

Chapter 2

Aided Augmentative and Alternative Communication: An Overview

Augmentative and alternative communication (AAC) includes any mode of expressive or receptive communication that is used to replace or supplement spoken communication for a person with a disability who cannot use conventional speech (Ronski and Sevcik 1997). AAC may be unaided, such as systems that do not require external equipment, e.g., manual sign language and gestures (Light et al. 1998). Alternately, AAC can be aided. Aided AAC includes devices and external equipment such as communication boards with drawings, cards with picture or words that are exchanged, and computerized devices with or without verbal output (Light et al. 1998). Below, aided AAC will be described and research on aided AAC will be reviewed, followed by conclusions and suggestions for future research. An overview of the use of manual sign language with people with ASD and related research is provided in Chap. 9.

Aided AAC ranges from low-tech, including single pictures or icons on cards or printed arrays of drawings, to high-tech, sophisticated devices, including devices with one or more pads to select pictures and generate speech, computerized devices dedicated for communication purposes, and more recently, tablet computer and smart phone communication applications (McNaughton and Light 2013).

Low-Tech Aided AAC

Low-tech AAC has been widely used, including systems that require the person with CCN to point to pictures, letters, or words and those that involve exchanging icons, or picture cards, with someone to make a request or otherwise impart information (Ganz et al. 2012b). The pictures, words, or letters may be fixed on a single-page array or may be affixed to a book or surface by Velcro® to allow them to be taken off. Advantages of low-tech aided AAC include portability, ease of creation of new materials, low expense, low probability of loss or damage, and ease of interpretation by much of the public (Ganz et al. 2012b). Much of the literature involving low-tech AAC for people with ASD involves a well-defined system and protocol,



Fig. 2.1 Exchange-based communication system. Photo credit: Jennifer Ninci. Used with permission

called the Picture Exchange Communication System (PECS; Frost and Bondy 2002); other picture exchange or picture point systems are described in the literature, but are not used as widely or following a precise treatment protocol (Ganz et al. 2012b). An example of a picture exchange-based AAC book is shown in Fig. 2.1.

The Picture Exchange Communication System

Although PECS is only one type of picture-based, low-tech aided AAC, it involves a distinct instructional protocol, was developed specifically for people with ASD, and has received significant attention in the last decade (Bondy 2012; Ganz et al. 2012a); thus, it is worth describing it in detail in this chapter. PECS was developed for individuals with autism spectrum disorders and complex communication needs (Bondy 2012), that is, individuals who cannot use speech as their primary means of functionally communicating. PECS is a type of alternative and augmentative communication (AAC) system. PECS is considered a low-tech AAC system. It is made up of a binder with Velcro® strips attached and icons, or picture cards, that are stored in the binder. The icons are used by the individual with ASD to communicate. The person hands a picture or pictures to a communication partner, often an adult or peer, to make a request, comment, answer a question, or otherwise engage in conversation.

PECS was developed specifically for individuals with ASD and has been used with people with a variety of developmental disabilities. The developers, Andy Bondy and Lori Frost (1994), created the treatment protocol while working with individuals at the Delaware Autistic Program in the 1980s. The system begins with teaching requesting preferred items because children with ASD are infrequently motivated to participate in communicative interactions for purely social purposes (Bondy 2012). That is, typically developing children often use initial language skills for social means (e.g., getting attention, labeling something in the immediate environment), while children with ASD often communicate primarily to gain preferred items. Thus, Frost and Bondy (2002) suggest that beginning communication with requesting is a logical first step.

Implementation of PECS is based on applied behavior analysis (Bondy 2012). That is, discrete, evidence-based teaching procedures are used to teach new communication skills, based on Skinner's (1957) analysis of verbal and other communicative behavior. These techniques include prompting and prompt-fading (e.g., full physical prompts, partial physical prompt), backward chaining (e.g., fading prompts beginning with the final step in a chain of behaviors) (Bondy 2012). The summary of PECS instruction that follows should not be considered a replacement for attending a formal training.

PECS Phases of Instruction. There are six primary phases within the PECS protocol (Frost and Bondy 2002). Prior to instruction, a reinforcer assessment is conducted (Frost and Bondy 2002). This may be an informal assessment, involving asking caregivers to identify the client's preferred items and activities, but often also includes formally placing items in front of the client and collecting data regarding which items are picked most often (Frost and Bondy 2002). Preference assessments may be repeated, formally or informally, often, as preferred items vary over time and even within a day, depending on recent deprivation or satiation or changing desires. That is, for example, if a child has recently had 2 h of access to a favorite movie, he or she is unlikely to be motivated to request that movie.

The terminal goal in Phase 1 is that the student learns to independently pick up a picture card and hand it to a communicative partner in exchange for a preferred item, food, or activity (Frost and Bondy 2002). Instruction in Phases 1 and 2 requires two trainers. In Phase 1, one instructor sits or stands behind the learner, serving as the prompter, and the other sits or stands in front of the learner, serving as the communicative partner. The communicative partner places a picture card in front of the learner and entices the learner, such as by showing the learner a preferred item, taking a bite of a preferred food, and holding the item out toward the learner. The prompter waits for the learner to show interest or motivation to take it. The learner may do so by reaching for the object, looking at it and leaning toward it, or vocalizing. If the learner does not show interest in the item, the communicative partner exchanges the item for another preferred item and replaces the picture card with a corresponding picture card. When the learner does show interest in the item, the physical prompter, who does not engage in communication with the learner,

provides a full physical prompt to assist the learner in picking up the picture card, handing it to the communicative partner, and placing it in the communicative partner's hand. These physical prompts are rapidly faded until the learner independently and spontaneously picks up the picture and places it in the communicative partner's hand in exchange for a preferred item. Key strategies during Phase 1 include backward chaining (i.e., fading prompts from the end of the sequence—placing the picture in the communicative partner's hand—to the beginning), introducing a wide variety of picture cards and corresponding items, targeting PECS instruction across a wide variety of contexts and settings, and including a variety of communicative partners. It is important in Phase 1 and throughout PECS instruction that instruction is not restricted to limited contexts or the learner may fail to generalize PECS use across contexts, materials, and communicative partners, thus, preventing it from being a truly functional communication system.

Phase 2 of PECS is an extension of Phase 1 (Frost and Bondy 2002). The learner is taught to use PECS across farther distances. That is, the terminal outcome for Phase 2 is that the learner will retrieve his or her PECS communication binder, retrieve the desired picture from the front of the book, and bring it to a communicative partner, possibly in another room. Two instructors are required in Phase 2. In initial stages, the physical prompter remains behind the learner. The learner's communication book remains within arm's reach of the learner and the communicative partner entices the learner with a preferred item while moving just out of reach. That is, the communicative partner begins Phase 2 instruction far enough away that the learner must take a step or two to place the picture card in his or her hand. The learner may independently stand and bring the picture card to the communicative partner; however, if he or she takes the card, but does not move closer, the physical prompter nudges or provides other physical prompts to assist the learner in moving toward the communicative partner. As in Phase 1, the physical prompts are quickly faded. The communicative partner gradually moves farther away, then gradually moves the communication book farther away until the learner independently exchanges pictures across a wide range of distances.

In Phase 3, the learner is taught to discriminate among pictures to select the one that corresponds with one of a variety of preferred items (Frost and Bondy 2002). By the end of Phase 3 instruction, the learner should be able to select the correct picture from among numerous placed through his or her communication book. Phase 3 and beyond do not require two instructors. Phase 3 has two stages. In Phase 3a, two picture cards are placed on the front of the communication book—one of a preferred item and one of an item that the learner does not like. As before, the communicative partner entices the learner with a preferred item. If the learner reaches for the incorrect picture, the communicative partner blocks the learner, then conducts an error correction procedure, which includes modeling the correct response by holding up the correct picture and naming it, prompting the learner to hand the correct picture by pointing to it or physically prompting, inserting a distraction by turning the book over or asking the learner to follow a quick, previously mastered task, and presenting the item again. Phase 3b involves presenting two or more

pictures of preferred items, eventually leading to the child selecting from among numerous pictures within or on the cover of the communication book. Phase 3b instruction is identical to Phase 3a, with the addition of periodic correspondence checks. A correspondence check involves determining whether or not the student is accurately discriminating between the available pictures. When the student makes errors, Frost and Bondy (2002) recommend structured error-correction procedures.

In Phase 4, the client is taught to create simple sentences to make requests, combining an *I-WANT* symbol with an icon of a preferred item (Bondy 2012; Frost and Bondy 2002). The instructor uses backward chaining to first teach the client to place the preferred item's icon onto a sentence strip that already contains the *I-WANT* icon and hand the entire sentence strip to the communicative partner. Eventually, these supports are faded until the client learns to place the *I-WANT* icon and the preferred item icon on the strip and independently taking it off the book to hand to the communicative partner. Eventually, the client is taught to combine requests for multiple items into a single sentence and to add modifiers to requests (e.g., *I-WANT APPLES-TO-APPLES™ GAME*). Phases 5 and 6 involve teaching the clients to answer questions regarding what they want and see and to comment on their surrounding (Bondy 2012).

High-Tech Aided AAC

AAC technologies are rapidly becoming more portable and less expensive (Shane et al. 2012). Further, they are becoming more commonly used, via tablet computer and smartphone apps, as speech-generating devices (SGDs), along with other interventions for people with ASD and DD (Ganz et al. 2014; Kagohara et al. 2013; Murdock et al. 2013). SGDs, also sometimes called voice-output communication aids (VOCAs), have been used as AAC for several decades. Because they have natural-speech or synthesized speech output, it provides a means for the individual with CCN to get the attention of the listener and can be understood easily (Ronski and Sevcik 1997; Schepis et al. 1998). These devices are electronic and range in sophistication from single buttons with recorded voice messages to small computers that allow the user and caregivers to program and add vocabulary. While low-tech systems may be either picture point or picture exchange, SGDs involve pressing, touching, or selecting a button or icon that is attached or integrated into the SGD (Shane et al. 2012; Son et al. 2006). Figures 2.2, 2.3, 2.4, 2.5, 2.6, and 2.7 provide examples of a range of low- to high-tech AAC systems.

As mobile devices have become ubiquitous in the USA (Gal et al. 2009), there has been an upsurge in studies incorporating the use of applications on table computers and smartphones for use as SGDs (Flores et al. 2012; Kagohara et al. 2013; van der Meer et al. 2012). There are numerous advantages to software and applications for mobile technologies compared to traditional SGDs that are often large and heavy, particularly considering that people with ASD, unlike people with physical

Fig. 2.2 Picture point communication system. Photo credit: Jennifer Ninci. Used with permission. The picture communication symbols ©1981–2010 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission. Boardmaker™ is a trademark of Mayer-Johnson LLC



Fig. 2.3 Example of a single-switch AAC device. Photo credit: Jennifer Ninci. Used with permission





Fig. 2.4 Example of a four-choice array speech-generating device. Photo credit: Jennifer Ninci. Used with permission. The picture communication symbols ©1981–2010 by Mayer-Johnson LLC. All Rights Reserved Worldwide. Used with permission. Boardmaker™ is a trademark of Mayer-Johnson LLC

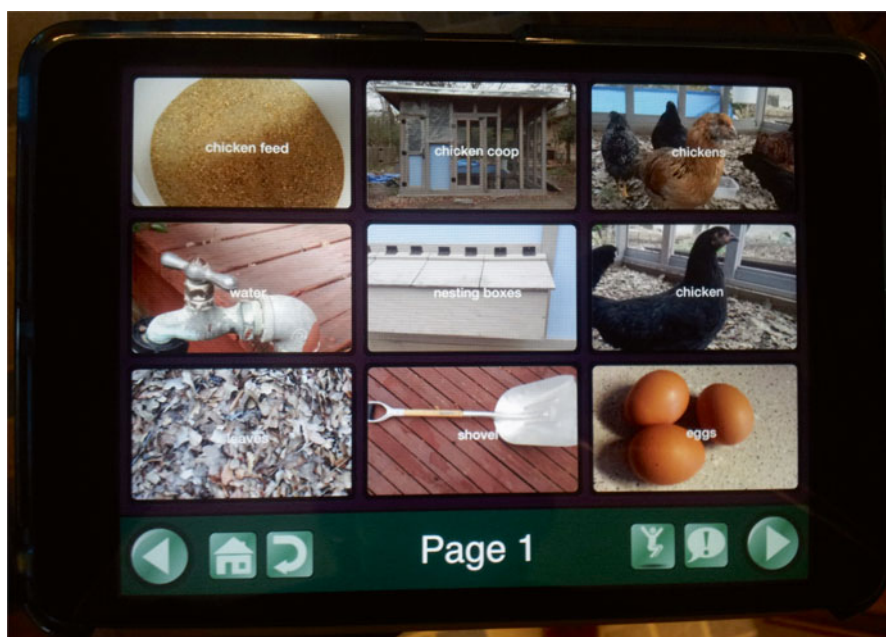


Fig. 2.5 Example of a tablet computer-based AAC nine-image grid application. Photo credit: Jennifer B. Ganz. Used with permission



Fig. 2.6 Example of a visual scene display AAC page; the *shaded boxes* represent hot spots. Photo credit: Jennifer B. Ganz. Used with permission

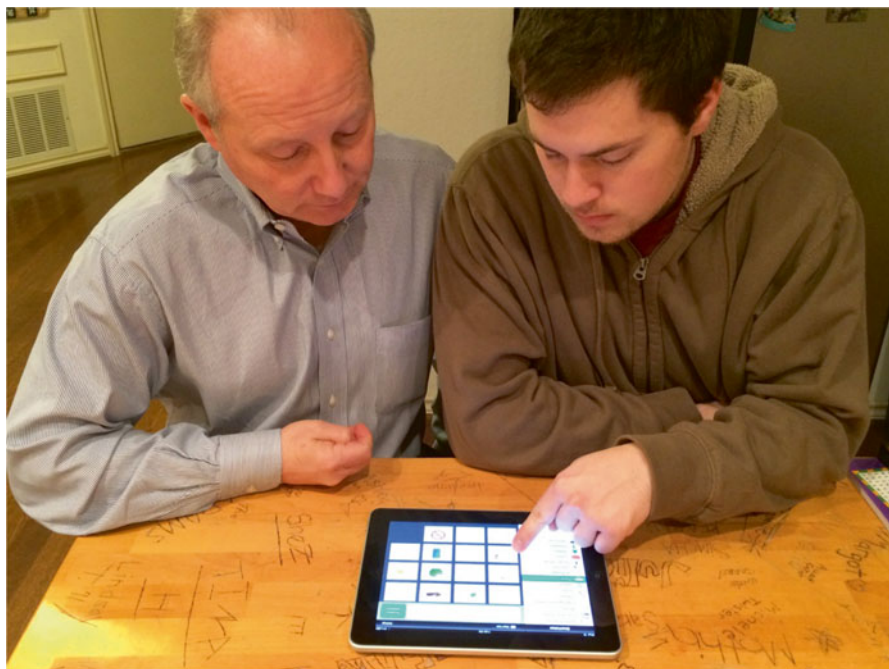


Fig. 2.7 Example of a man using a tablet computer-based AAC application. Photo credit: Margot B. Boles. Used with permission

disabilities that have CCN, are typically ambulatory (Sennott and Bowker 2009). Digital technologies are becoming more powerful while at the same time decreasing in size. Now, mobile devices are lightweight and can be used during various activities, including while seated at a table, but also while walking, riding in a car, or playing (Sennott and Bowker 2009). Further, dynamic mobile devices that make sound may be more appealing to many individuals with ASD than flat picture exchange systems (Ganz et al. 2013), leading to less abandonment of the system. Further, the speech output provides a consistent verbal model than low-tech AAC, increasing the opportunities for people with ASD to associate the spoken word with concrete concepts. Mobile device-based AAC also enables the person with CCN and others to quickly add vocabulary, which is not as easy when low-tech pictures must be located and printed (Ganz et al. 2013). Finally, because mobile devices are so ubiquitous, they may be more appealing than bulky communication books, which family members and teachers may feel are more noticeably “different.” Indeed, teachers have reported that they preferred tablet computer-based AAC over picture exchange AAC, stating that they found it easier to use, took less preparation time, required fewer materials, and allowed students with ASD to communicate more quickly (Flores et al. 2012). Again, increasing the social validity and desirability of AAC may lead to more rapid adoption and lengthier use.

Types and Organization of Symbols Used in Aided AAC

AAC displays must take into account the age, functioning, and preferences of the person with ASD and CCN and his or her communicative partners (Light et al. 2007; Light and Drager 2002). Dynamic displays for AAC for mobile devices are available via computerized AAC programs and applications (for example, Dynavox Compass™,¹ Proloquo2Go²). That is, unlike traditional displays that had arrays that were fixed or that had to be manually moved, computerized apps and programs allow the user to organize and add vocabulary, incorporate new symbols and photos, automatically correct grammar and spelling, and have touch-screen capabilities, including swiping the screen to access additional vocabulary (Drager et al. 2004; Sennott and Bowker 2009). Traditionally, icons were displayed in grid arrays (Wilkinson and McIlvane 2013); however, now, they may also be provided in a format that incorporates contextual scene, called visual scene displays (VSDs), particularly thought to be useful for people with intellectual disabilities and young children with ASD.

VSDs are being promoted as a means of presenting concepts in a manner that more closely matches principles of visual processing to better enable people with CCN to communicate (Wilkinson and Jagaroo 2004). Unlike grid-style AAC

¹ www.mydynavox.com

² www.assistiveware.com

displays, VSDs have language concepts imbedded within photos or drawing of natural events (Wilkinson and Light 2011). These scenes are programmed with hot spots, so that components of the scenes say words or make sounds when tapped or selected (Wilkinson and Light 2011). For example, a photo of a child's house with the car parked in front may have hot spots that say, "window," when the window is touched and may make a sound of an engine revving when the image of the car is selected (Fig. 2.6 is an example of a VSD). Such an approach to presenting language appears to more closely match typical early language learning experiences, during which language is embedded in contextual experiences, rather than in isolation (Drager et al. 2003; Light et al. 2004). That is, typically developing children learn new vocabulary by hearing words in various contexts.

Several elements of VSDs are thought to be critical to providing access to AAC. One is attention to human figures (Wilkinson and Light 2011). Human figures have been found to draw visual attention in studies of typically developing individuals, regardless of the presence of other prominent objects (Wilkinson and Light 2011; Light and McNaughton 2012). Thus, it may be beneficial to include drawings or photos that have people in them. However, this may or may not be effective with individuals with ASD, given their decreased attention to humans when compared to attention to other objects in view (Klin et al. 2002; Riby and Hancock 2009). It should be noted though that individuals with ASD, while looking less at humans than their peers do, do look at humans at least some of the time (Riby and Hancock 2009), justifying the inclusion of human figures in at least some AAC displays. Two, vocabulary presented visually and in context appears to be easier to learn and identify than vocabulary presented in isolation in a grid format, particularly for very young children (Drager et al. 2003; Light and McNaughton 2012). That is, young children and older individuals with intellectual disabilities or significant language delays may benefit from the presentation of vocabulary in context and may learn to identify and locate that vocabulary on an AAC device more easily than in grid formats. Three, vocabulary is presented in a context that is familiar to the child (Light and McNaughton 2012); thus, children draw from memory of particular events to draw language concepts. Vocabulary in VSDs is presented similarly to the way in which children are exposed to new contexts in real life, through highly visual and complex contexts.

Although research has not yet been published that supports the use of VSDs with children with CCN, research has found that typically developing infants, finding they oriented to VSDs more than grid-type displays (Wilkinson and Light 2011) and that typically developing toddlers can locate concepts more easily on VSDs than grids (Drager et al. 2003).

Research Support for Aided AAC

Recent legislation requires that schools, and particularly special education programs, implement evidence-based practices (Reichow et al. 2008; Schlosser and Raghavendra 2004). In particular, meta-analytic procedures allow researchers to use

a single metric to compare performance between baseline and intervention and to aggregate the results of numerous studies (Parker et al. 2009). A number of recent meta-analyses and literature reviews have been published summarizing the research on the use of aided AAC. Some of this work has focused exclusively or primarily on people with ASD, while other work has included a broader range of disability categories. This body of work provides some insight into the state of the field related to the effects of AAC.

AAC and ASD. Overall, via meta-analyses, AAC has been determined to be very effective in teaching communication skills to people with ASD (Ganz et al. 2012b). Further, meta-analyses have made more fine-grained analyses regarding the use of various types of AAC with people with ASD. More specifically, regarding particular outcomes, impacts on communication skills have been found to be greater than those for challenging behaviors and social interaction skills (Ganz et al. 2012b). When comparing effects on specific categories of outcomes related to what AAC mode was implemented, researchers found that communication outcomes were effected more by PECS and SGDs than other picture-based systems and that challenging behavior appeared to respond better to SGD interventions than PECS (Ganz et al. in press-b). These results should be interpreted with caution because of the small number of studies in each subcategory (e.g., effects of SGDs on challenging behaviors versus effects of PECS on challenging behaviors) and other factors that have not yet been investigated may be responsible. Comparisons across AAC mode have found that SGDs and PECS had significantly better overall effects than other types of picture-based AAC (Ganz et al. 2012b). Participant characteristics also had some impact on the efficacy of aided AAC interventions (Ganz et al. 2011a). Specifically, individuals with ASD and no comorbid disabilities had better outcomes than those with ASD and ID, and young children had better outcomes than older individuals with ASD. Further, AAC was more effective in general education settings than others (Ganz et al. in press-b), potentially related to the functioning level of the individuals with ASD who are more likely to be placed in general education settings; however, this is unclear in the current research literature.

Additionally, meta-analyses and literature reviews have focused on individual AAC modes, including PECS and SGDs, used with people with ASD. Ganz et al. (2012a) conducted a meta-analysis on the impact of PECS on outcomes in individuals with ASD, finding that PECS had moderate overall effects. Further, effects were moderate for targeted AAC-use outcome measures (i.e., learning to use pictures to request) and weaker for non-targeted skills (i.e., collateral outcomes that are not specifically aims of PECS), such as challenging behavior, social interactions, and speech. Further, PECS was more effective on targeted outcomes for preschool children than elementary-aged children; the number of studies with older individuals was too small to make a confident comparison. Additional meta-analyses and literature reviews on the use of PECS and SGDs with people with ASD have been published (Flippin et al. 2010; Ostryn et al. 2008; Preston and Carter 2009; van der Meer and Rispoli 2010); due to their use of discredited metrics for meta-analysis, such as PND (Subramanian and Wendt 2010), or no effect size measures, their

results must be interpreted with caution. However, when considered as a whole, they provide support for the statement that the majority of participants who were taught PECS and SGDs had gains in AAC use.

AAC and DD. Only one recent meta-analysis has been conducted using up-to-date effect size metrics to investigate the impact of AAC on people with DD overall; though there have been additional reviews that have also considered this topic. Walker and Snell (2013) conducted a meta-analysis of the impact of all types of AAC on challenging behaviors. Findings indicated that overall, AAC interventions result in decreased challenging behaviors in individuals with CCN. In particular, interventions incorporating functional behavior assessment had stronger effects on challenging behavior than those that did not. Further, AAC was more effective on challenging behaviors in younger children than older individuals, although far fewer studies were conducted with adults than children. Other reviews have been conducted, but should be considered with caution because their chosen metric, percent of non-overlapping data (PND; Scruggs et al. 1986), is limited in that PND values cannot be aggregated into overall effect sizes (Subramanian and Wendt 2010) or because they only provide summaries of the literature without an aggregating metric that meets current standards.

When investigating the impact of AAC on outcome measures (i.e., targeted skills) in people with DD, findings of less rigorous reviews have been positive for communication and other outcomes. Lancioni et al. (2007) reviewed the literature on the use of picture exchange systems and SGDs to teach requesting to people with DD, finding that most participants were successfully taught to communicate, regardless of the selected AAC mode, and participants did not significantly select one over the other when given the choice. Although families often express concern that AAC will inhibit speech, reviews have suggested that none of the studies reported decreased speech and most found speech gains occurred as AAC was implemented (Ganz et al. 2008b, 2010a, 2011b; Hart and Banda 2010; Millar et al. 2006). Further, Chung and colleagues' (2012) review suggested that overall, the effects were positive for peer interaction during AAC interventions.

Reviews that investigated or compared particular AAC modes have concluded that they are effective with people with DD. SGDs have been successfully implemented with people with DD (Rispoli et al. 2010). A review of PECS implementation suggested that PECS had positive outcomes related to communication, particularly the use of AAC for requesting, and some participants had improvements in social interaction and challenging behaviors (Sulzer-Azaroff et al. 2009). However, this article included studies that did not meet minimum quality criteria and should be interpreted with caution because most studies included only evaluated half or fewer of the PECS instructional phases. Further, four of the five authors were employees of Pyramid Educational Consultants, who sell PECS materials and provide training, including the two developers of PECS; thus, the authors had a conflict of interest. Therefore, the results of this review should be interpreted with caution, although their results are reflective of those found in more rigorous meta-analyses (Ganz, et al. 2012a).

A few reviews have reviewed literature relevant to participant choice of AAC system. Investigations of preference of people with CCN have indicated that they tend to prefer aided AAC to unaided; however, this may relate to the level of motor

imitation skills in the individual or other individual characteristics (Gevarter et al. 2013). Further, van der Meer et al. (2011) evaluated studies that assessed preference across mode of AAC, including manual sign, picture exchange-based systems, and SGDs, finding that more of the participant preferred SGDs, although many others preferred picture exchange.

Conclusions and Future Research Directions

It is clear that aided AAC has a history of effective implementation with people with ASD, particularly in teaching requesting skills, and for young children with ASD (Ganz et al. 2012b). Aided AAC is a potential alternative for individuals who cannot communicate effectively with speech (Ronski and Sevcik 1997). However, there remain numerous questions regarding for whom AAC is most effective and matching AAC to client characteristics, new modes and formats of AAC, comparisons across modes of AAC and related to client preference, key implementation strategies, and generalization and maintenance of learned skills across natural contexts.

Research has primarily involved a limited range of participant characteristics. Across meta-analyses and literature reviews, authors noted that the majority of research on AAC, including those with participants with ASD, have involved children (Chung et al. 2012; Ganz et al. 2012b). Thus, it is critical that more research with young adults and adults with CCN be conducted. In particular, it is critical to determine if particular strategies may be implemented with older individuals to raise the effectiveness of AAC to levels seen in preschool children (Ganz et al. 2011a) and to determine if strategies or AAC modes need to be adapted to be more effective for individuals with comorbid disabilities, such as sensory impairments. Research on the use of aided AAC with individuals from culturally and linguistically diverse backgrounds is lacking (Ganz et al. 2012c; Simpson and Ganz 2012). As the USA becomes more diverse, it becomes more imperative to investigate the impact of various languages of instruction on individuals who come from homes in which the primary language is different from that of the school they attend or community in which they live. Finally, instructional modifications for individuals who do not learn to use AAC as rapidly as most should be investigated (Ganz et al. 2005; Ganz et al. 2010b).

The variety and availability of modes of AAC are rapidly expanding to include lower-priced applications for mobile technology. Because the use of these devices is relatively new, few published studies have incorporated them. Investigations involving complex AAC systems, such as those with dynamic displays, are needed (Chung et al. 2012; Drager et al. 2004; Ganz et al. *in press-a*). In particular, research that investigates the feasibility of use of high-tech AAC for caregivers, practitioners, and people with CCN is lacking. Research investigating new AAC applications that are flexible in the creation of new vocabulary in the moment and that are usable for all stakeholders would be helpful. Currently, low-tech aided AAC may be preferable due to its cost-effectiveness, portability, and ease of repair compared to higher-tech devices (Wilkinson and Hennig 2007); however, as prices for portable electronics drop, this may change.

Articles that have investigated comparisons between AAC modes and related to personal preference for particular AAC mode are increasing in the literature; however, such work is still needed. Gevarter et al. (2013) concluded that comparative research, including aided AAC, unaided AAC, and speech-based instruction, is still needed. Further, the role of preference of AAC mode by the person with CCN should be investigated further (Ganz et al. 2013; Sigafoos et al. 2005; van der Meer et al. 2011), particularly in terms of impact on outcomes and how to best evaluate preference when selecting a device or mode.

Finally, future research is needed to investigate expanding treatment techniques and broad demonstration of skills across varied natural contexts. Much of the literature is limited to primary communication outcomes and highly structured settings. Intervention strategies cited in research vary widely, from highly structured protocols to sparsely described procedures; research should be conducted to answer questions related to the best combination of strategies to meet the needs of people with CCN. While the type of AAC used is important, more important is discovering specific strategies that can be used across AAC types to improve outcomes of people with ASD and CCN. Further, because much of the research involves implementation by highly trained researchers, research involving implementation of AAC strategies by typical service providers and caregivers (Chung et al. 2012) under typical circumstances is needed, including investigations of feasibility of implementation and treatment fidelity (Hart and Banda 2010), or how well typical communicative partners can implement interventions. Further, studies are needed that investigate more advanced AAC skills, as most studies on people with ASD have evaluated impacts only on requesting (Ganz et al. 2012a). This research base would benefit from measures of the effects of AAC generalized across contexts and maintained long term (Didden 2012; Ganz et al. 2008a; Hart and Banda 2010), which is unfortunately missing from much of the single-case research on AAC to date.

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