Disclosure: The first author was the co-developer of Proloquo2Go.

Autism, AAC, and Proloquo2Go

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Abstract

People with ASD often need to access AAC in situations where a tabletop digital device is not practical. Recent advancements have made more powerful, portable, and affordable communication technologies available to these individuals. Proloquo2Go is a new portable augmentative and alternative communication system that runs on an iPhone or iPod touch and can be used to meet the diverse needs of individuals with autism spectrum disorders (ASD) who are ambulatory and have difficulty using speech to meet their full daily communication needs. This article examines Proloquo2Go in light of the best practices in AAC for individuals with ASD such as symbols, visual supports, voice output, and inclusion.

A wide range of augmentative and alternative communication (AAC) devices are used to meet the diverse needs of individuals with autism spectrum disorders (ASD) who have difficulty using natural speech to meet their daily communication needs (Schlosser, Sigafoos, & Koul, 2009). Consider this analogy: When taking a long journey on a bicycle, most riders would prefer to use what is commonly called a road bike, which is streamlined with smooth tires optimized for this use. However, when a rider wishes to move off the road onto a wooded trail, a mountain bike with rugged tires would be preferred. Similarly, many people use multiple computing devices such as a laptop computer as well as smaller portable devices such as an iPhone. Most people use their laptops while seated at a table or desk. However, it is awkward to perform mobile tasks such as walking/wheeling down the street or riding public transportation while using a laptop computer. In order to meet specific needs while walking or manually wheeling around, many people use a range of portable computing options such as a Blackberry, Palm Pre, and iPhone.

Most individuals with ASD have the ability to walk without assistance (i.e., they are ambulatory), which means that they require AAC solutions that are both portable and lightweight. Portable technologies have changed considerably over the past few decades; consider, for example, the device that was used by Romski and Sevcik (1996) in their early research on the System for Augmented Language (SAL), as compared with the latest iPhone.

Figure 1. Left: the Words+ Portable Voice II system, as pictured in Romski and Sevcik (1996), utilized a cart so it could be wheeled around. Right: the Apple iPhone 3G with Proloquo2Go in the palm of a hand.

Computational power has increased and computers have become both more affordable and more portable than would be expected, according to Moore's Law. This "law" of computing, described by Intel founder Gordon Moore in 1965, states that the number of transistors on a microchip tends to double roughly every 18 months (Moore, 1998). For individuals with ASD, Moore's Law helps explain in part why more powerful and portable digital AAC options are now available at more affordable prices then ever before. This is good news for individuals with ASD who require AAC, who face challenges that are very similar to those of the cyclist described previously. People with ASD often have the need to access AAC in situations where a tabletop computer is simply impractical. Of course, there are benefits and limitations of all individual components that comprise a holistic AAC system, and it is important to compare each component to established best practices. Thus, the purpose of this article is to examine a relatively new AAC system component, Proloquo2Go, against evidence-based practices in AAC for individuals with ASD.

Evidence-Based Practice and Proloquo2Go

Proloquo2Go is an AAC device from AssistiveWare that runs on the Apple iPhone and iPod touch and is sold and distributed online through the Apple App Store (http://www.apple.com/iphone/apps-for-iphone/). The iPhone and iPod touch both have a screen that is 3.5 inches long, a multi-touch display, and a few hard buttons that turn the device on/off, adjust the volume, and enable return to a home screen. It incorporates a number of features that are aligned with evidence-based practices in ASD.

Use of Symbols and Visual Supports

The use of visual supports and symbols as receptive and expressive components of an AAC system has been established as an evidence-based practice for individuals with ASD (Mirenda & Iacono, 2009). The influence of Temple Grandin's (1996) book *Thinking in Pictures* helped to popularize the suggestion that people with ASD have relative strengths in visual thinking. Of course, this is not true for everyone on the autism spectrum; for example, Donna Williams (2007), another author with ASD, has noted that some people (both with and without ASD) think more visually and others think more verbally. Nonetheless, a number of specific uses for symbols and visual supports have been found to be effective with this population. In a recent review, Wendt (2009) found that the use of graphic symbols for requesting has the most extensive evidence base for people with ASD. Mirenda and Brown (2009) reviewed the use of

visual supports for augmented input and found that both between-activity and within-activity schedules, as well as Social Stories™, have a reasonably strong evidence base. The Picture Exchange Communication System (PECS) also has a strong research base with regard to enhancing functional communication skills (Bondy & Frost, 2009). Other visual support strategies, including Power Cards, contingency maps, rule scripts/charts, and cognitive picture rehearsal scripts also have emerging evidence to support their use (Mirenda & Brown). Overall, the use of symbols and visual supports for communication, scheduling, and instruction has gained acceptance as a set of practices that can used effectively with individuals with ASD.

Symbols and Visual Supports in Proloquo2Go

Proloquo2Go can provide visual supports using both iconic symbols and photographs.

Figure 2. The use of SymbolStix icons and digital images.

When a vocabulary item is created in Proloquo2Go, a visual image that includes text, a symbol, and/or a photograph may be added to the item. These vocabulary items can be viewed in either a list or grid layout in multiple sizes that range from one item per screen to up to 36 items per screen. Additionally, a text-only option may be selected for both the message window and the vocabulary display.

The default symbol set used in Proloquo2Go is called SymbolStixs, which includes over 8,000 color vector-based line drawings. This symbol set is also used in News-2-You, the online newspaper geared towards individuals with disabilities (http://www.news-2-you.com/). In addition to the default symbols, digital photographs from the iPhone or iPod touch photo library are available to be converted into picture symbols. Photographs taken using the iPhone's built-in digital camera can also be used to create customized visual supports.

The visual supports created in Proloquo2Go can be used to support a range of receptive and expressive communicative functions. Between-activity and within-activity schedules with voice output can be created using Proloquo2Go by numbering and ordering items within a category. Various types of stories, cues, and contingency-based messages also can be created. These schedules and stories can be customized by re-ordering the messages in either the list or grid views.

Figure 3. School schedule that launches to activity-based communication categories.

Symbol and Visual Supports Weaknesses in Proloquo2Go

In its current form, Proloquo2Go running on an iPod Touch or iPhone has some weaknesses regarding visual supports. Currently, in order to utilize other symbol sets such as the Picture Communication Symbols, the user must import these symbols into the iPhone or iPod touch photo library via iPhoto or iTunes and then must attach each symbol one-at-a-time to vocabulary items. In addition, the small size of the display may prohibit some AAC users with vision or motor impairments from effectively accessing the device.

Speech and Voice Output Communication Aids

A common concern voiced by parents and educators of individuals with ASD is that use of AAC will interfere with or suppress the development of natural speech (Beukelman, 1987). In part, this concern surfaces because many individuals with ASD do exhibit some speech that is functional for communication. The question thus arises: Should the AAC team focus on increasing an individual's repertoire of natural speech instead of devoting therapy time to AAC?

Over the past few years, it has become clear that this is a false dilemma—AAC use and natural speech development are not mutually exclusive. This is supported by quality evidence. Millar, Light, and Schlosser (2006) published a review of studies regarding the effects of AAC intervention on speech production in children with developmental disabilities and found no evidence that AAC hindered speech production. More recently, both Schlosser and Wendt (2008) and Millar (2009) published additional comprehensive literature reviews specifically examining research on children with ASD and found no evidence that AAC hinders speech development. Indeed, in many cases, the children in these studies made modest gains in

speech. It seems clear from these reviews that AAC interventions are important components of a comprehensive communication system for individuals with ASD.

Two of the most important advances in AAC technology over the past decade have been the development of high-quality synthesized voice output and dynamic displays that automatically change the visible options in response to user input. However, most of the studies of AAC and ASD have involved non-technical or older electronic devices that feature static displays and/or no voice output, such as PECS (Schlosser & Wendt, 2008). Nonetheless, the use of computer-based systems with dynamic displays and voice output for individuals with ASD does have a growing base of research support (Schlosser, 2003; Schlosser et al., 2009). Although some would argue that speech output may not be valuable to individuals with ASD who are primarily "visual learners," it appears that some individuals with ASD may prefer voice output and benefit from its use (Son, Sigafoos, O'Reilly, & Lancioni, 2006).

Proloquo2Go and Dynamic Displays

Proloquo2Go offers a basic dynamic display in addition to touch screen input, an extensive default vocabulary hierarchy, the use of high quality voices from Acapela, the ability to add symbols and photos, the ability to spell words letter-by-letter, item editing and customization capabilities, and the ability to save and store vocabularies. Proloquo2Go also introduces innovations to dynamic display technology that include automatic verb conjugation; automatic creation of plurals and possessives for nouns; one button addition of new vocabulary items; and access to recently spoken items for the past 15 and 60 minutes up to one week back.

The default vocabulary system, VocaSpace, is designed to be a flexible starting place for customization that can allow for a balanced set of communicative functions that goes beyond wants and needs. One feature, the ability to create branching sentence starters, empowers an individual user to combine core vocabulary and fringe vocabulary efficiently. Using requesting as an example, an AAC user can start at the home page and proceed as follows:

a. The user taps the item I WANT, which appears in the message window. The wants category is then opened, showing a number of additional vocabulary items.

b. The user next selects SOMETHING TO EAT, which opens up the food and drink category, with I WANT remaining in the message window.

c. A number of food and drink items are now available and the user selects LUNCH, opening up the corresponding display.

d. The user scrolls down the category and then selects PIZZA, which is sent to the message window.

e. The message now reads I WANT PIZZA and the user simply selects the message window to speak the whole message. This simple example demonstrates Proloquo2Go's branching capability, which can be used to combine core vocabulary and fringe vocabulary across a range of communicative functions. Additionally, the default vocabulary of Proloquo2Go has a range of categories including social greetings, comments, manners, a keyboard, personalized categories, basic needs, activities, and so forth.

Figure 4. Using a branch starter in the large appearance setting.

Proloquo2Go has some traditional dynamic display characteristics as well as some innovations. First, Proloquo2Go uses the iPhone interface that allows scrolling to reveal more vocabulary options via a swipe across the screen rather than by pressing a button. Visual indicators are included in the interface to reinforce this action, such as smooth animation of the page as it slides vertically. This smooth animation also accompanies transitions within the hierarchy of the organization structure, which is accomplished by pressing on-screen buttons. Pressing an item is visually reinforced by an animated resizing of the button as it is touched.

Auto-morphology is another innovation in Proloquo2Go. Auto-morphology features include auto-conjugation of verbs, and both auto-pluralization and auto-possession of nouns.

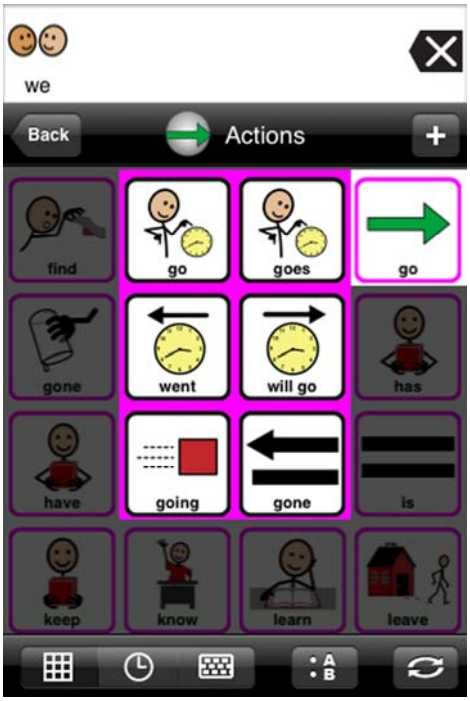

Figure 5. Auto-conjugation of a verb.

In the settings, users can choose to press and hold items or can double tap to activate the morphology features of a word. For instance, when a user presses and holds the symbol for the verb GO, the options GO, GOES, WENT, WILL GO, GOING, and GONE are all presented. This auto-morphology also applies to new words added to the vocabulary system, using a computational system licensed from Ultralingua.

Finally, the Recent View feature provides quick access to any sentence that was created in the Proloquo2Go message window during the past week.

Figure 6. *Recently spoken items.*

Recent messages are divided into those used during the last 15 minutes, the last hour, earlier today, yesterday, the day before yesterday, and earlier than that. By selecting any of these items, the AAC users sees a detailed list of all messages that were created during time interval. If there are many messages, they can be scrolled up and down with a single finger. Selecting a recent message speaks the message again, and selecting the large green plus button adds the message permanently to the vocabulary. The Recent Messages feature is designed to help users begin to retell, reutilize, and self-program their AAC systems.

Dynamic Display Weaknesses of Proloquo2Go

According to the DSM-IV, motor impairments are not a necessary criteria for the diagnosis of ASD (American Psychological Association, 2000). However, many individuals in this population do experience motor control or motor planning difficulties that may interfere with access to an AAC system (Mirenda, 2003). At this time, the iPhone/iPod touch platform, with its emphasis on input via a 3.5-inch touch screen, is not an appropriate computer platform for people with significant motor impairments. The operating system does not allow adjustments to the screen sensitivity, activation-on-release, averaged activation, or any other adjustments to the touch input. These are common features on other communication devices, to adjust for tremors or to minimize accidental activations. In addition, it only has been possible since June 2009 for third parties to make peripherals such as switches that can be used for alternate access on the iPhone/iPod. Because these peripherals are not yet

commercially available, Proloquo2Go currently does not support scanning and other forms of alternate access.

Inclusion

AAC can be an important support for inclusion and participation in school, employment, and community settings or individuals with complex communication needs, including those with ASD (Jorgensen, Schuh, & Nisbet, 2006; McNaughton & Bryen, 2007; McSheehan, Sonnenmeier, & Jorgensen, 2009). School is of both academic and social importance to students with ASD, who spend a significant amount of time in this environment. Assuming a 180-day school year, students with ASD from age 3 to 18 have the potential to spend 2,520 days in school. For post-school aged individuals, work and community life become the major environments in which they spend time.

AAC tools can be used in these environments to help meet daily communication needs as well as to change expectations. Colin Portnuff, an adult AAC user with ALS, stated in a webcast that people treated him differently when he had his talking laptop computer with him on his wheelchair (2007). Light, Page, Curran, and Pitkin (2007), speaking about school-aged children's designs for AAC systems, described the need for highly appealing integrated devices that meet multiple functions and that provide dynamic features to support social interactions with peers. They also described the importance of decorating and customizing AAC systems to make them more visually appealing. While there is no evidence base to support the impact of an AAC "coolness factor" for individuals with ASD, it seems obvious that most individuals would prefer to use AAC devices that are attractive, powerful, and appealing to their peer group.

Proloquo2Go and Inclusion

In school and community settings, both the iPhone and iPod touch are ubiqitous at the present time. Because of their widespread use, people with ASD who use these tools do not look different from their peers and almost automatically become "cool." In addition, Proloquo2Go is a flexible system that is widely accepted across all age groups as a communication tool that can be individualized with custom cases and other personalized features. While it is impossible to quantify the inclusion value of the iPhone or iPod touch with Proloquo2Go, all of these features increase the visual appeal of the device and may facilitate social inclusion as a result. Additional analysis of the social perception of AAC devices is required to examine this issue in detail.

Conclusion

Similar to bicycle riders and computer users who select an appropriate tool for each situation, AAC users with ASD face similar choices when gathering the right tools to meet their various AAC needs. Proloquo2Go running on an iPhone or iPod touch is a tool that appears to be especially appropriate for individuals with ASD who are ambulatory and have good visual processing skills. Research is needed to clarify advantages and disadvantages of this new AAC device in addition to those summarized in this review.

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