Effects of a Treatment Package on Imitated and Spontaneous Verbal Requests in Children with Autism

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Abstract: Students with autism spectrum disorders (ASD) have difficulties with verbal language. Many interventions to remediate such deficits require numerous materials and significant teacher time. This study sought to determine if a simple multi-component intervention that incorporated noncontingent reinforcement (NCR) and verbal modeling would result in increased spontaneous verbal requesting in two preschool boys with autism. Results indicated that the participants did increase use of spontaneous and imitated verbal requests. Implications are discussed.

Deficits in communication and speech are a hallmark of autism spectrum disorders (ASD; American Psychiatric Association [APA], 2000). Many individuals with ASD do not speak or have delayed communication skills (APA), including limited communication functions (e.g., requests and refusals; Ogletree, 2008). Some have difficulty maintaining conversations and use repetitive or echolalic speech (APA; Janzen, 2003). Other aspects of speech may be delayed, including articulation, content, grammar, and using abstract concepts in language (Janzen).

The National Research Council (2001) recommends that programming for children with ASD includes at least 25 hours per week of systematic instruction, focusing on functional and spontaneous communication. Such instruction may cost up to $60,000 per year (National Research Council). Thus, it is important to determine if some children with ASD respond to less costly, effective strategies, which allow precious resources, including personnel training time and cost, instructional time, and materials, to be reserved for those students who require costly and intensive interventions. Koegel, Koegel, Shoshan, and McNerney (1999) report that children with autism who demonstrate more frequent spontaneous communication, including nonverbal communication, prior to communication treatment respond better to such treatment.

Several methods have been proposed to replace challenging behaviors with socially acceptable communication skills in children with ASD. Noncontingent reinforcement (NCR) focuses on increasing socially relevant skills and has been proven effective with individuals with a variety of disabilities. Further, elements of incidental teaching and time-delay have had promising results.

Modeling of behaviors has been used to improve a variety of skills in children with ASD (Matson, Matson, & Rivet, 2007; Stahmer, Ingersoll, & Carter, 2003). This procedure, when used for modeling names of items for requesting, had also been called mand-modeling (Mobayed, Collins, Strangis, Schuster, & Hemmeter, 2000). Research has supported the use of in vivo modeling of peers and adults to promote labeling (Charlop, Schreibman, & Tryon, 1983) and following directions (Egel, Richman, & Koegel, 1981). In vivo modeling has also resulted in improved play and social skills in children with autism, including dis-
playing affect (Gena, Couloura, & Kymissis, 2005), cooperative play skills (Tryon & Keane, 1986), and independent play (Jahr, Elevik, & Eikeseth, 2000). Thus, repeated, verbal modeling of names of preferred items may have potential in improving the communication skills in such children.

Noncontingent reinforcement (NCR) involves giving children access to reinforcement regardless of whether or not they perform desired behaviors (Heflin & Alaimo, 2007; Tucker, Sigafos, & Bushnell, 1998). NCR has been demonstrated to be effective in a few studies with individuals with ASD and developmental delays. Carr, Dozier, Patel, Adams, and Martin (2002) implemented NCR with response blocking to reduce object mouthing. Lalli, Casey, and Kates (1995) implemented NCR with and without extinction procedures, resulting in reduced aggressive and self-injurious behaviors. Roscoe, Iwata, and Goh (1998) compared the use of NCR with extinction and found both to be effective in reducing self-injurious behaviors. Butler and Luiselli (2007) used noncontingent escape, combined with other interventions, to decrease aggression, self-injury, and tantrums in a child with autism. One study (Marcus & Vollmer, 1996) successfully demonstrated the combination NCR with differential reinforcement of alternative behavior to improve communication skills in children with mental retardation and autism. Similarly, Mildon et al. (2004) implemented noncontingent escape with functional communication training to improve verbal communication and compliance in a young child with autism. Finally, Ganz, Heath, Rispoli, and Earles-Vollrath (2010) noted a small increase in related speech during a noncontingent reinforcement plus verbal modeling procedure for a three-year-old with autism, which was not found during implementation of the Picture Exchange Communication System.

Time-delay, when used to promote the use of speech in individuals with ASD, usually involves offering a child a reinforcing item, modeling the name of the item, and withholding the item until the child repeats the correct name of the item (Ross & Greer, 2003). Such a procedure is often limited to children who already speak, but need to learn new words. This procedure has also been successfully implemented within an incidental teaching model to teach speech within natural contexts (Charlop-Christy & Carpenter, 2000; McGee, Almeida, Sulzer-Azaroff, & Feldman, 1992; McGee, Krantz, Mason, & McClannahan, 1983).

The purpose of this study was to investigate the impact of implementing a multi-component instructional package, including NCR in combination with repeated verbal modeling, on spontaneous and imitated verbalizations in children with autism. The following research question was investigated: can children with autism who do not speak spontaneously (but can imitate 1–2 word phrases) learn to make spontaneous or imitated verbal requests with NCR and verbal modeling? While increases in spontaneous speech were preferable, data were also collected on imitated verbalizations; increased use of imitated speech may emerge before spontaneous speech in children with ASD and such progress in echolalic speech indicates an increased likelihood for further language development (Carpenter & Tomasello, 2000).

Method

Participants and Materials

Participants were recruited from a private school for children with ASD and other developmental disabilities. They were diagnosed with autism independently of this research by certified medical professionals according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) criteria. The participants’ diagnoses were then confirmed via the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988) and the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999). Two children with autism were identified as potential participants, met the inclusion criteria, and completed this study. Participant descriptions given below reflect information obtained from the researchers’ administration of the CARS based on observations and the researchers’ administrations of the ADOS.

Josiah was 3-years, 6-months old and was diagnosed with autism. He fell within the autism range on the ADOS and mild/moderate...
autism on the CARS. Regarding social interactions, he would respond when an adult persisted in attempting to gain his attention, though he was not as responsive as typically-developing peers. Josiah’s verbal communication was characterized by one-word utterances that were clearly articulated and infrequent spontaneous verbal requests. Josiah did not engage in severe problem behaviors, however, he often snatched or grabbed items he wanted due to a lack of more socially acceptable means of requesting. That is, he demonstrated spontaneous, but nonconventional means of communication.

Ari was 4-years, 11-months old and was diagnosed with autism and speech impairment. He fell within the autism range on the ADOS and the mild/moderate autism range on the CARS. Specifically, Ari did not respond to a social smile, used few facial expressions directed at others, and did not initiate joint attention. Further, Ari’s verbal communication was characterized by infrequent use of one-word phrases, poorly articulated word approximations (e.g., he frequently left off final consonant sounds), and infrequent spontaneous use of verbal requests. Ari frequently engaged in tantrums (crying and screaming) when he did not obtain items he wanted. Ari did communicate spontaneously, using non-conventional means.

**Setting**

Both of the participants were enrolled in a private school for children with autism and developmental disabilities in three classes that served children from age two through elementary ages. The study took place in the school therapy room and in an office which was also used as an assessment clinic. The researcher sat within arm’s reach of the participants at a table or on the floor. Materials included a variety of toys and food items that the children preferred.

**Response Definitions and Measurement**

Each session included five opportunities, or trials, to request items. Each trial began when the researcher enticed the child by showing the item and ended 10 s after the participant was given the item (with or without correctly naming the item). Data were only recorded for trials during which the child showed interest in the item presented by gesturing or reaching for it or requesting it verbally. If the child did not show interest in the item, another item was presented.

The researchers collected data on three dependent variables. For each opportunity to request an item, the observers recorded whether (+) or not (-) the participant engaged in that behavior. The dependent variables included (a) requested with verbal model (did the participant use the correct, intelligible name for the item following a verbal model from the researcher?), (b) requested independently (did the participant correctly name the item using a single word or phrase that correctly applied to the item shown and without a verbal model?), and (c) word approximations (did the participant use a correct word approximation with or without a verbal model [at least two phonemes from the actual word?]?). Data for these variables were reported in percentage correct per session. The researchers also recorded word-for-word what the participants said during each trial. Data were collected during all intervention sessions.

**Experimental Design**

A multiple baseline design across object sets (3 reinforcing items per set) was used. The study was implemented in three phases across the three sets for each participant. The criterion for a phase change, that is implementation of intervention with the next set, was three consecutive sessions of 80–100% requested independently or word approximations, if the participant had poor articulation but was comprehensible.

**Procedure**

**Reinforcer assessment.** First, the participants’ parents completed reinforcer checklists. Then the experimenter offered each participant two to four items at a time, changing placement of the items for each presentation. Food items were offered separately from toys. The experimenter recorded tally marks to assess which items each participant chose most frequently. Each participant’s preferred items were di-
vided into three sets that were approximately equivalent in terms of reinforcing value or topographic use. For example, Josiah’s set 1 included a wind-up zebra, a laser disk, and light-up clackers; set 2 included a wind-up monkey, a sound stick, and stretchy string; and set 3 included a wind-up car, glitter wand, and fun fruit.

Baseline. First, baseline data were collected. The experimenter held one of the child’s preferred items and enticed him by shaking the item, playing with it herself, holding it out as if to hand it to the child, or saying something to get the child’s attention, but did not name the item. If the participant showed interest in the item (e.g., reached for it, tried to grab it, gesturing toward it) without requesting it verbally, the experimenter would hold onto the item for a 5 s time delay. If the child did independently request the item or used a word approximation, the experimenter would immediately give the item to the child. If the participant did not correctly name the item, he would not be given the item until the end of the 5 s delay. Then, he would have brief (approximately 10 s) access to the item. At least two items from the current set were used during a single session. That is, the researcher would entice the participant with at least two items throughout the session, although the participant did not necessarily initiate trials with both.

Multi-component instructional program. The intervention phase was identical to the baseline conditions with the addition of verbal models and expansion of delayed access to reinforcers. Intervention incorporated Tucker et al.‘s (1998) suggestions regarding NCR: following initial continuous reinforcement (baseline), reinforcement should be faded to a lower frequency, and NCR should be combined with educational interventions (e.g., modeling). This implementation of NCR was a slight variation from how NCR is typically implemented in that the items were not freely available, but were frequently available without a prerequisite behavior.

The experimenter would entice the child as in baseline. When the participant initiated a trial, the experimenter would give up to a 5 s time delay. If the child did not initiate a verbal request, following the 5 s delay, the examiner would continue to hold the item and correctly name it up to three times, pausing approximately 2 s between each verbal model. If the child correctly requested the item at any time, he would be given access to the item for approximately 10 s. Once he requested independently or requested following a verbal model, the verbal models would cease for the remainder of the trial, however, if he used a word approximation, he would immediately be given access to the item and the experimenter would continue to correctly model the word. If the child did not request independently or approximate the name, he would receive the item 2 s following the third verbal model and have access to it for 10 s. That is, he would non-contingently obtain the item, but after a delay. Making a request independently or a request following a verbal model resulted in quicker access to the item.

Generalization. Generalization involved implementation of the intervention with a novel experimenter for one session for each set with the participants who completed all three intervention phases. These sessions took place within the two days following the completion of intervention. Procedures were identical to those described above in the previous section.

Follow-up. Follow-up data were collected 3 weeks following the cessation of intervention for each of the participants who completed all three phases of intervention. Follow-up followed the procedures described above in the intervention section.

Analysis

Results were analyzed via visual analysis of the graphically displayed data for each participant to determine if there was a functional relation between the intervention and the communication behaviors. Visual analysis inspected for ascending or descending trends, swiftness of change in trend and change in mean. Data were also analyzed via an effect size, the Improvement Rate Difference (IRD) (Parker, Vannest, & Brown, 2009). IRD calculates the amount of overlap between data points in different phases (e.g., baseline versus intervention) or between different treatments. IRD: (a) has a lengthy record in medicine, as “risk difference;” (b) has a known sampling distribution, thus p-values and confidence intervals may be calculated, and (c) correlates with
other effect size measures and with visual analysis (Parker et al.). IRD measures the difference in “improvement rates” between two phases or interventions. “Improved” data points in phase A are larger than expected. Parker et al. recommend the following guidelines when interpreting IRD scores: IRDs of below 0.50 signify small or questionable effects, IRDs between 0.50 and 0.70 suggest moderate effects, and IRD scores at approximately 0.70 or 0.75 or higher are large or very large effects.

Inter-observer Agreement and Treatment Fidelity

The observers included two college professors and a graduate research assistant, who are the authors of this article. Inter-observer agreement was assessed by using a point-by-point agreement ratio. The number of agreements was divided by the total number of agreements plus disagreements and multiplied by 100 (Kazdin, 1982). An agreement occurred when two observers independently recorded the same score for a dependent variable during a trial. During baseline, inter-observer agreement was assessed for 58% of Josiah’s sessions and 64% of Ari’s sessions. Mean inter-observer agreement for baseline was calculated at 100% and 98% (range = 80%–100%), respectively. During intervention, inter-observer agreement was assessed for 81% of Josiah’s sessions and 85% of Ari’s sessions. Mean inter-observer agreement for intervention was calculated at 96% (range = 73%–100%) and 97% (range = 80%–100%). Inter-observer agreement was assessed during generalization sessions for one (33%) of Josiah’s sessions and was calculated at 100%, and for two (67%) of Ari’s sessions and was calculated at 77% (range = 73%–80%). Inter-observer agreement was assessed for one (33%) of Josiah’s follow-up sessions and was calculated at 100% and for all (100%) of Ari’s follow-up sessions and was calculated at 100%. Coefficients of agreement broken down by dependent variables are available by request from the authors.

Treatment fidelity was assessed on six days of intervention. The following steps or components of intervention were assessed by an observer and she recorded whether or not the interventionist correctly implemented each step or component of intervention: (a) held item within view; (b) waited for the child to initiate for 5 s; (c) when the child did not initiate, chose another item; (d) when child initiated, but did not say the word or an approximation, gave verbal model of word; (e) gave up to three verbal models before giving the item; (f) waited approximately 2 s between verbal models of word; (g) if the child said the word or approximation, or after all verbal models, gave the item immediately; and (h) allowed the child to play with the item for at least 10 s. Treatment fidelity was assessed as 100% for all observed sessions.

Results

Josiah

Figure 1 presents Josiah’s requests following a verbal model, those that were requested independently, and the use of word approximations to make requests.

Requested following a verbal model. There were no opportunities for Josiah to request following a verbal model during baseline sessions. During intervention for set 1, Josiah quickly began requesting following a verbal model at a high rate (mean = 36%, range = 0–100% of the trials), however, these rapidly dropped in level as independent requests increased. During generalization for set 1, Josiah requested following a verbal model during 0% of the trials. At follow-up, Josiah requested following a verbal model during 40% of the trials. During intervention for set 2, Josiah requested following a verbal model at a lower rates (mean = 13%, range = 0–40% of the trials). During generalization and follow-up for set 2, Josiah never requested following a verbal model. During intervention for set 3, Josiah requested following a verbal model at a low, but variable rates (mean = 33% range = 0–100% of the trials). During generalization and follow-up for set 3, Josiah did not request following a verbal model.

Requested independently. For set 1, Josiah infrequently requested independently (mean = 13%, range = 0–20% of the trials) during baseline sessions. During intervention, Josiah gradually began independently requesting the items at a high rate (mean = 60%, range = 0–100% of the trials). During generalization
for set 1, Josiah independently requested the items during 60% of the trials. At follow-up, Josiah independently requested items during 40% of the trials. For set 2, Josiah infrequently requested independently (mean = 10%, range = 0–20% of the trials) during baseline sessions. During intervention, Josiah began independently requesting the items at a higher rate (mean = 73%, range = 40–100% of the trials). During generalization for set 2, Josiah independently requested the items during 60% of the trials. During generalization for set 3, Josiah independently requested the items during 100% of the trials. At follow-up, Josiah independently requested items during 80% of the trials. For set 3, Josiah never independently named the items during baseline sessions. During intervention, Josiah gradually began independently requesting the items at a higher rate (mean = 57%, range = 0–100% of the trials). Overall IRD for Josiah’s independent (i.e., not following a verbal model) requesting was 0.73, 90% CI [0.47, 0.86], p = .000. This suggests moderate to large effects for this participant and this dependent variable.

**Word approximations.** For set 1, Josiah never used word approximations to make re-

Figure 1. Josiah: Percentage of trials during which he requested following a verbal model, requested independently, and used word approximations.
quests during baseline sessions. During intervention, Josiah used word approximations at a low rate (mean = 6%, range = 0–40% of the trials). During generalization for set 1, Josiah used word approximations during 40% of the trials. At follow-up, Josiah used word approximations during 20% of the trials. For set 2, Josiah infrequently used word approximations (mean = 5%, range = 0–20% of the trials) during baseline sessions. During intervention, Josiah infrequently used word approximations (mean = 13%, range = 0–40% of the trials). During generalization for set 2, Josiah used word approximations during 40% of the trials. At follow-up, Josiah used word approximations during 20% of the trials. For set 3, Josiah never used word approximations during baseline sessions. During intervention, Josiah used word approximations during only one session (mean = 3%, range = 0–20% of the trials). During generalization for set 3, Josiah did not use word approximations. At follow-up, Josiah used word approximations during 20% of the trials. Visual analysis clearly demonstrates that the intervention was far more effective for independent requests for Josiah, thus, IRD was not calculated for word approximations.

Ari

Figure 2 presents Ari’s correct requests with a verbal model, those that were correctly requested independently, and his use of word approximations to make requests.

Requested following a verbal model. There were no opportunities for Ari to request following a verbal model during baseline. For set 1, during intervention, Ari began requesting following a verbal model at a low rate (mean = 11%, range = 0–20% of the trials). During generalization and follow-up for set 1, Ari did not request following a verbal model during any of the trials. For set 2, during intervention, Ari correctly requested the items during only one session (mean = 8%, range = 0–40% of the trials). During generalization and follow-up for set 2, Ari did not request following a verbal model during any of the trials. During intervention for set 3, Ari infrequently requested following a verbal model (mean = 4%, range = 0–20% of the trials). During generalization and follow-up for set 3, Ari did not request following a verbal model. Requested independently. For set 1, Ari never correctly and independently named the items he was requesting during baseline sessions. During intervention, Ari correctly and independently requested the items at low rates (mean = 14%, range = 0–60% of the trials). During generalization and follow-up for set 1, Ari never correctly and independently requested the items. For set 2, Ari did not correctly and independently name the items he was requesting during any baseline sessions. During intervention, Ari correctly and independently requested the items during only one session (mean = 8%, range = 0–80% of the trials). During generalization and follow-up for set 2, Ari did not correctly and independently request the items during any of the trials. For set 3, Ari infrequently correctly and independently named the items (mean = 6%, range = 0–20% of the trials) during baseline sessions. During intervention, Ari correctly and independently requested the items at a low rate (mean = 28%, range = 0–80% of the trials). During generalization for set 3, Ari correctly and independently requested the items during 20% of the trials. At follow-up, Ari did not correctly and independently request items during any of the trials. Visual analysis clearly illustrates that the intervention had a greater impact on word approximations for Ari, thus, IRD was not calculated for independent requests.

Word approximations. For set 1, Ari never used word approximations to make requests during baseline sessions. During intervention, Ari used word approximations at a high rate (mean = 69%, range = 20–100% of the trials). During generalization and follow-up for set 1, Ari used word approximations during 100% of the trials. For set 2, Ari never used word approximations during baseline sessions. During intervention, Ari frequently used word approximations (mean = 84%, range = 20–100% of the trials). During generalization and follow-up for set 2, Ari used word approximations during 100% of the trials. For set 3, Ari used some word approximations (mean = 20%, range = 0–60% of the trials) during baseline sessions, using more near the end of baseline data collection. During intervention, Ari used word approximations frequently (mean = 72%, range = 20–100% of the trials). During generalization and
follow-up for set 3, Ari used word approximations during 80% of the trials. Overall IRD for Ari’s use of word approximations was 1.00, 90% CI [0.75, 1.00], \( p = .000 \). This intervention had large effects for word approximations for Ari.

**Discussion**

Both participants made progress in targeted behaviors, one in independent requests and the other in use of word approximations. Josiah rapidly began imitating the correct names and eventually began to spontaneously use the correct names. Following implementation in sets 2 and 3, Josiah rapidly began to independently request the items he was requesting. During generalization probes with a new communicative partner, he used the requests, though at a lower rate for set 2. At follow-up, Josiah maintained the use of correct and independent requests, though at lower rates than during intervention phases. While Josiah did use some word approximations, his artic-
ulation was generally clear and he was able to correctly pronounce the names for the items most of the time.

Ari also made sufficient progress during intervention, however, he had some difficulties with articulation and used word approximations more frequently than requests, either following a verbal model or independently. Ari did quickly meet criterion for word approximations for all sets and was able to get his message across. Further, he generalized use of the word approximations to a new communicative partner at high rates and maintained the use of the word approximations during follow-up. While, preferably, Ari would have increased in spontaneous communication during intervention, an increase in imitated verbalizations often precedes spontaneous communication in individuals with ASD and is a positive indicator of language development (Carpenter & Tomasello, 2000). Though we did not collect data on the independent use of word approximations, we did anecdotally note that, during the last sessions of intervention for each set, Ari began using word approximations without requiring an immediate verbal model.

The implications of this study indicate that it may be possible to improve imitated or spontaneous speech skills in some students with autism with less costly and less intensive intervention packages, such as a combination of NCR and verbal modeling. One question that remains is what types of students would be most likely to respond to such interventions and which would require more intensive interventions. Considering the results of this study, it may be that children with higher rates of spontaneous communication skills, including nonconventional and less sophisticated skills (e.g., grabbing, reaching), and those who initially respond to others’ initiations more frequently (e.g., responding to their name) may more easily respond to simpler interventions. Further, younger students and those with more complicated health issues and those with more severe scores on diagnostic instruments may require more intensive and costly interventions.

NCR has been shown to decrease mouthing behaviors (Carr et al., 2002), reduce aggressive and self-injurious behaviors (Lalli et al., 1995). There is little research in which NCR has been used to increase communication. Therefore, the current study extended the line of research on the use of a treatment package, which included NCR and communication instruction, to increase communication behaviors (i.e., Marcus & Vollmer, 1996; Mildon et al., 2004). This intervention package incorporated Tucker et al.’s (1998) recommendations to fade initially high rates of reinforcement to lower rates and to combine NCR with educational interventions. Further, this study evaluated a modification on how NCR is typically implemented.

This study has some limitations. First, due to the implementation of this study during the summer, follow-up data was collected only once, three weeks following the cessation of intervention. It is not possible to assess the long term outcomes of this intervention without the collection of maintenance data several months following the cessation of intervention. Further, the researchers did not systematically collect data on the independent use of word approximations. Though the researchers noted anecdotally that Ari began using independent word approximations near the end of intervention, it would have been useful to determine the extent to which he did so. Clearly, many children with ASD will require far more intensive communication interventions. Another limitation is the use of intervention conditions when measuring generalization and follow up. Without a true return to baseline conditions, it is unclear whether or not Josiah and Ari would continue to make independent requests without continued training, though they did demonstrate use of previously learned skills with minimal instruction. A final limitation is the use of a multi-element intervention; because we always combined NCR with verbal modeling, it may be the case that modeling alone would have been sufficient and that NCR was irrelevant. Without investigating each component separately, we are unable to make the case that the combined intervention is necessary.

The current study included a small sample of children and was an initial demonstration of the combination of naturalistic teaching and NCR. Further replication is needed to generalize the results and refine the procedures. Future research is needed with children with varied characteristics, within differ-
ent settings, such as inclusive learning environments, and with larger groups of children. Future research is needed to investigate whether NCR would affect more complex communication behaviors.

Another area of future research is the use of NCR combined with verbal modeling by parents, caregivers, and teachers in natural settings such as home and childcare settings. Implementation in these settings might allow for varied and more complex requests than were allowed with the design of the current study. Future research might investigate the ease with which these strategies might be implemented by parents, caregivers, and teachers as well as their effectiveness in increasing others types of communication behaviors across settings.

References


Received: 31 August 2010
Initial Acceptance: 21 October 2010
Final Acceptance: 12 December 2011