

TEACHING CHILDREN WITH AUTISM WHICH RESPONSES  
TO IMITATE IN AN ORDINARY ENVIRONMENT

by

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A dissertation submitted to the Graduate Faculty in Psychology  
in partial fulfillment of the requirements for the degree of  
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This manuscript has been read and accepted for the Graduate Faculty in Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

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Autism is a pervasive developmental disorder that affects as many as 1 in 150 children. Children with autism demonstrate major deficits in language, imitation, and social skills. There is an extensive literature on operant conditioning procedures to establish an initial imitative repertoire in learners with autism (Baer and Sherman, 1964; Lovaas, Berberich, Perloff, & Schaefer, 1966; Baer, Peterson, & Sherman, 1967; Brigham & Sherman, 1968). The teaching of an initial generalized imitative repertoire is not sufficient to produce observational learning in unstructured ordinary environments for learners with autism. There is little empirical research on procedures to teach learners with autism to imitate selectively in ordinary environments. Learners with autism may fail to imitate peers in ordinary environments because they are not observing relevant discriminative stimuli or unprogrammed reinforcement contingencies that occasion imitative responding in ordinary environments by typically-developing learners. The purpose of the current study was to examine the extent to which imitative performances can be brought under the control of discriminative stimuli that occur in an ordinary environment in three learners with autism. A multiple-baseline-experimental design across participants with a graduated guidance and reinforcement treatment package was

used to teach learners with autism to imitate a peer in a classroom. All three participants demonstrated generalized imitative performances. The procedures in the graduated guidance and reinforcement treatment package enabled the participant's imitative performances to be brought under the control of discriminative stimuli in an ordinary environment.

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Children with autism demonstrate deficits in language, play, social, and imitation skills (Rogers, Hepburn, Stackhouse, & Wehner, 2003). In typically developing children, an imitative repertoire is established within the first year of life (Poulson & Kymissis, 1988). Imitative repertoires allow children to learn many new responses without direct training of each novel response and play an important role in the development of age-appropriate social and language skills (Baer, Guess, & Sherman, 1972; Baer & Deguchi, 1985). Typically developing children may use their imitative repertoires to learn new skills in ordinary environments (Brown, Brown, & Poulson, 2008). The term “ordinary environment”, in this paper, will refer to environments that do not include specific programming for imitation. For example, in a kindergarten classroom, a child may observe the student sitting next to him coloring a worksheet with a blue crayon and then may imitate him by coloring his worksheet with a blue crayon. In this situation, the typically developing child imitates the responses of another child without direct teaching of that new response. Deficits in imitation demonstrated by children with autism may prevent them from learning new skills in ordinary environments like their typically developing peers.

Even in structured teaching environments, children with autism often demonstrate deficits in imitation when a discriminative stimulus for imitation is presented. The term

“modeling stimulus” will be used to describe a stimulus that could operate as a discriminative stimulus for imitation. In other words, a modeling stimulus is the behavior of the model. The term “matching response” will be used to describe the responses of the learner that have similar topography to that of the modeling stimulus. Operant teaching procedures have been successfully used to teach imitation skills to children with autism in structured settings. In a typical imitation teaching trial, a discriminative stimulus to imitate is presented, manual prompts are provided, and consequences are programmed to increase imitative responding. Once the learner with autism can imitate a variety of modeling stimuli in non-reinforced trials it can be concluded that the learner has demonstrated a generalized imitative repertoire.

The teaching of an initial generalized imitative repertoire is not sufficient to produce imitation in an ordinary environment. In an ordinary environment, the discriminative stimuli and the consequences for imitation are not programmed specifically to increase imitative responding. To demonstrate imitation in ordinary environments, the imitative responding of the learner with autism must come under the control of potential discriminative stimuli present in an ordinary environment. Additionally, the behavior of the learner with autism must come under the control of unprogrammed reinforcement contingencies. The issue becomes how to teach stimulus control of imitative performances in learners with autism.

A review of the literature on observational learning addresses variables that influence imitative responding in typically developing children. Bandura’s research identifies several categories of discriminative stimuli that influence children’s imitative

responding. In Bandura's research the term "model" refers to an individual. Bandura's research suggested that gender of the model is associated with selection of an individual to imitate. The participants in Bandura's studies were more likely to imitate same-sex models than opposite sex models (Bussey & Bandura, 1984). Nevertheless, gender does not function as an independent variable because it cannot be manipulated. Thus, the results of the Bussey & Bandura (1984) study cannot be interpreted as showing a causal relation between gender and selection of a model to imitate.

In addition to demographic variables, Bandura studied the extent to which observation of reinforcement contingencies influenced the acquisition and performance of imitative responding. In the classic Bandura (1965) Bobo doll experiment, participants who observed a model being rewarded for aggressive responding demonstrated more imitation of aggressive responses as compared to participants who observed the model receiving punishment or no consequences for aggressive behavior. The Bandura (1965) study demonstrated that aggressive imitative responding by participants was controlled by the observed reinforcement contingencies.

The influence of contingencies of reinforcement on imitative responding was studied by assessing the extent to which participants imitated under conditions of delayed reinforcement (Bandura & Mischel, 1965). Participants in the Bandura & Mischel (1965) study selected reinforcement contingencies that matched the delay of reinforcement pattern of the observed model. That is, participants who observed a model selecting delayed access to preferred toys, edibles, and money at testing demonstrated preference for delayed access to preferred items, even though at pretest the participants selected

immediate reinforcement. The Bandura and Mischel (1965) and Bandura (1965) studies demonstrated that the responding of typically developing participants is sensitive to observed reinforcement contingencies.

In summary, the work of Bandura and his colleagues on observational learning suggests that demographic variables may function as discriminative stimuli for imitative responding (Bussey & Bandura, 1984), and furthermore, that consequent stimuli for the observed behavior may also influence imitative responding in a laboratory environment (Bandura, 1965; Bandura & Mischel, 1965). Nevertheless, the work of Bandura and his colleagues on observational learning does not directly provide strategies for teaching selective imitation skills to learners with autism in ordinary environments.

#### *Initial Imitation Training*

As stated above, learners with autism demonstrate deficits in imitation (Rogers, et al. 2003). Nevertheless, there exists an empirically based operant learning literature on procedures to teach generalized imitative repertoires to learners with autism and typically developing children. To demonstrate generalized imitation, each motor or vocal response does not require direct reinforcement. Baer and Sherman (1964) provided one of the first empirical accounts of the development of generalized motor and vocal imitative repertoires in typically developing preschool children. In the Baer and Sherman (1964) study, participants demonstrated imitative responding to nonreinforced stimuli. An experimental analysis of verbal imitation in three typically developing children yielded similar results (Brigham & Sherman, 1968). In the Brigham and Sherman (1968) study participants were reinforced for imitation of English words, but they received no

programmed consequences for imitation of Russian words. After completing training, participants demonstrated increased accuracy in imitating Russian words as long as reinforcement was provided for accurate imitation of English words. The results of the Brigham and Sherman (1968) study demonstrated the development of a generalized vocal imitative repertoire.

Similar operant learning procedures have been used to teach imitation skills to children with autism and other developmental disabilities (Lovaas, Berberich, Perloff, & Schaefer, 1966; Baer, Peterson, & Sherman, 1967). The Baer et al. (1967) study provides one of the earliest accounts of the development of a generalized imitative repertoire in three children with developmental disabilities. Prior to participation in the study the participants did not demonstrate any spontaneous motor or vocal imitation. Participants were initially taught to imitate a variety of motor responses (i.e. raise left arm, tap nose, tap nose, tap table with left hand) using food reinforcement, manual prompting, and shaping procedures. During training trials, responses that topographically matched the motor imitation stimulus were reinforced. During probe trials, no reinforcement was provided. Participants demonstrated imitative responding during non-reinforced probe trials. Upon acquisition of generalized motor imitation, two of the three participants were taught to imitate vocal stimuli using similar procedures. The Baer et al. (1967) study demonstrates that children with developmental disabilities can develop a generalized imitative repertoire through operant learning procedures.

As shown in the above studies, an initial generalized imitative repertoire can be learned with operant teaching procedures by typically developing learners and learners

with developmental disabilities. Thus, imitation of vocal responses will often generalize to untrained vocal stimuli, but not necessarily to untrained motor stimuli. Similarly, imitation of motor stimuli will often generalize to untrained motor stimuli, but not necessarily to untrained vocal stimuli. (Young, Krantz, McClannahan, & Poulson, 1994; Poulson, Kyparissos, Andreatos, Kymissis, & Parnes, 2002). A study by Baer et al. (1967) provides an example of teaching procedures that can be used to take an existing motor imitation repertoire to then establish a vocal imitative repertoire. The Baer et al. (1967) procedure involved chaining motor and vocal stimuli together and then fading out the motor component. This study provided one of the earliest demonstrations of behavior analytic teaching procedures to train imitation skills across stimulus modalities.

The following section of the paper will include a discussion of procedures that could be used to teach learners with autism to display their generalized imitation skills in an ordinary environment.

*Continuum of Imitation Skills: Initial Imitation Training and Ordinary Environment Imitation*

Once a learner with autism demonstrates a generalized imitative repertoire in a structured environment, those imitation skills need to be displayed in ordinary environments if he or she is to be able to use those skills. Imitative responding in ordinary environments must be brought under the control of relevant discriminative stimuli and unprogrammed reinforcement contingencies. A traditional three-term contingency analysis as described by Baer, Guess, and Sherman (1972) can be used to examine the controlling variables that could lead to imitative responding in ordinary

environments. During the teaching of an initial generalized imitative repertoire in a structured environment, the learner often sits facing his/her instructor and upon evoking an orienting response the instructor may provide the instruction “Do this” and present a modeling stimulus. If the learner engages in a response that is topographically similar to the modeling stimulus, reinforcement is provided. If the learner’s response does not match the modeling stimulus, manual prompts might be provided. In this example, the discriminative stimulus for imitation is a compound of the modeling stimulus and the verbal instruction “Do this.” The verbal instruction “Do this” is designed to increase the salience of the modeling stimulus, thus increasing the probability of a response.

Additionally, in the above example, the delivery of consequences for matching the modeling stimulus occurs without delay. Furthermore, nonreinforced probe models are usually interspersed among reinforced models perhaps at a ratio of one to three. The use of such procedures routinely leads to the development of an initial generalized imitative repertoire as shown by the acquisition of responding during the nonreinforced probes. Nevertheless, these procedures are not usually sufficient to teach spontaneous imitation of others, or observational learning, in ordinary environments.

In an ordinary environment, such as an elementary school classroom, if a child failed to respond to an instruction from the teacher to take out his or her math book, he or she might look to another child to see what book the other child took out. Furthermore, that learner might observe the consequences of that act by the other child – either verbal praise or avoidance of a reprimand from the teacher. Unlike the training of an initial generalized imitative repertoire, there are no clear discriminative stimuli that set the

occasion for imitative responding in the classroom. The discriminative stimuli that are present in an ordinary classroom environment may not set the occasion for an imitative response by a student. Those initial training procedures may need to be modified and extended to the ordinary classroom environment to enable the child with developmental disabilities to make use of his or her generalized imitation skills in the classroom so that observational learning may more easily occur. A conceptual analysis of the antecedent and consequent stimuli for imitation in ordinary environments could reveal potential stimuli in the ordinary environment that could evoke and maintain imitative responding. The following section of this paper will address possible naturally-occurring discriminative stimuli that could be used to extend an imitative repertoire into an observational repertoire in the classroom.

#### *Discriminative Stimuli*

This section of the paper will address procedures to transform stimuli that are present in an ordinary environment into stimuli that are discriminative for imitative responding by a learner with autism.

*Verbal instructions.* In an initial imitation teaching environment the modeling stimulus is often presented with a specific verbal instruction to imitate, such as “Do this.” Yet, in an ordinary environment typically developing learners are often observed imitating unprogrammed modeling stimuli without additional verbal instruction. Teaching learners with autism to display imitation skills in ordinary environments could require the learner to imitate without the presence of a verbal instruction to imitate.

Learning to imitate without verbal instructions is an initial step in teaching learners with autism to imitate in ordinary environments.

There have been imitation studies that have addressed imitation in the absence of verbal instructions (Metz, 1965; Apolloni, Cooke, & Cooke, 1997) but only the Metz (1965) study included participants with autism. In these studies there was an absence of verbal instructions during imitation training and the experiment was conducted in a laboratory environment that did not simulate the discriminative stimuli present in an ordinary environment.

*Peers.* The presence of peers as presenters of modeling stimuli is another important stimulus to be programmed in the transfer of imitation skills from an initial imitation teaching environment to an ordinary environment. Teaching learners with autism to imitate modeling stimuli presented by peers may be an important skill for them to learn to display imitative responding in an ordinary environment. In an initial imitation teaching environment, procedures could include teaching learners with autism to observe and reliably respond to peers during imitation training. Programming for peer behavior to serve as discriminative stimuli for imitation should increase the probability of imitative responding occurring in an ordinary environment.

Teaching learners with autism to select a single modeling stimulus to imitate in an environment from many potential modeling stimuli may require specific teaching procedures. During training in an initial imitation teaching environment, only one modeling stimulus is usually presented during an imitation trial. In an ordinary environment there often are a variety of potential modeling stimuli to imitate and the

learner must identify appropriate discriminative stimuli for imitation among a variety of stimuli. Teaching learners with autism to select peer responses that have been reinforced by the teacher could be a teaching strategy for selecting among the many potential modeling stimuli in the environment to imitate and may result in imitation of those modeling stimuli in an ordinary environment.

In the present study, the extent to which imitative performances can be brought under control of discriminative stimuli present in an ordinary environment was examined with three learners with autism. In this study there were three components of discriminative stimuli that were different from previous training procedures of an initial generalized imitative repertoire. First, no verbal instructions to imitate were provided to the learner with autism. Secondly, the modeling stimuli were presented to the learner with autism by peers, rather than adults. Finally, peer-modeled responses received positive reinforcement from a confederate teacher, and it is those responses that were targeted as modeling stimuli for learners with autism. This intervention package included graduated guidance (MacDuff, Krantz, and McClannahan, 2001) and reinforcement to teach learners with autism to imitate their successful peers in the classroom.

## Method

### *Participants*

Three children with autism served as participants. All three children were students at REED Academy, a private non-profit school for children with autism located in northern New Jersey. Qualified professionals not associated with REED Academy independently diagnosed each of the children with autism. Each of the participants met

the criteria for autism as defined in the Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> ed., text revision, (American Psychiatric Association, 2000).

Jeanette was 9-years old at the beginning of the study. She had received 4 years of educational services at REED Academy. Jeannette scored an age equivalent of 2 years 7 months on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). Justin was 9-years old at the start of the study and had been a student at REED Academy for 4 years. Justin scored an age equivalent of 3 years 3 months on the Peabody Picture Vocabulary Test. At the start of the study Mike was 10-years old and had been a student at REED Academy for 4 years. Mike's age equivalent was 4 years 11 months on the Peabody Picture Vocabulary Test.

All three children had prior experience with behavior analytic teaching procedures and token-based motivational systems. All three participants had acquired generalized imitation skills in a one-to-one teaching environment. Each participant displayed low levels of stereotypic behavior, such as noncontextual vocalizations.

### *Setting*

*Materials and equipment.* All sessions were conducted in a small-group instruction room at REED Academy that was 4 m by 5 m. As can be seen in Figure 1, the small group instruction room contained a teacher's desk, a group table that was 1 m by 1.5 m, a typical student desk and typical student desk chairs. On the student desk, foam core board that was 40 x 50 cm was mounted with hook and loop fasteners to block the participant's view of the activity schedule used by the confederate peer. An activity schedule was prepared using a small 1-inch half sheet three-ring binder, clear page

protectors, and color photographs depicting a person performing each of the fine motor modeling stimuli. Behind the foam core board a small photographic activity schedule was placed that was used to sequence the presentation of the confederate peer's modeling stimuli. The modeling stimuli included Fisher Price® Imaginex™ adventures battle coach and royal ship toys. These sets of toys contained a horse, a coach, a ship, and a knight. A token board was present on the group table in front of the confederate peer. The token board was constructed of a memo-sized clipboard 15 cm x 23 cm on which pennies could be attached with hook and loop fasteners. A small plastic cup was set near the participant on the group table for placement of the participant's tokens during the study. Tokens could be exchanged for preferred activities and snacks.

#### *Peer Model (Confederate Student)*

Austin was 5 years old at the beginning of the study and was a student at REED Academy. Austin had received educational services at REED Academy for 2.5 years and had received 1.5 years of transition services at REED Academy. At the start of the study Austin spent half of his school day in a regular kindergarten classroom.

#### *Instructor and Confederate Teacher*

The instructor was trained in applied behavior analysis and was a doctoral student in psychology. A REED Academy instructional staff member served as the confederate teacher for all treatment sessions.

#### *Dependent Measures*

The dependent measures were matching and nonmatching responses that were scored during each session. A matching response was defined as a response that matched

or closely approximated the topography of the reinforced responses of the confederate peer that occurred within 6s of a modeling stimulus. A nonmatching response was defined as any response that did not match the topography of the modeling stimuli or occurred more than 6s after the presentation of the modeling stimuli. Definitions of matching responses are listed in Table 1.

### *Measurement Procedures*

*Social validity measures.* A social validity measure was used to assess the importance of the goals and appropriateness of the procedures used to teach learners with autism to imitate peers in an ordinary environment. A social validity questionnaire was completed by the instructional staff at a private school for learners with autism. The social validity questionnaires were distributed and collected by a supervisor during weekly staff meetings. The social validity questionnaires were kept anonymous. Table 2 lists the five questions that were rated. Each question was rated on a scale ranging from 1 (not important or not appropriate) to 7 (very important or very appropriate). The data for the social validity measures were summarized as the median rating for each question, the median rating for each aspect of social validity, and the overall median for the questionnaire.

### *Stimulus Sets*

Three different toys and 12 motor actions made up the set of 12 modeling stimuli, previously shown in Table 1. Each of the 3 toys was used 4 times to make up the 12 different motor responses. For example, the horse was used for the galloping, jumping, lying down, and rearing modeling stimuli. All three participants had the same 12

modeling stimuli. Nine of the 12 modeling stimuli were designated as training items and 3 of the modeling stimuli were probe items. Initial assignment of stimuli to training and probe status was random and was consistent across participants and sessions. The presentation of training and probe stimuli were presented in a random order for each session for each of the participants.

### *General Procedure*

Sessions were conducted five days a week. Each session was approximately 15-minutes in length and one to two sessions were conducted each day. The experiment was conducted in a small group instruction as described under the “setting” section of the paper. Figure 1 depicts the spatial arrangement of the small group instruction room including the participant, the confederate teacher, confederate student, and instructor’s placement in the classroom.

The graduated guidance and reinforcement treatment package included two components: Graduated guidance and reinforcement for correct matching responding. The experiment was conducted in a mock ordinary classroom environment that included a confederate teacher that reinforced confederate peer responses, a confederate peer who presented modeling stimuli, and an instructor who provided prompting and reinforcement to the participant.

A session began when the confederate student began following an activity schedule (McClannahan & Krantz, 1997). Each session included the presentation of twelve trials in a random order during baseline and treatment sessions. Nine of the trials were training trials and 3 of the trials were probe trials. The confederate student and the

participant sat across from each other and had identical sets of toys. The confederate student followed a specific schedule of activities, each of which served as a modeling stimulus in this study. If the confederate student failed to present the modeling stimulus, the confederate teacher directed the confederate student's attention to the activity schedule until the modeling stimulus was correctly presented. Upon completion of the correct presentation of each modeling stimulus the confederate teacher delivered a token on the confederate student's token board along with a verbal praise statement. The praise statements were non-descriptive, such as "good" or "nice work" to eliminate the possibility that responding by the participants was controlled by the praise statement.

*Baseline sessions.* During baseline sessions no prompts or tokens were provided during either training or probe trials to the participant.

*Treatment sessions.* During treatment sessions if the participant did not emit a matching response within 6s of the modeling stimulus or if an incomplete or incorrect response was emitted, graduated guidance was used as an error correction procedure in which the instructor prompted the participant from behind to complete the correct motor response during training trials. If graduated guidance was delivered a response was scored as incorrect. Graduated guidance included the use of physical guidance to assist the learner in completing a modeled action. The physical prompts were faded in their intensity and location as the learners acquired matching responding. Initially the instructor used hand-over-hand prompts, and then used less forceful guidance to assist the learner in completing the response. Prompts were faded from hand-over-hand prompts to prompts at the wrists, forearm, elbow, and shoulder (Cooper, Heron, & Heward, 1987).

During probe trials no prompts or tokens were delivered. During training trials reinforcement was provided for every correct matching response and to responses that closely approximated the correct response. The participant received tokens that could be exchanged at the end of the session for preferred activities or snacks. After the participant demonstrated matching responses on 67% of trials during treatment, prompts were no longer delivered for incorrect responding during training trials. Reinforcement continued to be provided for correct responding in the treatment phase on training trials after prompting was removed. There were no consequences for incorrect responding after prompting was removed.

### *Experimental Design*

A multiple-baseline-experimental design across participants was used to evaluate the effectiveness of teaching learners with autism to imitate modeling stimuli in a mock ordinary classroom environment. The intervention package was introduced first for Jeannette, then Mike, and finally Justin.

### *Interobserver Agreement*

*Dependent measure interobserver agreement.* Two trained observers scored the participant's matching responding. The scorers were trained until they achieved at least 80% interobserver agreement on each of the measures in a single session. Independence of the scorers was maintained by having them sit across the room from one another. To be scored as an agreement both observers had to score each matching response that met the response definition as described in Table 1 and occurred within 6s of the confederate peers presentation of the modeling stimulus. Interobserver agreement was scored on a

trial-by-trial basis and the percentage was calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100.

Table 3 displays the mean percent of interobserver agreement on matching responses and percent of sessions with IOA for Jeannette, Mike, and Justin. During baseline sessions interobserver agreement had a range of 89 to 100% for Jeannette. Interobserver agreement during treatment sessions ranged from 99 to 100% for Jeannette. Interobserver agreement was 100% for baseline sessions and ranged from 96 to 99% for treatment sessions for Mike. For baseline and treatment sessions interobserver agreement was 100% for Justin.

#### *Procedural Validity*

*Procedural measures.* Accuracy of the confederate peer's presentation of the modeling stimulus was measured during the study. Table 1 includes a list of the modeling stimuli presented by the confederate peer. Accuracy of reinforcement delivery by the instructor to the participant was also measured. Reinforcer delivery was scored as correct if a reinforcer was delivered according to the schedule of reinforcement that was in effect for the current phase of the study. During baseline sessions for training and probe trials and probe trials during treatment, no reinforcement was provided to the participant. Thus, a correct consequence was recorded when a reinforcer was not delivered during baseline sessions and probe trials during treatment sessions. During treatment sessions, if the learner correctly matched the modeling stimulus during a training trial and a reinforcer was delivered, a correct consequence was scored. During treatment session training trials

the reinforcement schedule in effect was continuous reinforcement (CRF) for every correct matching response. Prior to the discontinuation of prompting, incorrect or incomplete matching responses during treatment sessions were prompted and intermittently reinforced resulting in a partial reinforcement schedule. Thus, reinforcer delivery was not included in the data analysis for incorrect matching responses during training trials in the treatment phase.

*Procedural results.* Percentage accuracy of modeling stimulus presentation by the confederate peer for Jeannette, Mike, and Justin was 100% across all three participants, during baseline and treatment sessions, for both training and probe trials.

Table 4 displays the mean percent accuracy of reinforcer delivery by the instructor for Jeannette, Mike, and Justin. During baseline sessions accuracy was 100% for training and probe trials across all three learners. Accuracy of reinforcer delivery had a range of scores from 96–99% for Jeannette, Mike, and Justin during the treatment phase for training trials with correct responses. During probe trials no reinforcers were delivered resulting in 100% accuracy.

*Procedural interobserver agreement.* Interobserver agreement data were collected on the accuracy of the modeling stimulus presentation by the confederate peer. To be scored as an agreement both observers needed to score the modeling stimulus as presented accurately in accordance with the response definitions described in Table 1.

The mean percentage of interobserver agreement on the accuracy of modeling stimulus presentation by the confederate peer was collected on a range of 39 to 50% of baseline sessions and a range of 33 to 39% of treatment sessions for Jeannette, Mike, and

Justin. Interobserver agreement on the accuracy of modeling stimulus presentation by the confederate peer was 100% for training and probe trial stimuli across both baseline and treatment sessions for all participants.

Interobserver agreement data on accuracy of reinforcer delivery is displayed in Table 5 for Jeannette, Mike, and Justin, respectively. Across baseline and treatment phases and across all three participants interobserver agreement had a range of 92 to 100%.

### *Results*

Figure 2 shows percentage matching responding during training and probe trials. Sessions are shown on the abscissa and percentage of responses matching the peer model is shown on the ordinate. The vertical line indicates the change in condition from baseline to treatment. The open circles represent probe trials and the closed circles indicate training trials. The top panel includes data for Jeannette, the middle panel for Mike, and the bottom panel for Justin.

#### *Training Trial Data*

As seen by the closed circles in the top panel of Figure 1, Jeannette did not emit any matching responses on training trials during baseline sessions. With the introduction of the graduated guidance and reinforcement treatment package, Jeannette's percentage of matching responding during training trials increased from 0% during baseline to 100% by session 15. This level of responding was thereafter regularly maintained throughout treatment. The arrow in the top panel of Figure 1 indicates that beginning at session 15,

manual prompts were no longer provided following incorrect responding. Reinforcement continued to be delivered for correct matching responses during training trials.

The middle panel of Figure 2 displays the data for Mike's performance. In the baseline phase of the experiment Mike did not emit any matching responses during training trials. Mike's matching performance increased from 0% during baseline to 100% during the first 7 sessions of treatment (session 27). Matching performance for Mike stabilized at this level during the final 9 sessions of treatment. Again, the arrow indicates that manual prompts were discontinued beginning at session 27 for Mike.

Justin's data are shown in the bottom panel of Figure 2. During the baseline phase of the experiment Justin did not emit any matching responses during training trials. Treatment was introduced during session 34 and matching responding increased from 0% during baseline to 100% within the first 3 sessions of graduated guidance and reinforcement treatment package. Matching responding for Justin maintained near this level throughout the remaining treatment sessions. The arrow shows the discontinuation of graduated guidance beginning at session 36 for Justin.

The treatment data show that there was a systematic increase in the percentage of matching responses during training trials emitted by the three participants with the introduction of the graduated guidance and reinforcement treatment package.

#### *Probe Trial Data*

The open circles in the top panel of Figure 1 depict Jeannette's performance during probe trials. As seen by the open circles in the top panel of Figure 1, Jeannette did not emit any matching responses on probe trials during baseline sessions. Matching

performance during probe trials increased from 0% during baseline to 100% by session 15 for Jeannette. Matching responding during probe trials stabilized at this level throughout the remainder of treatment for Jeannette.

The open circles in the middle panel of Figure 2 depict the data for probe trials for Mike. Mike did not engage in any matching responses during probe trials during the baseline phase of the experiment. Matching performance during probe trials increased from 0% during baseline session to 100% by session 25, during treatment for Mike. Responding during probe trials stabilized at this level beginning at session 27 for Mike.

As shown in the bottom panel of Figure 2, Justin did not emit any matching responses during baseline probe trials. With the introduction of treatment at session 34, Justin's probe responding increased from 0% to 100%. Matching performance on probe trials maintained at this level throughout the remaining treatment sessions for Justin.

The probe data show there was a systematic increase in the percentage of matching responding emitted during probe trials by the three participants with the introduction of the graduated guidance and reinforcement treatment package.

Overall, all three learners demonstrated a systematic increase in the percentage of matching responding with the introduction of the graduated guidance and reinforcement treatment package during training trials. More importantly, all three participants demonstrated a corresponding increase in matching responding emitted during nonreinforced probe trials upon the introduction of the graduated guidance and reinforcement treatment package during training trials.

### *Social Validity Data*

A social validity questionnaire (Table 2) was used to determine the importance and appropriateness of the procedures in the current study to teach imitation to learners with autism in an ordinary environment. All 24 social validity questionnaires that were distributed were returned, giving a return rate of 100%. Table 6 displays the median rating for each question and the median rating for each aspect of social validity. As seen from Table 6, the mean for social validity of goals was 7, and the mean for social validity of the procedures was 7.

Overall, imitation in ordinary environments is determined to be an important goal for learners with autism. Also, the data suggest that the procedures used in this study are appropriate for teaching learners with autism to imitate peers in an ordinary environment.

### Discussion

Because the three participants demonstrated systematic increases in the percentage of matching responding during training trials with the introduction of treatment during the training trials, one may conclude that the graduated guidance and reinforcement treatment package caused the increase in matching during the training trials. Furthermore, because there was a systematic increase in the percentage of matching responding during generalization probes with the introduction of treatment during training trials, one may conclude that the graduated guidance and reinforcement treatment package implemented during training trials produced generalization from training to probe trials without additional teaching.

In the present study the graduated guidance and reinforcement treatment package was successfully used to bring generalized imitative performances of three learners with autism under the control of discriminative stimuli present in an ordinary social environment. At the onset of the experiment all three learners with autism displayed generalized imitation skills in an initial imitation teaching environment but did not display their imitation skills in an ordinary environment. The participants were taught imitation skills using operant learning procedures (Lovaas et al., 1966; Baer et al., 1967). These procedures were effective in establishing the initial generalized imitative repertoire of the participants, but the learners did not imitate peers in an ordinary environment. In the current study learners with autism were taught using the graduated guidance and reinforcement treatment package to imitate peers in an ordinary environment. Bandura's work on observational learning provides a starting point for identifying discriminative stimuli that might be present in ordinary environments. Bandura's research demonstrated that the responding of typically developing participants is subject to the influence of observed reinforcement contingencies (Bandura & Mischel, 1965; Bandura, 1965). Thus, participants who observed a model selecting delayed access to preferred items also selected delayed access to preferred items. In the current study, the participants observed the delivery of the reinforcer from the confederate teacher to the peer model. In fact, in this study it was the reinforcement of the peer model's behavior that was used as the discriminative stimulus for imitation. In summary, the work of Bandura and his colleagues on observational learning suggest that there are stimuli in the environment that might potentially serve as discriminative stimuli in an ordinary environment, such as

avoidance of punishment from the teacher, reinforcement from the teacher, or the continuation of current tasks. Such potential discriminative stimuli could be targeted in teaching learners with autism to imitate peers in ordinary environments.

In the present study discriminative stimuli that might be suitable to occasion imitation in an ordinary environment were transformed to be discriminative stimuli as part of the graduated guidance and reinforcement treatment package. The section below will discuss the targeted stimuli used in the current study as part of an ordinary environment: a.) The absence of verbal instructions for imitation, b.) The antecedent stimuli consisted of modeling stimuli that were presented by peers, and c.) The consequent stimuli included responses emitted by a confederate peer that were reinforced by a confederate teacher.

In the current study no verbal instructions for imitation were provided prior to presentation of the modeling stimulus. The omission of verbal instructions prior to presentation of a modeling stimulus simulates a more ordinary environment in which there are few instructions that indicate when imitation should occur. For example, one would not usually expect instructions to imitate in an elementary school classroom. A review of the literature indicates that the use of verbal instructions for imitation has been studied previously (Metz, 1965; Apolloni et al., 1977). In a peer imitation study by Apolloni et al. (1977) no verbal instructions for imitation were presented prior to the presentation of the modeling stimulus. In the Apolloni et al. (1977) study, imitation in the absence of verbal instructions was demonstrated; but other stimulus conditions in the Apolloni study did not simulate an ordinary environment. First, in the Apolloni et al.

(1977) study, the experimenter whispered instructions on which response to emit to the peer, so the participant could not hear him. Secondly, when the participant did imitate the modeling stimulus presented by the peer, there was verbal praise provided by the experimenter. The experimenter's presence in the environment may not reflect the stimulus conditions that are present in the ordinary environment. Nevertheless, the Apolloni et al. (1977) study does provide one of the first accounts of omission of verbal instructions for imitation by developmentally delayed participants. In the present study the absence of verbal instructions was part of the package of discriminative stimuli during imitation teaching specifically programmed to simulate an ordinary environment, and all three participants learned to imitate modeling stimuli presented in the absence of verbal instructions with the introduction of the graduated guidance and reinforcement treatment package.

Peer responses that were reinforced by the confederate teacher were designed to serve as modeling stimuli in the current study. In an ordinary environment it might be helpful if the responses of peers that have been reinforced by the teacher could function as discriminative stimuli and evoke imitative responding by a learner with autism. There are some studies that have used peers as presenters of modeling stimuli for learners with autism (Carr & Darcy, 1990, Jones & Schwartz, 2004). In the Carr & Darcy (1990) study, the peer who presented the modeling stimulus received some verbal praise from the experimenter, yet it is not clear if praise was delivered for each modeling stimulus presentation. In the Jones & Schwartz (2004) study, the peer who presented the modeling stimulus received verbal feedback from the experimenter after presentation of the

modeling stimulus. In the current experiment, confederate peer responses were reinforced by a confederate teacher and it was this peer-modeling and subsequent reinforcer delivery that was designed to function as a discriminative stimulus for an imitative response. Reinforcement and graduated guidance prompting procedures were used as part of a treatment package in the current study. This, this study cannot separate the effects of either procedure in the current treatment package.

In the present study a modeling stimulus was followed by a descriptive praise statement from the confederate teacher following each peer model. Thus, there were no opportunities to measure or teach discriminative responding only to peer models that did not produce praise, as opposed to those that did. In the ongoing flow of activity in an ordinary environment there may be many potential peer responses that could evoke an imitative response. It may be relevant to teach learners with autism to respond to modeling responses that are reinforced by a teacher, rather than modeling responses that might have been reprimanded by the teacher. Such stimuli may both be equally salient. Nevertheless, it may be important for the learner with autism to acquire discrimination skills so that only appropriate modeling stimuli evoke imitative responding. It may be important to teach the discrimination between those peer responses that are eligible for reinforcement and those peer responses that are not eligible for reinforcement by the teacher. Using such stimuli as discriminative stimuli for imitation may be a useful next step for teaching selective imitation in ordinary environments.

The social validity measures used in the current study demonstrated that the imitation of peers in an ordinary environment was perceived by other instructors of

children with autism to be an important goal for learners with autism. Additionally, the social validity data support the use of the modeling, prompting, and peer modeling procedures that were included in the treatment package as appropriate for teaching learners with autism to imitate peers in an ordinary environment.

Table 1

*Fine Motor Training Stimuli, Probe Stimuli (\*), and Response Definitions*

Stimulus	Definition
Galloping	Move the horse in a forward motion in an alternating sequence of, back legs of the horse touch the table while front legs lift off the table, then back legs lift off the table while front legs touch the table.
Rearing	Move the horse so that the front legs come off the table and the back legs remain on table.
* Lying down	Move the horse from an upright position so that the side of the horse makes contact with the table.
* Jumping	Move the horse at least 3 inches off the table, then all four legs make contact with the table.
Driving	Roll the car forward across the table so that all four wheels make contact with the table.
Rolling over	Move the car forward then upside down where the top of the car touches the table and the wheels face upward.
Wheelie	Move the car forward so that the front wheels come off the table and back wheels make contact with the table.
Bouncing	Move the car forward across the table so that all four wheels alternate with making contact with the table and coming off the table.
Tacking	Move the boat across the table while turning the boat alternately to the left and right.

Table 1

*Fine Motor Training Stimuli, Probe Stimuli (\*), and Response Definitions*

Stimulus	Definition
* Sailing	Move the boat above the table alternating with the front of the boat up while the back is down and then, front of the boat is down while the back is up.
Capsizing	Move the boat forward and then rotate boat onto its side.
Flying	Move the boat at least 3 inches above the table in a forward motion while maintaining a horizontal position.

Table 2

*Social Validity Questions*

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Question
<b>Social Validity of Imitation Goals</b>
Q1 How important is it that learners with autism learn to imitate the appropriate behavior of peers in an ordinary environment?
Q2 Do you think it is an important goal for learners with autism that do not currently imitate the appropriate behavior of peers in an ordinary environment to learn this skill?
<b>Social Validity of Imitation Teaching Procedures</b>
Q3 How appropriate is it to use manual prompting to teach learners with autism to learn to imitate the appropriate behavior of peers in an ordinary environment?
Q4 How appropriate is it to use reinforcement to teach learners with autism to learn to imitate the appropriate behavior of peers in an ordinary environment?
Q5 How appropriate is it to use peer models and a teacher to teach learners with autism to imitate the appropriate behavior of peers in an ordinary environment?

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Table 3

*Mean Percent of Interobserver Agreement (IOA) on Matching Responses and Percent of Sessions with IOA for Jeannette, Mike, and Justin Across Baseline and Treatment Phases*

Trial Type	Baseline		Treatment	
	IOA	% of Sessions	IOA	% of Sessions
Jeanette				
Matching Training Trials	100	50	99	39
Matching Probe Trials	89	50	100	39
Mike				
Matching Training Trials	100	50	99	36
Matching Probe Trials	100	50	96	36
Justin				
Matching Training Trials	100	39	100	33
Matching Probe Trials	100	39	100	33

Table 4

*Mean Percent Accuracy of Reinforcer Delivery by the Instructor for Jeanette, Mike, and Justin*

	Baseline		Treatment	
	Training Trials	Probe Trials	Training Trials	Probe Trials
Jeanette	100	100	98	100
Mike	100	100	96	100
Justin	100	100	99	100

*Note.* Training trials during the treatment phase refer only to those trials with correct responses.

Table 5

*Mean Percent of Interobserver Agreement (IOA) on Accuracy of Reinforcer Delivery and Percent of Sessions (%) with IOA for Jeanette, Mike, and Justin Across Baseline and Treatment Phases*

	Baseline				Treatment			
	Training Trials		Probe Trials		Training Trials		Probe Trials	
	IOA	%	IOA	%	IOA	%	IOA	%
Jeanette	100	50	100	50	100	39	100	39
Mike	100	50	100	50	92	36	100	36
Justin	100	39	100	39	100	33	100	33

*Note.* Training trials during the treatment phase refer only to those trials with correct responses.



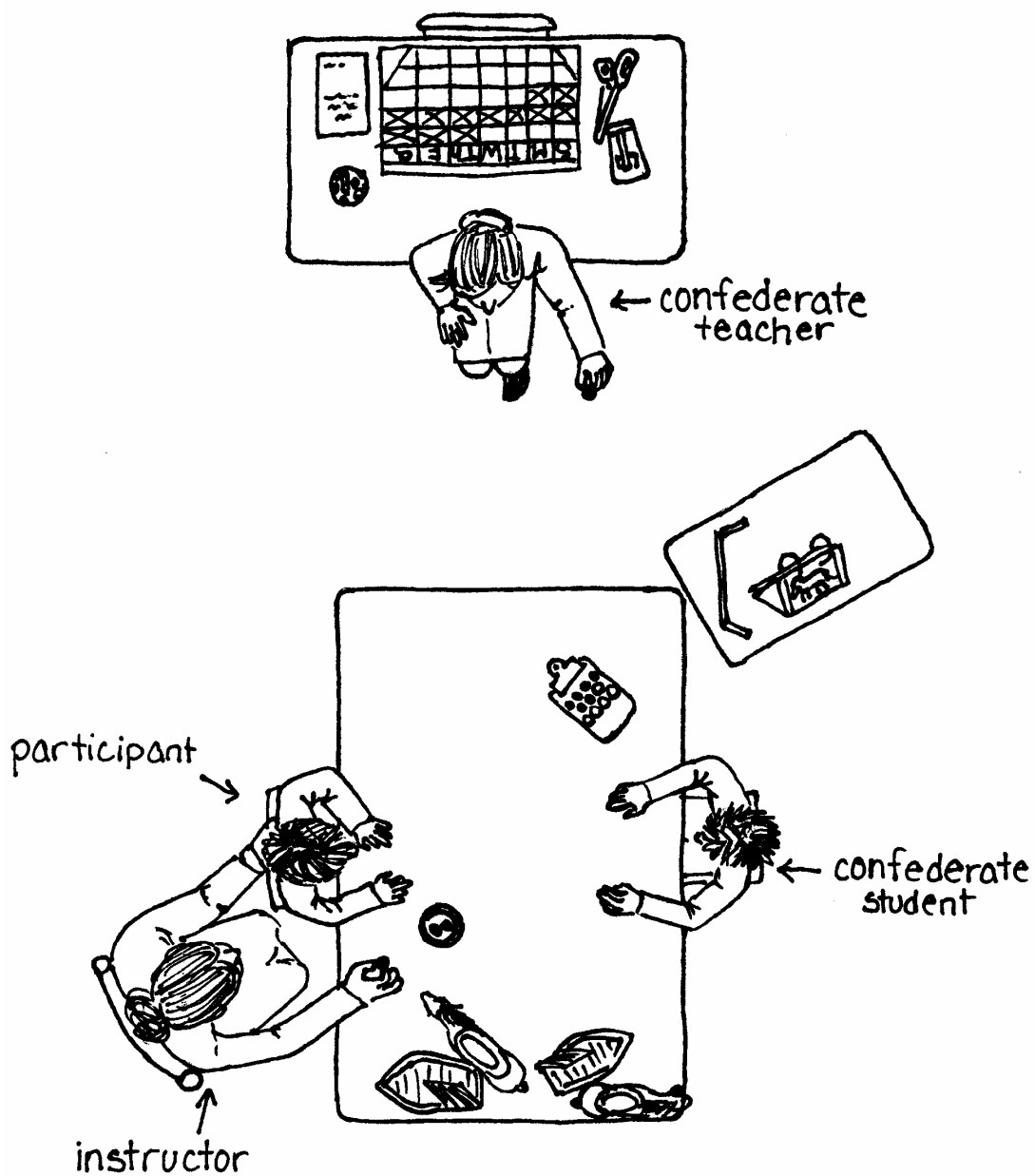


Figure 1. Depiction of the spatial arrangement of the confederate teacher, confederate student, learner with autism, and teacher.

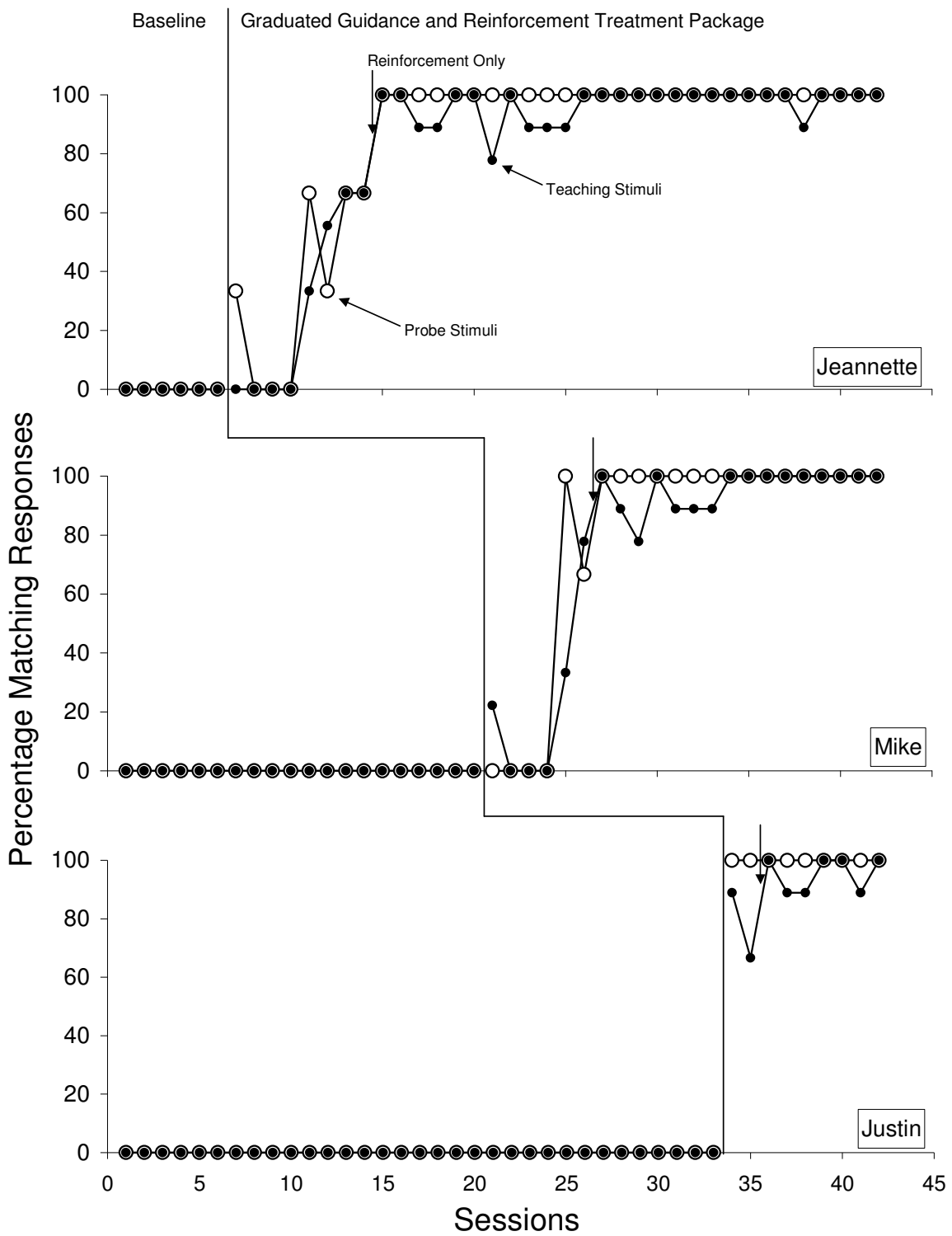


Figure 2. Percentage correct matching responses across the three participants.

## Appendix

### Pilot Study

One possible teaching strategy to teach children with autism to display observational learning skills in an ordinary environment would include the teaching of a differential observing response. Dube and McIlvane (1999) define a differential observing response procedure as one that requires a different response to each sample stimulus. In discrimination training with learners with developmental disabilities, the requirement of a differential observing response has led to improved performance (Dube & McIlvane, 1999). If discrimination training in learners with developmental disabilities can be improved with an observing response requirement, then perhaps for learners with autism, observational learning in ordinary environments can also be improved with an observing response requirement.

In an ordinary environment a monitoring response may facilitate a learner's observation of peer responding that produces reinforcement by the teacher. Peer responses that have been reinforced by the teacher may potentially serve as discriminative stimuli for a monitoring response. A differential monitoring response is similar to a differential observing response in that the learner must make a differential response to indicate that he or she has discriminated the sample stimulus from other potential sample stimuli. Following a differential observing response discriminative stimuli are presented. A differential monitoring response could be distinguished from a differential observing response because no choice stimuli are presented. With a differential monitoring response the learner is required to monitor the presence of a

specific sample stimulus among several potential sample stimuli. The pilot study examined the extent to which training a monitoring response will improve imitative performances in an ordinary environment among learners with autism. One learner with autism was taught to emit a differential monitoring response to peer responses that have been reinforced by the teacher. Correct differential monitoring responses were reinforced. Imitative responding was measured during baseline and following such training to determine the extent to which the training facilitated imitation in ordinary environments.

## Method

### *Participant*

One child with autism served as a participant in the pilot study. Justin was a student at REED Academy. A qualified professional who was not affiliated with REED Academy independently provided a diagnosis of autism. Justin met the criteria for autism as defined in the Diagnostic and Statistical Manual of Mental Disorders 4<sup>th</sup> ed., text revision, (American Psychiatric Association, 2000).

Justin was 9-years old at the start of the study. He had received services at REED Academy for 4 years prior to the beginning of the study. Justin scored an age equivalent of 3 years 3 months on the Peabody Picture Vocabulary test (Dunn & Dunn, 1997).

Justin had prior experience with behavior analytic teaching procedures and token-based motivational systems. He had have acquired generalized imitation skills in a one-to-one teaching environment. Justin displayed low levels of stereotypic and disruptive behavior.

### *Setting*

*Materials and equipment.* All sessions were conducted in a small-group instruction room at REED Academy that was 4 m by 5 m. As can be seen in Figure 1, the small group instruction room contained a teacher's desk, a group table that was 1 m by 1.5 m, a typical student's desk and typical student's desk chairs. A small photographic activity schedule was placed that was used to sequence the presentation of the confederate peer's modeling stimuli. An activity schedule was prepared using a small 1-inch half sheet three-ring binder, clear page protectors, and color photographs depicting a person performing each of the modeling stimuli. On the student desk, foam core board that was 40 x 50 cm was mounted with hook and loop fasteners to block the participant's view of the activity schedule used by the confederate peer.

The modeling stimuli included vocal stimuli as listed in Table A1. The token board was constructed of a memo-sized clipboard 15 cm x 23 cm on which pennies could be attached with hook and loop fasteners. A small plastic cup was set near the participant on the group table for placement of the participant's tokens during the study.

The differential monitoring response sheets were constructed out of 8.5 by 11 inch standard white paper. On each sheet there were 12 color photographic images of each modeling stimulus that were presented by the peer model. The photographic images ranged in width from 2.8 cm to 5 cm with a height of 3.8 cm. On the right side of each image was a 1 cm x 1 cm bold-square-black box for the learner to record a checkmark during differential monitoring response sessions. On the differential monitoring response sheet the photographic images were arranged in two columns of six photographs.

*Peer Model (Confederate Student)*

Austin was 5 years old at the beginning of the study and was a student at REED Academy. Austin had received educational services at REED Academy for 2.5 years including 1.5 years of transition services. At the start of the study Austin spent half of his school day in a regular kindergarten classroom.

*Instructor and Confederate Teacher*

The instructor was trained in applied behavior analysis and was a doctoral student in psychology. A REED Academy instructional staff member served as the confederate teacher for all treatment sessions.

*Dependent Measures*

The dependent measures included measures of differential monitoring and imitation.

*Differential monitoring response.* A participant's differential monitoring response was scored as correct if they selected the option that corresponded to the modeling stimulus presented during each trial.

*Match.* A matching response was defined as a response that matched or closely approximated the topography of the reinforced responses of the observed peer that occurred within 6 s of the modeling stimuli. A nonmatching response was defined as any response that did not match the response definitions for the modeling stimuli or occurred more than 6 s after presentation of the modeling stimuli. Definitions of matching responses for the pilot study are listed in Table A1.

### *Procedural Measures*

Accuracy of the confederate peer's presentation of the modeling stimulus was measured during the study. Table A1 includes a list of the modeling stimuli presented by the confederate peer. Accuracy of reinforcer delivery was also measured. Reinforcer delivery was scored a correct if a reinforcer was delivered according to the schedule of reinforcement that was in effect for the current phase of the study.

*Differential monitoring sessions.* During differential monitoring sessions, reinforcer delivery was scored for correct responding during training trials. Thus, during differential monitoring sessions during training trials with correct responses the reinforcement schedule that was in effect was continuous reinforcement (CRF) for each correct response. Incorrect or incomplete differential monitoring responses during treatment were prompted and shaping procedures were used to teach correct differential monitoring responses resulting in a partial reinforcement schedule. Thus, reinforcer delivery was not included in the data analysis for incorrect differential monitoring responses during training trials during treatment. During differential monitoring sessions during probe trials no reinforcement was provided. Thus, for all probe trials during differential monitoring sessions, the absence of a reinforcer was scored as a correct reinforcer delivery.

*Matching sessions.* All correct responses were reinforced during baseline and treatment matching sessions on a CRF schedule. Probe trials were never reinforced during matching sessions in either baseline or treatment. As described above, the

absence of a reinforcer was scored as a correct reinforcer delivery during probe trials. No prompts were provided during training or probe trials during matching sessions.

### *Stimulus Sets*

Stimuli for the pilot study included the 12 vocal stimuli that are listed in Table A1. Assignment of stimuli to training and probe statuses was random. Nine of the 12 modeling stimuli were designated as training stimuli and 3 of the modeling stimuli were designated as probe stimuli. The presentation of training and probe stimuli were presented in a random order for each session

The differential monitoring response recording sheets included color photographic images of each of the 12 vocal modeling stimuli. For example, for the vocal modeling stimulus “dog” the differential monitoring data sheet included a picture of a dog with a checkbox next to the picture.

### *General Procedure*

Sessions were conducted five days a week. Each session was approximately 15-minutes in length and one to two sessions were conducted each day. Each session included the presentation of 12 modeling stimuli in a random order. A baseline, imitation, or differential observing response session began when the confederate student began following an activity schedule that provided a photograph depicting one of the motor responses (McClannahan & Krantz, 1997).

During imitation and differential monitoring treatment sessions the 12 modeling stimuli were presented in a random order. These consisted of nine training stimuli and three probe stimuli. The confederate student presented each modeling stimulus in

accordance with their activity schedule. If the confederate student failed to present the modeling stimulus or incorrectly presented the modeling stimulus the confederate teacher directed the confederate student's attention to the activity schedule and the modeling stimulus was presented. Upon completion of the presentation of each modeling stimulus the confederate teacher delivered a token to the confederate student's token board along with a verbal praise statement. The praise statements were non-descriptive, such as "good" or "nice work."

After baseline was completed sessions alternated in a one-to-one correspondence between differential observing response treatment sessions and imitation treatment sessions.

*Baseline sessions.* During baseline sessions correct matching responses for training trials were reinforced with a token placed by the instructor into a small cup that was on the table. To be scored as correct the participant's response needed to occur within 6 s of the confederate peer's presentation of the modeling stimulus and match the response definition for the vocal modeling stimuli listed in Table A1. For probe trials during baseline sessions all responses were not reinforced.

*Imitation sessions.* During imitation sessions no prompts were provided during both training and probe trials. The research assistant delivered tokens to the learner with autism for engaging in correct matching responses during training trials. Incorrect responses received no programmed consequences.

*Differential monitoring treatment sessions.* The learner with autism was taught to make a differential monitoring response following the confederate peer's response that

produced praise. During each session 12 modeling stimuli were presented in a random order. These consisted of nine training stimuli and three probe stimuli. During differential observing response treatment sessions if the participant did not emit a monitoring response within 6s of the modeling stimulus or an incomplete or incorrect response was emitted manual prompts were delivered from behind the participant during training trials. A differential monitoring response was scored as a correct response if the participant made a mark with their pencil into the checkbox next to the picture that matched the vocal modeling stimulus that was presented by the confederate peer. During probe trials no prompts or tokens were delivered. The research assistant delivered tokens to the participant for engaging in a correct or an approximation of a differential monitoring response during training trials.

### *Experimental Design*

The pilot study included the first leg of a multiple-baseline-across responses experimental design. Differential monitoring treatment was used to teach the participant to observe peer responses that were reinforced by the confederate teacher. Imitation was measured both before and after differential monitoring treatment.

### *Interobserver Agreement and Procedural Validity*

*Dependent measure interobserver agreement.* Two trained observers scored the participant's matching and differential monitoring responses. The scorers were trained until they achieved at least 80% interobserver agreement on each of the measures in a single session. Independence of the scorers was maintained by having them sit across the room from one another. To be scored as an agreement both observers had to score each

matching or differential monitoring response that met the response definition as described in Table A1 and each response must have occurred within 6 s of the confederate peers presentation of the modeling stimulus. Interobserver agreement was scored on a point-by-point basis and the percentage was calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100.

Table A2 shows the mean percent of interobserver agreement on matching and differential monitoring responses and percent of sessions with IOA for Justin in the pilot study. Interobserver agreement data were collected on a range of 33 to 40% of sessions across baseline matching, treatment matching, and differential monitoring sessions. Interobserver agreement ranged from 89 to 100% across baseline, and treatment matching and monitoring sessions.

*Procedural validity measures.* Mean percent accuracy for modeling stimulus presentation by the confederate peer for Justin in the pilot study is displayed in Table A3. Modeling stimuli were presented accurately 100% of the time for all baseline and treatment sessions.

Table A4 displays the mean accuracy of reinforcer delivery by the instructor for Justin in the pilot study. Accuracy of reinforcer delivery was 100% across all baseline and treatment sessions.

*Procedural interobserver agreement.* Interobserver agreement data for the accuracy of the modeling stimulus presentation by the confederate peer for Justin in the pilot study is displayed in Table A5. Interobserver agreement data were collected on a range of 33 to 40% of sessions across baseline matching, treatment matching, and

differential monitoring sessions. Interobserver agreement was 100% for all baseline matching, treatment matching, and differential monitoring sessions.

Table A6 displays the mean percent of interobserver agreement on reinforcer delivery and percent of sessions with IOA for Justin in the pilot study. Interobserver agreement was collected on a range of 33 to 40% of session for baseline matching, treatment matching, and treatment differential monitoring sessions. Interobserver agreement ranged from 94 to 100% across baseline matching, treatment matching, and treatment differential monitoring sessions.

### *Results*

Figure A1 shows the percentage of correct matching and monitoring responding for training and probe items for Justin in the pilot study. Sessions are displayed on the abscissa and percentage of correct responses are indicated on the ordinate. The top panel of the graph shows the data for training trials and the bottom panel of the graph shows the data for probe items. The open circles represent monitoring responses and the closed circles indicate matching responses. The solid vertical line indicates a change in condition from baseline sessions to treatment sessions.

As can be seen in both the top and bottom panel of Figure A1, Justin did not emit any matching responses during baseline sessions for both training and probe trials. Following the introduction of treatment during session 7, Justin's differential monitoring responding reached 100% during training trials by session 15. Differential monitoring during probe trials reached 100% during session 9. During treatment, differential-monitoring sessions alternated with matching sessions. As can be seen from Figure A1,

Justin's matching performance stayed at 0% during all treatment sessions during both training and probe trials.

### *Discussion*

As can be seen from Figure A1 Justin learned to make a differential monitoring response in the presence of each modeling stimulus. By session 15, Justin was accurately emitting a differential monitoring response on all probe and training items. Imitation sessions were interspersed with differential monitoring sessions in the pilot study. The data indicate that learning a differential monitoring response did not lead to improvements in matching performances for Justin. Justin's matching performance remained at 0% throughout the pilot study. After Justin failed to demonstrate matching performances after learning the differential monitoring response the pilot study was discontinued and a new study was designed to introduce a graduated guidance and reinforcement treatment package to teach imitation in an ordinary environment.

Table A1

*Vocal Training Stimuli, Probe Stimuli (\*), and Response Definitions*

Stimulus	Definition
Verbal model “pencil”	Verbal response “pencil”
Verbal model “fish”	Verbal response “fish”
Verbal model “cow” *	Verbal response “cow”
Verbal model “apple”	Verbal response “apple”
Verbal model “box”	Verbal response “box”
Verbal model “airplane”	Verbal response “airplane”
Verbal model “horse”	Verbal response “horse”
Verbal model “dog”	Verbal response “dog”
Verbal model “car” *	Verbal response “car”
Verbal model “candy” *	Verbal response “candy”
Verbal model “banana”	Verbal response “banana”
Verbal model “egg”	Verbal response “egg”

Table A2

*Mean Percent of Interobserver Agreement (IOA) on Matching and Differential Monitoring Responses and Percent of Sessions with IOA for Justin in the Pilot Study*

Trial Type	Baseline		Treatment	
	Percent of		Percent of	
	IOA	Sessions	IOA	Sessions
Matching Sessions				
Training Trials	100	33	100	40
Probe Trials	100	33	100	40
Differential Monitoring Sessions				
Training Trials			89	40
Probe Trials			100	40

Table A3

*Mean Percent Accuracy of Modeling Stimulus Presentation by the Confederate Peer for Justin in the Pilot Study*

Trial Type	Baseline	Treatment
Matching Sessions		
Training Trials	100	100
Probe Trials	100	100
Differential Monitoring Sessions		
Training Trials		100
Probe Trials		100

Table A4

*Mean Percent Accuracy of Reinforcer Delivery by the Instructor for Justin in the Pilot Study*

Trial Type	Accuracy
Baseline Matching Sessions	
Training Trials	100
Probe Trials	100
Treatment Matching Sessions	
Training Trials	100
Probe Trials	100
Treatment Differential Monitoring Sessions	
Training Trials with Correct Responses	100
Probe Trials	100

Table A5

*Mean Percent of Interobserver Agreement (IOA) on Accuracy of Modeling Stimulus Presentation by the Confederate Peer and Percent of Sessions with IOA for Justin in the Pilot Study*

Stimulus Type	Baseline		Treatment	
	Percent of		Percent of	
	IOA	Sessions	IOA	Sessions
Matching Sessions				
Training Trial Stimuli	100	33	100	40
Probe Trial Stimuli	100	33	100	40
Differential Monitoring Sessions				
Training Trial Stimuli			100	40
Probe Trial Stimuli			100	40

Table A6

*Mean Percent of Interobserver Agreement (IOA) on Reinforcer Delivery and Percent of Sessions with IOA for Justin in the Pilot Study*

Trial Type	IOA	Percent of Sessions
Baseline Matching Sessions		
Training Trials	100	33
Probe Trials	100	33
Treatment Matching Sessions		
Training Trials	100	40
Probe Trials	100	40
Treatment Differential Monitoring Sessions		
Training Trials with Correct Responses	94	40
Probe Trials	100	40

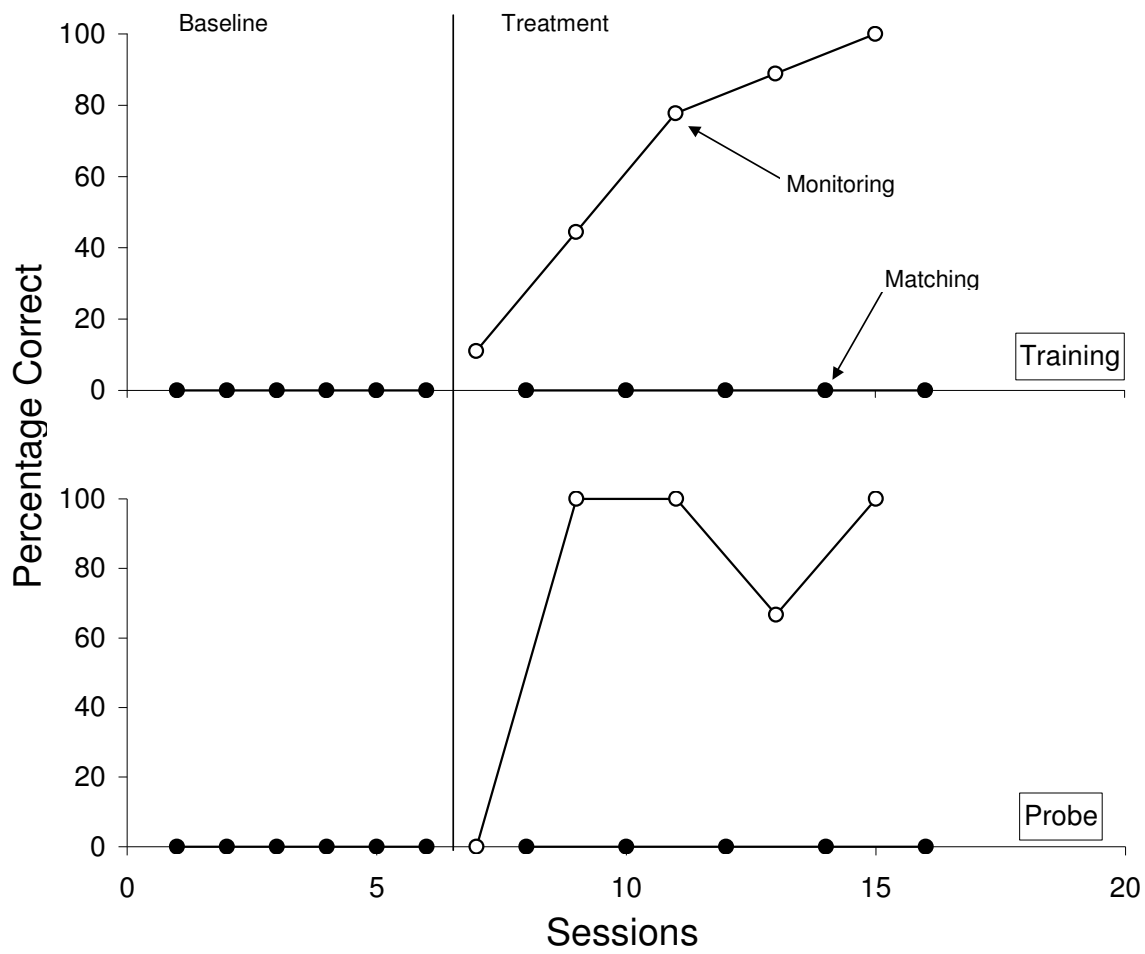


Figure A1. Percentage correct matching and monitoring responses for training and probe items for Justin in the pilot study.

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