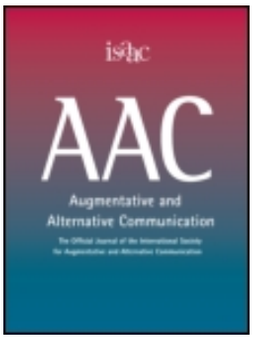

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A Comparison of Picture Exchange and Speech-Generating Devices: Acquisition, Preference, and Effects on Social Interaction

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Augmentative and alternative communication (AAC) includes picture exchange (PE) and speech-generating devices (SGD), but these two systems have rarely been compared. We therefore conducted three studies comparing PE and SGD for an adolescent boy with a developmental disability. Study 1 compared acquisition of a PE- and SGD-based requesting response and monitored the effects on social interaction. For Study 2, both communication modes were made simultaneously available and the child could choose to use either PE or the SGD. For Study 3, only PE intervention continued, with the distance between the child and trainer systematically increased to prompt social interaction. The results showed equally rapid acquisition of the PE- and SGD-based requesting response, but only the distancing manipulation had any positive effect on social interaction. We conclude that PE and SGD are equally viable modes of communication, but acquisition of an initial PE- or SGD-based requesting response may not be sufficient to promote social interaction.

Keywords: Augmentative and Alternative Communication; Picture Exchange; Speech-Generating Devices; Social Withdrawal; Developmental Disability

INTRODUCTION

Because many children with autism and other developmental disabilities fail to acquire speech, clinicians have increasingly focused on teaching augmentative and alternative communication (AAC) (Beukelman & Mirenda, 2005; Mirenda, 2003, Reichle, Beukelman, & Light, 2002; Schlosser & Blischak, 2001; Sigafoos, Arthur-Kelly, & Butterfield, 2006). An important decision when beginning an AAC intervention centers on the selection of an appropriate mode of communication for the individual (Sigafoos, O'Reilly, Schlosser, & Lancioni, 2007). This decision is complicated by the fact that a range of AAC systems have been recommended for individuals with autism and other developmental disabilities (Bondy & Frost, 2001; Frost & Bondy, 2002; Mirenda, 2003; Schlosser & Blischak, 2001). Two currently popular recommendations are picture exchange (PE) and speech-generating devices (SGD). With both of these types of systems, intervention has typically begun by teaching the individual to request access to highly preferred objects. In the first phase of PE instruction, for example, the individual might be taught to pick up a picture or line drawing of a highly preferred object and give it to a communicative partner in exchange for the corresponding real item (Bondy & Frost, 2001; Frost & Bondy, 2002). SGD intervention has also been successfully initiated by teaching requests for preferred objects (Sigafoos, Drasgow, & Schlosser, 2003). With SGD intervention, instead of exchanging a picture to obtain the real item, the learner is taught to touch a picture or line drawing on an electronic speech-output device, which then produces a relevant [pre-recorded] message (e.g., "*I want* ___").

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Studies comparing acquisition of requesting skills using PE versus SGD are few in number, but the results have generally shown very little differences in terms of the ease or speed of learning (see Lancioni et al., 2007 for a review). Son, Sigafoos, O'Reilly, and Lancioni (2006), for example, compared acquisition of requesting skills in three preschoolers with autism. The children received equivalent interventions to teach the use of both PE and SGD for requesting access to preferred objects. The results showed little difference between the PE and SGD interventions in terms of acquisition speed. However, following acquisition, two children demonstrated a consistent preference for the PE system, whereas the third child appeared to prefer using the SGD. These results suggest that, in addition to ease and speed of acquisition, clinicians may find it helpful to consider other variables, such as preference, when selecting a communication mode for AAC intervention.

One variable that may be affected by AAC intervention is the child's social interaction patterns. Social interaction can be defined as the ability to effectively initiate and maintain interactions with other people and refrain from inappropriate social behavior (Gresham & Elliott, 1984; Wilkins & Matson, 2007). Effective social interaction often requires the ability to integrate a combination of social and communication skills (Sigafoos, Schlosser, Green, O'Reilly, & Lancioni, 2008). When initiating a communicative exchange to request access to a preferred item, for example, it would seem socially appropriate for an AAC user to look at and be oriented to the communicative partner, rather than turning his or her back on the communicative partner.

The effects of AAC intervention on social interaction would seem especially worthy of investigation, given the well-documented deficits in social skills that are characteristic of individuals with autism and other developmental disabilities (Wilkins & Matson, 2007). Indeed, Ferguson (1994) argued that improving social interaction should be one of the primary goals of communication intervention for individuals with developmental disabilities. Thus, while requesting access to preferred objects is a highly functional skill to target for instruction during the initial stages of an AAC intervention, improvements in social interaction that arise from such instruction would certainly enhance the overall efficacy of the AAC program. At the present time there appear to be no studies that have compared the potential effects of PE versus SGD intervention on social interaction.

The present investigation was, therefore, designed to address this gap in the literature in a series of three studies. Study 1 was designed to compare acquisition of requesting responses using PE versus SGD while monitoring the effects of intervention on social interaction. Following this initial comparison, in Study 2, additional procedures were implemented to assess whether the child demonstrated a preference for using PE or SGD; while Study 3 considered whether social interaction during requesting sessions could be increased by manipulating the distance between the child and the trainer. This latter manipulation was based on procedures that have been recommended when teaching PE to children with autism and other developmental disabilities (Frost & Bondy, 2002).

Our main hypothesis driving this series of studies was that acquisition of an initial requesting response could lead to increases in social interaction, but that the degree of any such increase might be expected to vary across the two modes of communication (PE versus SGD). We predicted that PE would be associated with a greater increase in social interaction because the PE system requires the child to exchange a picture with an adult, thereby creating the need for at least some minimal level of social interaction. Making a request with an SGD, in contrast, does not necessarily require the individual to make any social overture towards a communicative partner. A study comparing the effects of PE versus SGD intervention on social interaction therefore seemed timely, given that improved social interaction could be seen as an important outcome from an AAC intervention. We also designed this study to systematically replicate and thereby extend the external validity of previous research that had compared acquisition and preference for PE versus SGD (Son et al., 2006). Based on the results of that earlier study, we further hypothesized that rapid acquisition of the requesting response would occur under both the PE and SGD interventions, but that following acquisition the child would show a preference for using one or the other of the two systems.

STUDY 1

Method

Participant

The single participant in this controlled case study was Trevor, (pseudonym) who was referred by his teacher for communication intervention because of his lack of speech and need for AAC, and because of his social withdrawal. Trevor was 15 years old when the study began. He had Down syndrome and a diagnosis of Autistic Disorder

based on DSM-IV criteria (American Psychiatric Association, 2000). He scored in the mildly-moderately autistic range (total score = 33) on The Childhood Autism Rating Scale (Schopler, Reichler, & Renner, 1988). His total raw score of 70 on the Aberrant Behavior Checklist – Community (Aman & Singh, 1994) indicated numerous forms of aberrant behavior that were rated as severe in degree and that were consistent with his diagnosis of Autistic Disorder (e.g., seeks isolation from others, is uncooperative, prefers to be alone, rocks back and forth repeatedly, has temper tantrums). IQ scores were not available, but on the Vineland Adaptive Behavior Scales (Sparrow, Cicchetti, & Balla, 2005), Trevor's overall adaptive behavior composite standard score was 32, indicating substantial deficits in adaptive behavior functioning. This overall adaptive behavior score was consistent with a diagnosis of intellectual disability requiring extensive supports, based on criteria established by the American Association on Mental Retardation (Luckasson et al., 2002).

Trevor attended a public school classroom that included six children with developmental disabilities, a teacher, and two teaching assistants. Trevor did not speak, and rarely vocalized. He communicated mainly by reaching for objects or by leading others by the hand, both of which appeared to function as communicative requests. He also occasionally banged his fists on the table, which appeared to function as a communicative protest. His lack of speech was not clearly a result of physical impairment. Concerning receptive language, Trevor occasionally responded appropriately to simple spoken and gestured commands from adults such as *come here*, *wash your hands*, and *sit down*. Socially, he actively avoided eye contact, did not often initiate social interaction, and completely ignored his peers. His problem behaviors included running away, throwing objects onto the floor, and social withdrawal/avoidance. His withdrawal and avoidance behaviors typically consisted of turning his back on the teacher, tucking his head between his knees and wrapping his arms around his shins. He often maintained this position for 20–30 min at a time and at such times was quite resistant to being prompted to sit up, interact socially, or participate in any classroom activities.

Trevor's vision and hearing were within the normal range. He did not appear to have any major limitations with respect to fine and gross motor skills. In terms of self-care skills, he fed, dressed, and toileted himself, but needed considerable assistance with other self-care tasks (e.g., tying shoes, bathing, brushing teeth).

Procedures

The study was implemented at a table in the classroom. The procedures associated with this study occurred in the context of a snack activity during which Trevor was taught to request preferred snack foods. This activity was selected because it was a consistent part of the daily classroom schedule, appeared motivating for Trevor, and included opportunities for communicative requesting.

Preferred snack foods were identified through a two-stage preference assessment (Green et al., 2008). First, the teacher was interviewed to identify snack foods that Trevor appeared to enjoy and which would be appropriate for consumption in the classroom. The resulting list included chocolate candy, potato chips, and jellybeans. Each item was offered six times in a random order. Trevor always selected and consumed the chocolate candies and jellybeans, but never selected the potato chips. Consequently, chocolate candy and jellybeans were retained as the snack items that he was taught to request.

Two AAC systems were used in the study. The PE system consisted of two (5 × 5 cm) Picture Communication Symbols™ (Mayer-Johnson Co., 1994) affixed with Velcro™ to a 28 cm × 15 cm plastic folder. One symbol contained a black and white line drawing showing two hands reaching out and the word *want* printed underneath. The second symbol consisted of a number sign (i.e., #) with the word *number* printed underneath. This symbol was included as a foil to ensure that the requesting task required symbol discrimination. The symbols were randomly allocated to the eight locations (5 × 5 cm square panels) on the folder. The SGD was a Tech/Talk 6 X 8™[1] electronic communication device manufactured by Advanced Multimedia Devices, Inc. The Tech/Talk consists of eight panels, each of which can accommodate a 5 × 5 cm graphic symbol and hold a digitized pre-recorded message. For this study, two panels were randomly selected and affixed with the same line drawings that were used with the PE system. Pressing the panel with the *want* symbol activated a relevant recorded message (e.g., "*Can I have a snack please?*"), whereas pressing the foil panel produced the pre-recorded message, "*Number*." Pressing any of the other panels had no effect.

Trevor received a baseline phase, followed by acquisition training, and then a final posttraining phase. During the baseline and posttraining phases, either the PE system or the SGD was provided in accordance with an alternating treatments design (Kennedy, 2005). The procedures associated with each phase were implemented in a

one-to-one format in sessions of 5 min duration. From two to four sessions were conducted per day, 2–3 days per week. For all sessions, Trevor and the trainer were seated next to each other at the table. Due to Trevor's occasional absences from school because of illness and other scheduling conflicts (e.g., school holidays and field trips), Study 1 was completed over an 8-week period.

For Baseline, a plate containing several servings of his preferred snacks was placed on the table in view, but out of Trevor's reach. The PE system or the SGD was placed directly in front of Trevor. Each session began with the trainer physically assisting Trevor to sit upright at the table and then orient towards her. She then provided a discrete requesting opportunity by holding up the plate for about 5 s while saying, *Let me know if you want a snack*. After this, the first instance of behavioral indication (or correct requesting) that occurred within 10 s of the trainer's offer was followed by giving Trevor one snack item from the plate. The snack that he received varied across opportunities on a quasi-random basis. Trevor always consumed the snack item he received from the trainer. Responses outside of this 10 s window of opportunity were ignored. The duration of social withdrawal was recorded, but after the initial cue, he was never prompted to sit upright or orient toward the trainer. Once each minute, the trainer provided another discrete requesting opportunity followed by another 10 s window of opportunity, so that a total of five such opportunities were provided during each session. Baseline continued until stable trends were evident in the duration of social withdrawal across three successive PE and SDG sessions. Stability was determined by visual analysis of graphed data (see Figure 1) using the guidelines recommended by Kennedy (2005).

For acquisition training, Trevor was presented with blocks of discrete trials to request using PE or the SGD. Each trial consisted of the trainer holding up the plate of snacks and saying, *Let me know if you want a snack*. After this the trainer waited up to 10 s for a correct response. A correct response was physically prompted if one did not occur independently by the end of the 10 s window of opportunity. Prompting involved using the graduated guidance procedure described by Duker, Didden, and Sigafoos (2004); that is, the trainer provided only as much physical assistance as was necessary for Trevor to execute a correct request. For example, the trainer might lightly guide Trevor's hand towards SGD, and stop providing this assistance as soon as he began to independently reach for the correct symbol in the SGD. Acquisition training began with PE. For the first three trials of PE acquisition training, Trevor was given the cue (i.e., the trainer held up the plate and said, *Let me know if you want a snack* and then immediately prompted Trevor to take the *WANT* symbol from the folder and hand it to the trainer. After these first three trials, the window of opportunity was extended to 10 s before prompting occurred. Training continued until Trevor made three successive correct requests without prompting and within 10 s of the trainer's offer. Once he had reached criterion on use of PE, acquisition training occurred with the SGD using the same procedures as with PE and to the same criterion (i.e., three successive and unprompted correct requests).

Following acquisition of PE and the SGD, Trevor entered the posttraining phase and received alternating sessions with PE and the SGD. The procedures were identical to baseline, except that behavior indication was ignored. Instead, Trevor only received access to snacks if he refrained from behavior indication and instead made a correct request within the 10 s window of opportunity. Responses occurring outside of this window of opportunity were ignored. He was never prompted to make a correct request during the posttraining phase.

Response definitions and measurement

Three defined responses were recorded during each session. For sessions involving PE, correct requesting was defined as removing the *WANT* symbol from the folder and handing it to the trainer within the window of opportunity. For sessions involving the SGD, correct requesting was defined as pressing the *WANT* symbol to produce the message "*Can I have a snack please?*" during the window of opportunity. Behavior indication was defined and recorded if Trevor directly reached for a snack item at any time during the window of opportunity. Social withdrawal was recorded if Trevor turned away from the trainer so that his face was not visible to her. This usually meant that Trevor had also turned completely away from the trainer, put his head between his knees, and wrapped his arms around his shins. The total duration (per session) of social withdrawal was recorded with a stopwatch beginning when Trevor had turned away from the trainer so that his face was no longer visible to the trainer and ending when he was oriented towards the trainer so that his face was visible to the trainer.

Reliability and treatment integrity

The trainer recorded whether or not behavioral indication and/or a correct request occurred

during each discrete training trial or window of opportunity and on the total duration of social withdrawal during each 5 min baseline and posttraining session. To assess the reliability of her data collection, an independent observer also recorded responses during 50% of the PE and SGD baseline sessions, 100% of the acquisition training trials, and 42% of the posttraining sessions, which included three PE and three SGD sessions. Percentages of agreement for behavior indication and correct requesting between the two recorders were calculated on a session-by-session basis (for baseline and posttraining) and on a trial-by-trial basis (for acquisition training) using the formula: [Agreements/(Agreements + Disagreements) × 100%]. For behavior indication and correct requesting, there was 100% agreement between the two observers. For duration of social withdrawal an agreement was recorded if the trainer and independent observer separately recorded durations that were within 10 s of each other. There were two instances of disagreement on duration of social withdrawal.

Treatment integrity was assessed during 25%, 100%, and 14% of the baseline sessions, acquisition training trials, posttraining sessions, respectively. The independent observer used a checklist of the procedures and recorded whether or not the trainer had correctly implemented each procedural step in its proper sequence. The checklist included each of the procedural steps that the trainer was taught to follow for each requesting opportunity within a session (e.g., Step 1: Place the PE or SGD on the table within Trevor's reach; Step 5: Offer the snacks by holding up the plate for about 5 s while saying, *Let me know if you want a snack*.). The results showed 88% correct implementation of the procedural steps during baseline (i.e., the trainer made two mistakes during one baseline session), and 100% correct implementation during both the acquisition training and posttraining phases.

Results

Figure 1 shows the number of instances of behavior indication and correct requesting (upper panel) and the duration (in seconds) of social withdrawal (lower panel). During baseline, behavior indication occurred from 2 to 5 times per session, whereas correct requesting, using PE or the SGD, was never observed. The duration of social withdrawal exceeded 260 s during most baseline sessions, with the exception of the first PE session, when Trevor was socially withdrawn for only 80 s.

Trevor achieved acquisition of PE- and SGD-based requesting (i.e., three successive and unprompted requests) on the sixth training trial with each system. During the posttraining phase, behavior indication did not occur, while correct PE- and SGD-based requests occurred from 3 to 5 times during each session. This represents a 60–100% level of correct responding in relation to the five windows of opportunities that were presented within each posttraining session. After the first three posttraining sessions, Trevor maintained a high level of performance (80–100%) with respect to correct PE and SGD requesting. Social withdrawal, in contrast, showed virtually no change from the previous baseline phase in that its duration was consistently above 180 s during each posttraining session. Throughout the study, the duration of social withdrawal was similar across the two alternating (PE and SGD) conditions.

Discussion

Trevor's rapid acquisition of both AAC systems replicates previous findings with preschoolers with autism (Son et al., 2006). Thus, a combination of structured opportunities, graduated guidance, and contingent access to highly preferred items appears effective for teaching initial PE- and SGD-based requesting skills to younger children and to older children, such as Trevor. However, while Trevor showed rapid acquisition of the PE- and SGD-based requesting response, neither intervention appeared to have any effect on social withdrawal.

The lack of change in social withdrawal is disappointing. We expected there to be less social withdrawal during the requesting sessions, given that Trevor was receiving highly preferred snacks from the trainer. We further expected relatively less social withdrawal during PE sessions because this system would seem to require a higher level of social orientation towards the trainer than through the use of the SGD (i.e., with PE the child is required to give the communication symbol directly to the trainer, whereas no such exchange was required to make a request with the SGD). The lack of change in Trevor's duration of social withdrawal might be attributed to two interacting factors. First, social interaction for its own sake did not appear to be reinforcing to Trevor, as evidenced by his longstanding pattern of extreme social withdrawal and avoidance. Second, the requesting scenario used in this study did not necessitate much social orientation or interaction. In fact, Trevor could, and did, make correct requests while engaging in only the briefest of social interactions. That is, approximately once each minute, he had to sit up and orient towards the trainer to locate or exchange

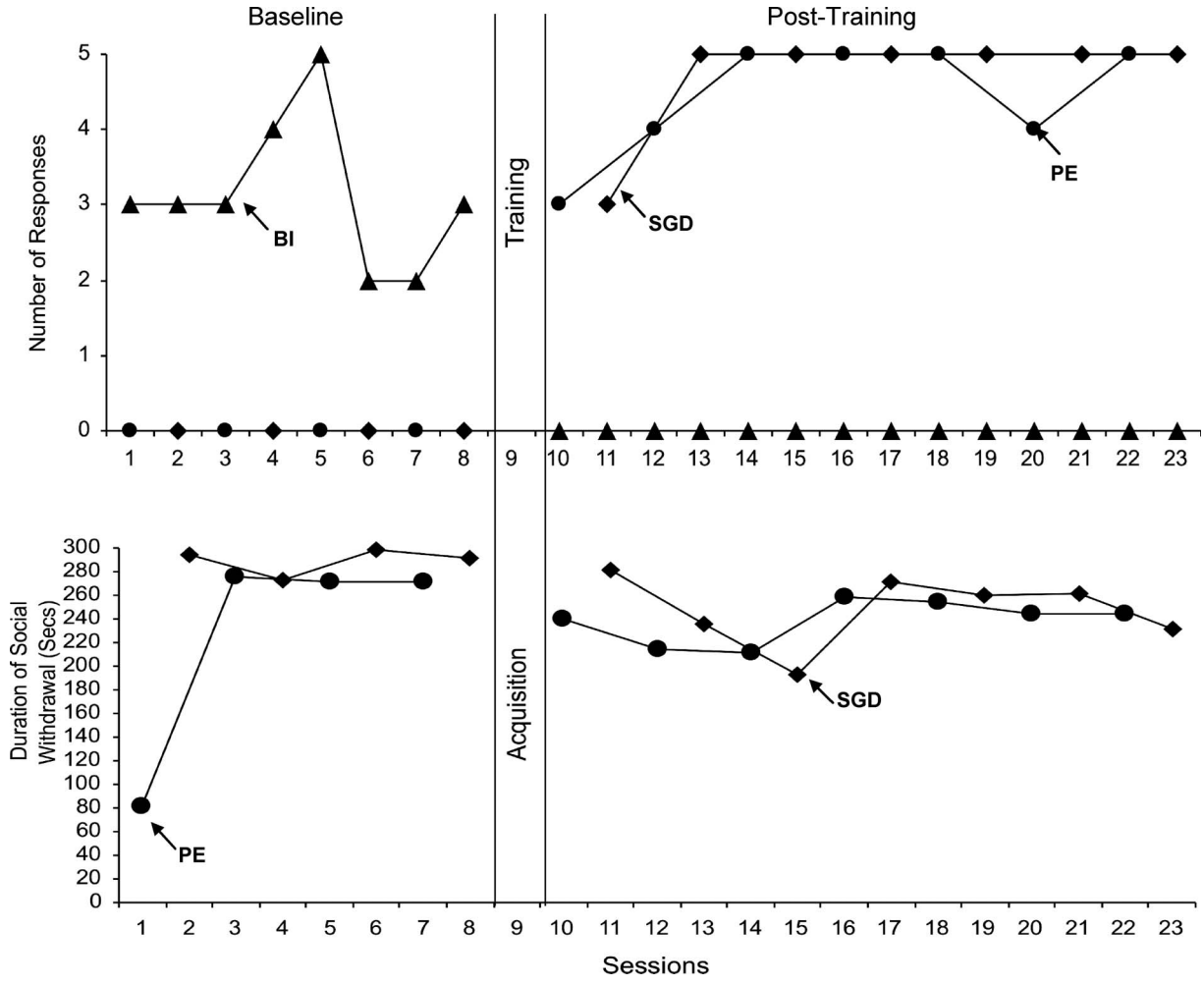

Figure 1. Number of instances of behavior indication and correct requesting (upper panel) and the duration (in seconds) of social withdrawal (lower panel) during the baseline and the posttraining phases of Study 1.

the symbol and receive a snack. Once he received the snack, he quickly turned away from the trainer until the next requesting opportunity was presented. Each of these brief encounters required only about 5–10 s and thus the total duration of social interaction during most sessions was rarely more than a minute.

Overall, the results of Study 1 demonstrated that acquisition of the initial PE- and SGD-based request was equally rapid, but neither intervention was sufficient to reduce the duration of social withdrawal. One could therefore conclude that, for individuals such as Trevor, who avoid social contact, additional procedures may be needed to promote social interaction during a beginning AAC intervention. Along these lines, but specific to PE, Frost and Bondy (2002) suggested a second phase of intervention, during which the trainer moves some distance away from the AAC user. This distancing procedure might have been promising for reducing Trevor's social withdrawal because he would have had to leave his seat to exchange the *WANT* symbol and receive the requested snack. This approach might also have been worth considering with the SGD, as Trevor would have been required to leave his seat to receive the requested snack.

However, prior to evaluating the effects of this distancing manipulation with Trevor, it was necessary to assess whether he had a preference for using PE versus the SGD, as was evident for three younger children in Son et al. (2006). If Trevor showed any such preference, it would be appropriate to continue his AAC program by implementing the distancing intervention, only with his more preferred ACC system. Study 2 was therefore designed to assess Trevor's preference for using PE versus the SGD.

STUDY 2

Method

The participant, and materials were the same as in Study 1.

Procedure

The setting and intervention context were identical to those of Study 1.The procedures were identical to the posttraining phase of Study 1 with one exception: During all sessions both the PE system and the SGD were placed on the table in front of Trevor. Thus, Trevor could choose to use either PE or an SGD to make a request. For each window of opportunity, the trainer recorded which device Trevor used to make a request. After the first six sessions (30 opportunities), anecdotal evidence suggested that Trevor was choosing whichever system happened to be marginally closer to him. We therefore altered the procedure for the remaining eight sessions by systematically manipulating and alternating the left versus right and far versus near placement of the devices. For the left/right manipulation, one device was placed 30 cm to the left of the table midline and the other device was placed 30 cm to the right. The left/right placement of PE system and the SGD was alternated after each window of opportunity. For the far/near manipulation, both devices were placed 30 cm to the right of midline, with one device placed at the table's edge closest to Trevor (near location) and the other placed 30 cm up from the table edge (far location). Again, the far/near placement of the PE system and the SGD was alternated after each window of opportunity. To ensure an equal number of left-right/far-near placements for each AAC system, the number of opportunities provided during the final eight sessions was reduced from five to four, for a total of 32 opportunities across these final eight sessions.

Reliability and treatment integrity

An independent observer recorded which device Trevor chose to use on 33% of the sessions. Agreement was 100%. Treatment integrity was checked on 33% of the sessions by comparing the trainer's actions to a checklist of the procedural steps. Procedural integrity was 100%.

Results

Trevor received a total of 62 opportunities to make a request with either PE or the SGD. Across these 62 opportunities he made a correct request within each 10 s window of opportunity. Overall, as indicated in Table 1, he showed a slight preference for PE (35 selections or 56%) over the SGD (27 selections or 44%). Across the 16 opportunities during which we manipulated the left/right placement of the devices, he selected the device placed on the left 15 times (94%) and only once selected the device that was placed on the right (6%). When both devices were placed on the right, but either nearer or farther from the table's edge, he opted for the near device 10 times (63%) and for the far device 6 times (37%).

Discussion

Trevor showed a slight preference for using PE over the SGD, but his choices appeared to be influenced mainly by relative location. Specifically, Trevor tended to opt for whichever device happened to be positioned closest to him. As in Study 1, in between each brief requesting episode, Trevor would turn away from the trainer and assume his usual position of social withdrawal. Because the trainer happened to be sitting to his right, this meant that whichever device happened to be placed to the left of the table's midline was closer to Trevor. His more frequent selection of the device placed to the left could thus be viewed as the easier option to select because reaching it involved less overall movement from his usual withdrawn position. This is the likely explanation of his almost invariable selection for the device placed to the left of the table's midline, regardless of whether it happened to be the PE system or the SGD. With respect to the far/near manipulation, when both devices were placed on the right of the table's midline, he was now required to move out of his socially withdrawn position to reach one of the devices. Having made this effort, it appeared to make relatively little difference as to whether he then selected the device placed in the near versus far location. This interpretation is based on the finding that, while he more often selected the nearer device, he also frequently opted to use the device that was placed 30 cm further up from the table's edge.

Overall, the results from Study 2 are somewhat at odds with research suggesting that individuals with developmental disabilities demonstrate a

TABLE 1 Number (%) of times Trevor selected PE versus SGD; and the left (versus right) or near (versus far) device.

	Device			Orientation			Distance		
	PE	SGD	Total	Left	Right	Total	Near	Far	Total
n	35	27	62	15	1	16	10	6	6
%	56%	44%	100%	94%	6%	100%	63%	37%	100%

preference when given a choice of two or more previously acquired AAC systems (Sigafoos, O'Reilly, Ganz, Lancioni, & Schlosser, 2005; Son et al., 2006; Soto, Belfiore, Schlosser, & Haynes, 1993). However, it is important to note the idiosyncratic nature of these preferences. For example, while some children might prefer using PE, others may prefer to use a SGD. It could also be the case that some individuals may not necessarily show a strong preference for any particular AAC system. Instead, as appeared to be the situation for Trevor, some individuals may opt to use whatever device is easier to access or whichever device requires less effort to use. This possibility indicates the need for clinicians to consider ease of access and response effort when assessing preferences for AAC devices.

Still, Trevor showed a slight preference for PE, and we decided to continue his AAC intervention program using only this system. PE appeared to be the more practical option for his classroom setting, given that his teacher had greater familiarity with PE. Continued PE intervention was in line with our therapeutic objective to reduce Trevor's social withdrawal because the planned distancing manipulation would seem easier to implement with the more portable PE, as compared to SGD, system. Study 3 was therefore designed to assess the effects of a distancing manipulation on correct requesting and social interaction while maintaining PE-based requesting.

STUDY 3

Method

The participant, setting, and intervention context were the same as in Studies 1 and 2. Trevor was provided with five opportunities per session to request the same preferred snacks with the PE system used in Studies 1 and 2. The SGD was not present during Study 3.

Procedure and experimental design

The procedures were identical to the posttraining phase of Study 1 except that after baseline, the trainer located herself either 60 cm, 90 cm, or 120 cm from the table before providing an opportunity for Trevor to request (i.e., holding up the plate and saying, *Let me know if you want a snack*. The final three PE sessions from Study 1's posttraining phase served as the baseline for Study 3. The baseline (or A phase) provided a comparison against which to judge the effects of the subsequent distancing manipulations. The three distance manipulations were then arranged in a BCDB sequence, starting with 120 cm, and then followed by 60 cm, 90 cm, and 120 cm distances. After baseline, the decision to move from one distance to another was based on visual analysis of Trevor's correct requests and social withdrawal. Distances were only increased if Trevor had less than 30 s of social withdrawal and made five correct requests in a session. For each of the five opportunities provided within a session, the trainer remained at each designated distance from the time she gave the cue, until the end of the window of opportunity. A response was considered correct if Trevor left his seat, approached within arm's length of the trainer, and gave her the *WANT* symbol within the 10 s window of opportunity. Following each correct request, he was given a snack. After each window of opportunity, the trainer returned the *WANT* symbol to the PE folder, if necessary.

Reliability and treatment integrity

An independent observer recorded correct requesting and the duration of social withdrawal across all sessions of the distance manipulations. Agreement on both dependent variables was 100%. Treatment integrity was not assessed due to an oversight; however the trainer's prior history of correct implementation during Studies 1 and 2 provides some evidence of her ability to follow treatment protocols with fidelity, at least with respect to common treatment elements (e.g., providing the PE system, holding up the plate and saying, *Let me know if you want a snack*, etc). The only novel aspect of Study 3 was the requirement to stand at varying distances from Trevor when making an offer, which would seem to be a fairly easy manipulation to implement correctly.

Results

Figure 2 shows the number of correct PE-based requests (upper panel) and the duration of social withdrawal (lower panel) during baseline and for each session of the various distances. In baseline, Trevor made 4–5 correct requests (80–100%) during each session, but also had lengthy durations of social withdrawal (>240 s per session). When the trainer initially moved 120 cm from the table (Sessions 4–6), requesting did not occur, but social withdrawal decreased to 0 s. During these sessions, Trevor remained seated at the table but oriented towards the trainer. Assuming that he was waiting for the trainer to approach him, we decided to move to a distance of 60 cm, thereby

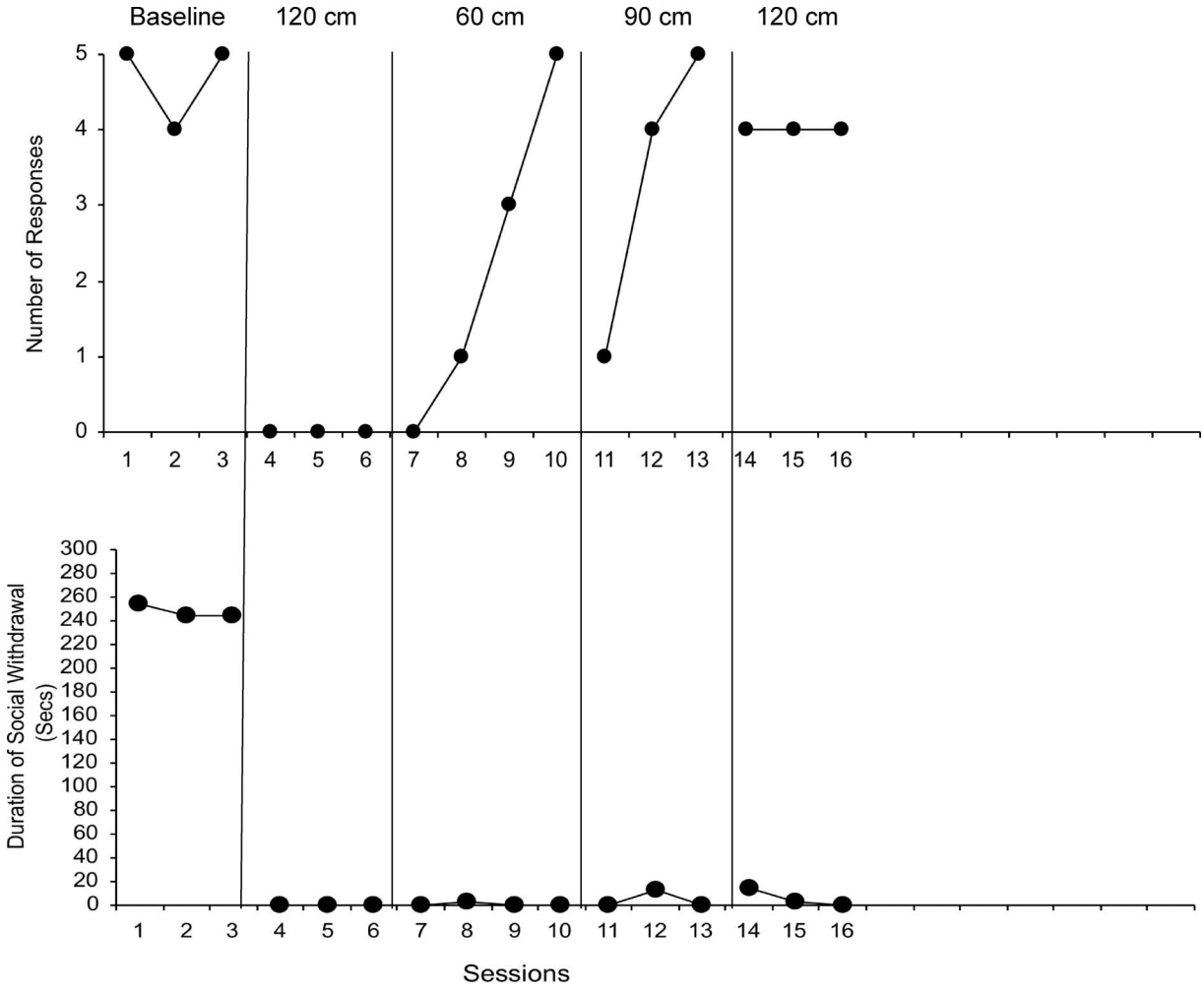

Figure 2. Number of correct PE-based requests (upper panel) and the duration of social withdrawal (lower panel) during baseline and for each session of the various distances that were used in Study 3.

reducing the response effort of exchanging the *WANT* symbol. With this distance reduction, correct requesting increased while social withdrawal remained negligible (<3 s). At 90 cm, social withdrawal remained low, while correct requesting temporarily decreased, but increased to 100% after two sessions at the 90 cm distance. This improvement in correct requesting prompted a final distance increase to 120 cm. In this final phase, correct requesting was maintained at 80%, with Trevor spending virtually no time socially withdrawn.

Discussion

The distancing manipulation was associated with an immediate, sustained, and dramatic decrease in social withdrawal. Correct requesting, in contrast, initially decreased, but eventually recovered to a high level at each of the three distances. These results support Frost and Bondy's (2002) recommendation to increase the distance between the trainer and the AAC user following acquisition of the initial requesting response.

When the trainer first stood 120 cm from Trevor and offered a snack (Session 4), he turned towards her and continued to look in her direction throughout the entire session. His adoption of this orientation towards the trainer accounts for the lack of social avoidance during Sessions 4–7. However, while Trevor remained oriented towards the trainer, he did not leave his seat to exchange the *WANT* symbol during any of the 20 windows of opportunity that occurred across these four sessions. This absence of requesting could indicate that (a) Trevor did not comprehend the new task requirements, or (b) he was not sufficiently motivated to make the additional effort that was now required to make a request. To address both of these potential factors, the trainer moved closer (to 60 cm) and tried to make it clear to Trevor that he should approach (i.e., she held out the plate of snacks while saying, *Let me know if you want a snack*. This interpretation is supported by the fact that

Trevor's frequency of requesting initially dropped again when the distance was increased from 60 to 90 cm.

Once he started making correct requests, the decrease in social withdrawal can be attributed to the need to leave his seat and approach the trainer before he could receive a snack. These new response requirements meant that there was simply less time for Trevor to be socially withdrawn. Interestingly, once he received a snack he often returned to his seat at the table, but remained oriented towards the trainer. It is possible that Trevor maintained this new position because it enabled him to determine exactly when the next opportunity to request arose.

Unfortunately the experimental design does not permit any firm conclusions as to the need for gradual increases in distance (i.e., distance fading). Anecdotally, we noted that 120 cm seemed to be the limit for Trevor, as a few follow-up sessions at greater distances resulted in a complete lack of requesting. Still, the results of Study 3 suggest that having the trainer move up to 120 cm away from the table was sufficient to virtually eliminate Trevor's tendency to remain socially withdrawn.

GENERAL DISCUSSION

Because Trevor's social withdrawal inhibited social interaction, we indirectly aimed for a reduction of this target behavior. Study 1 showed that despite Trevor's rapid acquisition of PE and SGD-based requesting, neither of these interventions had any positive effect on social withdrawal. We attributed this to the fact that the requesting scenario used in Study 1 required only minimal social interaction. The simple distance manipulation suggested by Frost and Bondy (2002), in contrast, appeared highly effective in reducing social withdrawal. These collective results suggest that while PE and SGD were equivalent in acquisition and preference, acquisition of an initial PE- or SGD-based requesting response is unlikely to produce any positive effects on social interaction. However, social withdrawal would seem to be relatively easily eliminated by the addition of a simple distancing procedure to the intervention.

It is important to note that while the present series of studies included PE as a mode or system of communication, these studies should not be seen as an attempt to implement or evaluate Frost and Bondy's (2002) Picture-Exchange Communication System (PECS). PE is a mode of AAC, whereas PECS is a comprehensive program for establishing basic and advanced use of PE for a range of communicative functions. Because our study was limited to an initial comparison of PE and SGD in terms of acquisition, preference, and effects on social interaction, we did not use the PECS manual to guide intervention. Instead we used more generic instructional strategies that have been empirically validated for teaching both PE and SGD (Sigafoos et al., 2007). The use of generic instructional strategies was appropriate, given the need for mode-neutral protocols to equate the PE and SGD conditions. Still, many of the instructional strategies described in the PECS manual were used in our studies (e.g., response prompting, differential reinforcement), but these strategies are not unique to, or applicable only in conjunction with, the PECS manual. For example, while we based Study 3's procedures on Frost and Bondy's distancing recommendation, this recommendation is entirely consistent with well-established behavioral principles of shaping, fading, and chaining.

The generality of our approach for other AAC users remains to be determined. The present study was limited to a single participant who presented with a rather overt form of social withdrawal, but an apparently high level of motivation to request preferred items. Future studies could expand this line of work by investigating effects on social interaction when teaching other communication skills, such as requests for toys or activities, commenting, and question asking. Research in other communicative contexts where social interaction is appropriate, such as play and leisure activities, would be instructive. It is unclear whether other procedures, such as directly prompting social interaction or incorporating more general social skills instruction into AAC intervention (Wilkins & Matson, 2007), could be used to increase social engagement in children such as Trevor. One might question whether the reduction in Trevor's social withdrawal was accompanied by any qualitative improvement in social interaction as defined by other researchers (e.g., Gresham & Elliott, 1984; Wilkins & Matson, 2007). Trevor certainly spent less time being socially withdrawn in Study 3, but this was probably a by-product of the new requesting requirements. While the reduction in the duration of social withdrawal was important in its own right, it was not clear that this represented an increase in social interaction more generally or simply a means to obtain a preferred snack. Future research should develop effective procedures for increasing social interactions during AAC intervention.

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