath, Balandin, Togher, & Stancliffe, 2009; Trottier, Kamp, & Mirenda, 2011). In general, these studies provide support for the use of naturalistic/milieu strategies to teach AAC use to individuals with ASD (Nunes, 2009), although additional research is required to examine the effectiveness for teaching communicative functions other than requesting.

Aided Language Modeling

Several language modeling techniques have been developed for AAC instruction and have been used successfully with children with ASD (Cafiero, 1998, 2001; Drager et al., 2006; Romski & Sevcik, 1996; Romski et al., 2009). The term *aided language modeling* (ALM) is used here to refer to the general approach, which is based on research describing how typically developing, speaking children acquire language by observing and interacting with communicative partners. ALM involves, at a minimum, a communicative partner who a) points to (i.e., models the use of) key pictorial symbols while speaking, in the context of motivating, interactive activities in natural contexts; and b) provides opportunities for the person with ASD to use the target symbols during the activity, make requests or comments, answer questions, and participate in other communicative routines. Because ALM techniques mimic the way natural speakers learn to comprehend language, they are intended to teach language in a very natural way that reduces the need for more explicit instruction.

In one of the empirical investigations with individuals with ASD, Drager et al. (2006) implemented ALM with two 4-year-old children who spoke between 10 and 20 words each. A clinician pointed to a target object in an interactive play activity and then simultaneously pointed to a corresponding line drawing symbol while saying its name. For example, when the clinician said, "It's time to feed the doll," she then pointed to a DOLL symbol while referring to the real doll. After repeated exposure to ALM, both children demonstrated increased comprehension and production of the target objects when provided with spoken labels alone (e.g., "Show me the doll"), suggesting that the pairing of symbols plus speech supported their language learning. Recently, Sennott, Light, and McNaughton (2016) summarized the existing ALM research in a systematic review and concluded that "AAC modeling-based intervention packages [have] had a positive impact across a range of language domains for young children who are beginning communicators" (p. 11).

CONCLUSION

The past 2 decades have seen an explosion of research related to strategies for supporting functional communication for individuals with ASD who rely on AAC (e.g., Beukelman & Mirenda, 2013; Johnston et al., 2012; Mirenda & Iacono, 2009). In particular, the AAC-RERC on Communication Enhancement (http://aac-rerc.psu.edu) includes a number of research and development projects that pertain directly to individuals with ASD across the age range. The Pennsylvania State University AAC website (http://aackids.psu.edu/index.php/page/show/id/1/index.html) is also a valuable resource for those working with young children with ASD and other complex communication needs. The future for individuals with ASD who experience severe communication challenges is promising, as researchers and clinicians continue to develop strategies for assessment and intervention that enable them to fully participate in home, school, and community life.

RESOURCES

Tobii Dynavox, 2100 Wharton Street, Suite 400, Pittsburgh, PA 15203; Phone: 1-800-588-4548; Fax: 1-866-585-6260; e-mail: mayer-johnson.usa@mayer-johnson.com; web site: www.mayer-johnson.com

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