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Behavioral Intervention Promotes Successful Use of an iPod-Based Communication Device by an Adolescent With Autism

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Abstract

Individuals with autism and limited speech are candidates for speech-generating devices (SGDs), but some individuals might experience difficulty in operating these devices. We describe the case of Steven, a 17-year-old adolescent with autism who used an iPod-based SGD, but had difficulty activating the speech output feature of this device. His difficulties were initially interpreted as motor control problems, suggesting the need to abandon this technology, prescribe a different SGD, or adapt his existing device. An alternative conceptualization was that the existing intervention procedures had failed to shape more effective response topographies. Along these lines, a behavioral intervention, involving differential reinforcement and delayed prompting, proved effective in shaping response topographies that enabled Steven to be more successful in activating the speech output function of his iPod-based SGD. The results suggest that behavioral intervention may provide an alternative to the more costly and involved process of replacing or modifying the person's SGD.

Keywords

augmentative and alternative communication, autism, behavioral intervention, iPod Touch®, requesting, speech-generating devices

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1 Theoretical and Research Basis

Many individuals with autism and other developmental disabilities fail to develop any appreciable amount of speech even with intensive therapy (Lovaas, 2003). While speech often fails to develop, such individuals might learn to communicate using augmentative and alternative communication (AAC; Beukelman & Mirenda, 2005; Schlosser, 2003). Various types of AAC modes have been taught to individuals with developmental disabilities, including manual signs, picture-exchange, and electronic speech-generating devices (SGDs; Lancioni et al., 2007; Mirenda, 2003).

Because of their associated speech output capabilities, SGDs are increasingly being recommended for nonverbal individuals with autism and other developmental disabilities (Schlosser & Blischak, 2001; Sutherland, Sigafoos, Schlosser, O'Reilly, & Lancioni, 2010). SGDs are typically computer-based devices with a visual display and either digitized or synthesized speech output. Various icons (e.g., line drawings, photographs, or printed words) can be presented on the visual display and the device programmed so that selecting an icon produces corresponding speech output. Touching an icon representing an apple, for example, might produce the phrase "*I would like to have an apple please.*" Several studies, reviewed by Rispoli and her colleagues, have demonstrated that behavioral intervention—involving differential reinforcement, response prompting, and prompt fading—can be effective in teaching SGD use to individuals with autism and other developmental disabilities (Rispoli, Franco, van der Meer, Lang, & Camargo, 2010; van der Meer & Rispoli, 2010).

While there is evidence to support the use of SGDs by individuals with autism and other developmental disabilities, our experience indicates some reluctance among clinicians to prescribe such devices. This reluctance may stem from the fact that SGDs are relatively more costly and more complicated to use compared to other AAC options. We can appreciate these concerns. Earlier to an adequate intervention trial, it is often unclear whether or not any given individual will be capable of operating, and interested in using, the prescribed SGD. If not, then a costly investment in assistive communication technology may have been wasted.

There are reasons to suspect that SGDs could be more difficult for individuals to operate than say manual sign and picture exchange systems. To use a SGD successfully—even for a relatively simple communicative function such as requesting a preferred snack—the user must not only discriminate among the icons on the screen, but must also correctly operate the device to activate the associated speech-output function. From our clinical experience, this latter aspect of SGD use often requires a degree of fine motor control that appears difficult for some individuals to master. For example, to successfully use one popular type of SGD, which consists of an iPod Touch® with Proloquo2Go™ software (Sennott & Bowker, 2009), the individual must select icons from the display with an extremely light tap/touch, rather than by forcibly pressing or pushing down on the icon. In our clinical work to date with such devices, we have encountered several individuals who have learned to select the correct icon from a set of several options, but who consistently fail to successfully activate the corresponding speech output because they press the icon with too much force.

On first analysis, these "errors" often appear to reflect problems of motor control. That is, the person appears to lack sufficient fine motor control to enable him or her to select icons from the display with the required finesse. Furthermore, clinicians may determine that the person's communicative attempts should be reinforced even if the associated speech output is not forthcoming. The logic here is that reinforcing such unsuccessful attempts will prevent extinction and thereby allow the person time and practice to become more proficient with the device.

However, this logic could inadvertently shape ineffective response topographies that persist over time because they remain successful from the user's point of view, even though they remain unsuccessful in terms of activating the speech output function, which is of course the main advantage of having a SGD in the first place. If the person then fails to show any improvement in terms of being more capable of activating the speech output function over time, the decision could be made to abandon this technology altogether, purchase a different, easier to use SGD, or adapt the existing device to compensate for the person's apparent motor control problems. Such options have costs and would leave the person without a means of communication until a suitable solution is found.

An alternative view is that such difficulties are not due to motor control problems, but rather reflect the effects of continuing reinforcement for nonactivating responses, that is responses to icons that did not result in successful activation of speech output. If this alternative view has validity, then behavioral intervention to shape more successful response topographies might eliminate the presumed need to abandon SGD technology or replace or modify the person's existing SGD. In the present case study, we evaluated the effects of a behavioral intervention for overcoming this type of difficulty in an adolescent with autism who was learning to use an iPod-based SGD.

2 Case Presentation

Steven was a 17-year-old male diagnosed with autism, obsessive compulsive disorder (OCD) and Attention Deficit Hyperactivity Disorder (ADHD). He attended a specialized high school that catered to students with developmental disabilities and emotional disorders. There were a total of five students in the classroom who were taught by a teacher and a teaching assistant. A speech-language pathologist provided input on communication and feeding issues. Steven was being taught to use an iPod-based SGD because he had extremely limited speech, consisting of a few single words that were largely unintelligible. Before his receipt of this SGD, he appeared to communicate mostly by pointing, informal gestures, and some speech-like vocalizations. His vision and hearing were in the normal range and he did not appear to show any major or obvious difficulties with gross or fine motor control. He was reported to be able to comply with simple 2- and 3- word instructions. Steven had limited social skills and engaged in impulsive, repetitive, aggressive, and self-injurious behavior (e.g., slapping the side of his head).

3 Presenting Complaints

Steven was receiving intervention so that he could learn to use the iPod Touch® with Proloquo2Go™ software (Sennott & Bowker, 2009) that had recently been prescribed to him. The iPod was housed inside an iMainGo®2 speaker case to amplify the resulting speech output. However, during the early stages of teaching Steven to use this SGD, it became clear that he was having considerable difficulty with activating the speech-output function of the iPod Touch®. Specifically, while he quickly learnt to select each of three icons from the iPod's visual display, his response forms for doing so, which consisted of pressing down too hard on the icon, were mainly unsuccessful in terms of activating the speech-output function of the iPod Touch®. The purpose of the present case study was to determine if a behavioral intervention could remedy this difficulty, which initially appeared to stem from problems of touch sensitivity or fine motor control.

4 History

Steven was diagnosed with autism and ADHD at the age of 7 years and had never acquired speech, apart from a few single and largely unintelligible word approximations. Steven had previous exposure to a picture-exchange communication system with limited success. The decision to investigate an iPod-based SGD was part of a larger research project investigating the feasibility of using such technology in the education of students with autism.

Beginning approximately 2 months earlier to the present intervention, Steven had received initial training to learn to use the iPod-based device to request three preferred snacks. This training

Figure 1. Photograph of the iPod Touch® inside the iMainGo®2 speaker case with the visual display of the icons for cookie, chips and candy.

occurred two mornings per week during a brief (approximately 5 min) classroom-based morning snack activity. This initial training focused on teaching Steven to request each of the three snacks by selecting corresponding line drawing icons (*COOKIE*, *CHIPS*, and *CANDY [LOLLY]*) from a visual display. Figure 1 shows the visual display on Steven's iPod Touch®. Training consisted of placing one snack item on the tray, pointing to the tray and saying *Let me know if you want something*. Steven was then given 10 s to make a correct request by selecting the corresponding icon and successfully activating the associated speech output ("*I want a cookie.*"). If a correct request did not occur within 10 s, the trainer prompted him to touch the correct icon using the least amount of physical guidance necessary. Training continued until Steven made three independent and correct requests for each of the three items. During this initial training it is important to note that a correct request required that Steven select the icon corresponding to the item being offered and that his selection of that icon resulted in activation of the associated speech output. Steven reached criterion in this initial training phase after 2 weeks of training.

Following the initial training phase, Steven then entered a post-training phase (referred to as the baseline phase in the present study). During this post-training or baseline phase he could request any of the three snack items during sessions that lasted approximately 5 min. Each session continued until Steven had initiated 10 requests. Multiple such sessions were conducted two mornings per week. At the beginning of each session, all three snacks were placed on the tray, the iPod Touch® was placed in front of Steven and the trainer pointed to the tray and said, *Let me know if you want something*. Steven could select any icon at any time until 10 such requests had been made. It was during this post-training (baseline) phase that his apparent motor control problems emerged, in that he would often make a request by selecting an icon on the screen, but his selection response was not always successful in activating the associated speech output function.

The present study started during the post-training phase when Steven was using the iPod Touch® to request, but was only occasionally successful in activating the associated speech output function. This post-training phase constituted the baseline phase of the present study.

5 Assessment

An adaptive behavior assessment and a preference assessment were completed before the baseline phase of the present study. Steven's adaptive behavior was assessed using the Vineland-II Adaptive Behavior Scales-Survey Interview Edition (Sparrow, Cicchetti, & Balla, 2005). Steven received an overall adaptive behavior composite standard score of 32, indicating a low adaptive level and severe deficits in adaptive behavior functioning. He received age equivalencies (years:months) of 2:10, 1:8, and 6:9 for the receptive, expressive and written sub-domains of the Vineland, respectively. These assessments indicated that Steven had extremely limited receptive and expressive communication skills, but relatively greater written communication abilities. This profile suggested that he would be able to learn to discriminate among the icons that were selected for the visual display of his SGD (see Figure 1). From the Vineland there were no motor deficits identified that would have contraindicated the use of the prescribed SGD.

The preference assessment was used to identify three highly preferred snack foods that Steven could be taught to request as the initial objective of his treatment program. The preference assessment followed a two-step process. First, the teacher was asked to provide a list of snack foods that Steven liked and that would be available for him to request during the morning snack activity. The teacher identified three preferred snacks for Steven (i.e., cookies, potato chips, and candy). Next, these three items were individually offered to Steven at least 10 times. Because each item was selected and consumed when offered, we retained these as the initial three snack items that Steven would be taught to request.

6 Case Conceptualization

A case conference was held during the early sessions of the post-training (baseline) phase to discuss Steven's apparent motor control difficulties. Initially, some members of his intervention team argued that he lacked the necessary fine motor control to successfully activate the speech output function of the iPod Touch®. Because his difficulties were initially conceptualized in terms of motor control, he continued to be reinforced for selecting icons regardless of whether or not the associated speech output was activated. It was argued that these nonactivating responses should be reinforced so that his iPod-based requesting behavior would not extinguish. It was also hypothesized that through this continued positive experience he might become more proficient in using the iPod Touch® over time. It was further argued that if he did not become proficient in time, then this would indicate that his difficulties did indeed stem from motor control problems, which prevented him from being able to select icons with the required light touch or tap. In this case, Steven would require either a different SGD, a modification to the operation of the iPod Touch®, or abandonment of this SGD technology altogether.

As the post-training (baseline) phase continued however, it became clear that Steven was not showing any positive change in how often he successfully activated the speech output function

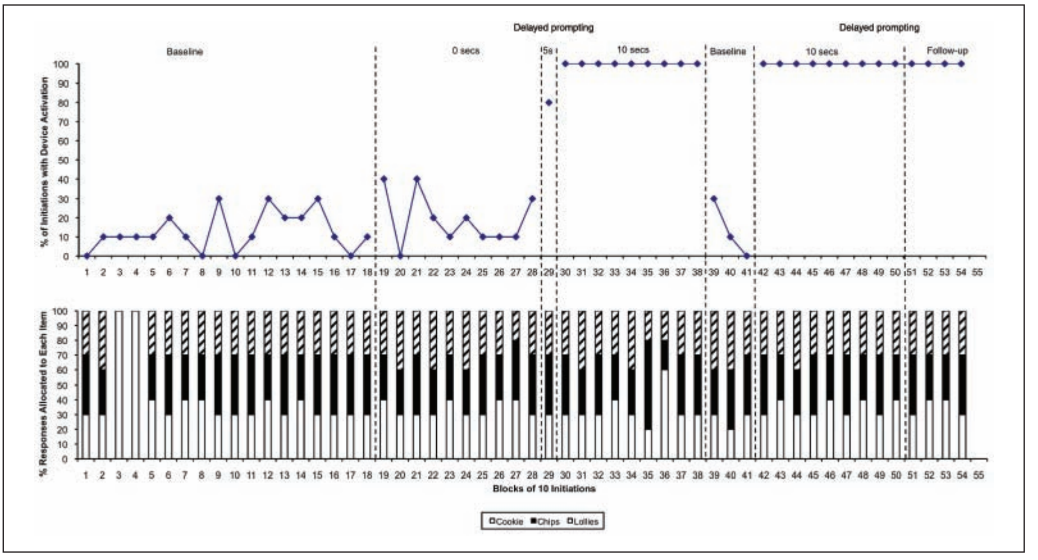

Figure 2. Percentage of successful speech output activations (upper panel) and percentage of responses allocated to each item (lower panel).

when selecting icons. At a second case conference during the final sessions of the post-training (baseline) phase, an alternative conceptualization was presented to explain Steven's difficulties. Specifically, a hypothesis was put forth that this was not a motor control problem, but rather reflected the fact that Steven's requests were reinforced whether or not his response to an icon activated the associated speech output function. This alternative conceptualization suggested an alternative treatment approach. Specifically, the treatment plan called for Steven's requests to be reinforced only if these responses were successful in activating the speech output function. To prevent extinction of iPod-based requesting behavior, an error-less prompting procedure would be implemented initially, in that Steven would receive physical guidance to assist him in lightly tapping icons. To eliminate dependency on physical guidance, a time-delay fading procedure would be implemented (Duker, Didden, & Sigafoos, 2004).

7 Course of Treatment and Assessment of Progress

Figure 2 shows the course of treatment. During the initial baseline (or post-training) phase, Steven used the iPod Touch® to request cookies, chips, or candy. Throughout each session, the trainer sat next to Steven, the iPod was within his reach, and a tray of cookies, chips, and candy was in view, but out of reach. The trainer initiated each session by saying *Let me know if you want something*. After that, each time Steven touched an icon, he was allowed to select the corresponding snack item from the tray, which he then consumed, regardless of whether or not his selection was successful in activating the associated speech output. The session continued until Steven had made 10 such requests. Each time Steven initiated a request, the trainer recorded which icon Steven had selected (i.e., COOKIE, CHIPS, or CANDY) and whether or not the associated speech output had been activated by Steven's response.

During all of the sessions shown in Figure 2, Steven never failed to initiate 10 requests. This result suggests that Steven had in fact learned to select icons from the screen to make a request. However, as indicated in the first 18 sessions in the top panel of Figure 2, Steven's percentage of initiations with successful activation of speech output ranged from 0 to 30% and showed only a slight trend toward improvement over sessions. The lower panel of Figure 2 shows the allocation of requests across the three snack items. To illustrate, for Session 1, the data show that Steven requested cookies three times (30%), chips four times (40%), and candy the remaining three times (30%). These data show that in addition to using the iPod to make requests, Steven was also requesting each of the three snack items. In fact, throughout the course of the 50 sessions, Steven showed remarkable consistency in the allocation of his responses to the different request options. Most often, Steven would request items in the following invariant order: candy, chips, cookie.

The effect of the intervention can be seen in the upper panel of Figure 2, beginning with Session 19. During this 0-s delayed-prompting phase, the procedures were identical to the previous baseline phase, except that if Steven touched an icon and the speech output was not forthcoming, he was immediately prompted to select the icon again while receiving full physical assistance to ensure he tapped the icon lightly so as to activate the associated speech output. This immediate prompting procedure was implemented for 10 sessions or 100 request initiations with little change in his performance. After this, a 5-s delay was added before prompting Steven (Session 29). This produced an immediate increase in the percentage of initiations that were successful in activating the associated speech output. The delay interval before prompting was then extended to 10 s (Sessions 30-38), which resulted in 100% successful initiations and consequently no need for the prompting procedure.

To demonstrate experimental control, baseline contingencies (i.e., all requests were reinforced regardless of whether speech output was activated) were reinstated for Sessions 39-41, resulting in a rapid decline in successful activations to below 30%. The effects of the intervention were then replicated in the next phase (Sessions 42-50), which involved the 10-s delayed-prompting procedure. The plan for this phase was to prompt activation of speech output if it did not occur within 10 s of an initiation, but given Steven's 100% performance with respect to speech output, no such prompting was required.

Overall, the data shown in Figure 2, suggest that a behavioral intervention, consisting of differential reinforcement and delayed prompting, was effective in promoting more successful activation of speech output. These data can be seen as highly reliable in that inter-observer agreement on Steven's performance (i.e., icon selected and whether speech output was activated) was checked for every session with agreement ranging from 80%-100% (mean = 94%). Treatment integrity checks, which were collected on at least 66% of the sessions in each phase, showed that the procedures were correctly implemented during 100% of these checks.

8 Complicating Factors

Successful use of an SGD requires at least two sets of skills. First, users must be able to visually discriminate among icons so as to be able to select the correct one from a visual display. Second, the user must also be able to select icons with a response topography that will result in activation of the associated speech output. Intervention studies to date have tended to emphasize the required visual discrimination skills (Rispoli et al., 2010; van der Meer & Rispoli, 2010). Consequently, while there are well-validated procedures for teaching individuals with autism and other developmental disabilities to select icons on SGDs to communicate, there appears to be less empirical work to guide clinicians when individuals experience difficulty in performing the second set of required skills for successful SGD use.

Because the iPod Touch® with Proloquo2Go™ software is gaining popularity (Mirenda, 2009), there may be an increase in the need for this type of guidance. This need is likely to arise because unlike many other SGDs, which are activated by pressing with firm pressure on the icon, the speech output function for the iPod Touch® is activated by a very light tap or touch.

In our clinical work, we have now seen several participants, in addition to Steven, who appear to have difficulty activating the speech output function of the iPod Touch®. In such cases, the problem has often been attributed to poor fine motor control. If such problems persist, clinicians might be tempted to abandon this type of SGD, replace it with another device, or modify the existing SGD, all of which are costly and time consuming options. An alternative would be to implement a behavioral intervention in an attempt to shape the required response topography. The results of the present study suggest that a combination of differential reinforcement and delayed prompting may help to shape the more gentle response topography that is required for successful activation of this type of SGD.

9 Managed Care Considerations

This clinical case study was carried out in New Zealand. New Zealand law provides access to public education of all children regardless of their level or type of disability. For students with autism and other severe disabilities, an educational program is developed, which routinely includes recommendations for a number of related services, such as speech-language pathology and occupational therapy services. Typically, implementation of communication interventions, such as the one reported here is viewed as the co-responsibility of the classroom teacher and teaching assistants in consultation with relevant specialists (e.g., a speech-language pathologist).

In the present case study, the treatment program was undertaken after gaining ethical approval from the relevant university committee and informed consent from Steven's parents, teacher, and school principal. Steven's assent to participate was implied by his willingness to cooperate in the intervention. In fact, Steven readily and eagerly complied with our invitations for him to participate in the requesting sessions. The initial intervention objective, which was to teach Steven to use an iPod-based communication device, was developed in consultation with the teacher and the school's speech-language pathologist. The treatment was also consistent with objectives in Steven's individualized education plan.

Students with severe communication impairment will typically be provided with a SGD on the recommendation of speech-language pathology assessments. In the present case, Steven was provided with the iPod Touch® with Proloquo2Go™ software (Sennott & Bowker, 2009), because he had been recruited into a research study that focused on teaching SGD use to students with developmental disabilities.

10 Follow-Up

Four follow-up sessions were conducted 10 weeks after the final session of the intervention phase. During the 10-week interval, Steven was on vacation from school and did not have access to the iPod. The four follow-up sessions had identical procedures to those of the final intervention phase. As shown in Figure 2 (Sessions 51-54), Steven's performance showed a 100% success rate in activating the speech output function when requesting his preferred items. These follow-up data suggest good maintenance of the treatment effect.

11 Treatment Implications of the Case

There seems to be a common view that when individuals with autism experience difficulties, such as those experienced by Steven, that these difficulties stem from subtle problems of motor control. While some individuals may have motor control problems that could prevent them from successful SGD use, there may be others for whom a behavioral intervention could be used to shape the required motor proficiency. Steven's improvement suggests that initial difficulties in operating a SGD should not necessarily contraindicate the use of a SGD. Instead, such problems might be effectively remedied through a behavioral intervention.

12 Recommendations to Clinicians and Students

The literature on AAC for individuals with autism and other developmental disabilities is quite large and expanding rapidly (Beukelman & Mirenda, 2005; Lancioni et al., 2007; Rispoli et al., 2010; Schlosser, 2003; van der Meer & Rispoli, 2010). One critical issue in this literature is the selection of an appropriate AAC mode. There is considerable debate as to whether manual signs, picture-exchange, or SGDs are best suited to the learning and behavioral characteristics of persons with autism and other developmental disabilities. Overall, the literature does not appear to favor one AAC option over others. Indeed all three options, including a variety of SGDs, have been successfully taught to individuals with autism and other developmental disabilities.

SGDs offer some unique features that may provide an advantage to the user in comparison to manual signs or picture-exchange systems. The main potential advantage of a SGD is the associated digitized or synthesized speech output, which provides a relatively natural and understandable signal to listeners (Schepis, Reid, & Behrman, 1996). In addition, the speech output feature combines attention-gaining with the communicative act and this may increase the probability of listeners attending to the person's communicative message. Furthermore, SGDs can be programmed to produce messages so precise (e.g., *"I need help opening the door."*) that misunderstandings are reduced. In light of these potential advantages, and evidence showing successful SGD use by individuals with autism and other developmental disabilities, one recommendation to clinicians is that SGDs should be considered as a promising AAC option for this population, as noted by Schlosser and Blischak (2001).

Of course, these advantages will only be realized if the person can successfully operate the SGD. Successful operation includes being able to consistently activate the speech output function of the SGD. If this skill is not well developed, then the SGD is not being used to its full potential.

Despite the potential advantages of SGDs, there appears to be some reluctance among clinicians to prescribe such devices to students with more severe disabilities. This reluctance may be overcome as empirical evidence demonstrating effective procedures for teaching SGD use, and troubleshooting floundering SGD interventions, accumulates.

For students, our work with Steven will hopefully highlight the critical importance of case conceptualization. When conceptualized as a problem of motor control, the possible solutions focused on either replacing or modifying Steven's prescribed SGD, or abandoning SGD intervention altogether. This would have deprived Steven of the opportunity to make use of what later proved to be a viable AAC option. When the problem was reconceptualized in terms of behavioral principles, the possible solutions focused on modifying the intervention procedures. In the end, behavioral intervention proved successful in promoting more successful use of an iPod-based communication device.

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